PROJECT MANUAL
ISSUED FOR BIDS: May 16, 2025

ENGAGEMENT HALL

for

McHenry County College

8900 U.S. Hwy 14
Crystal Lake, IL 60012

DEMONICA KEMPER ARCHITECTS

125 N. Halsted Street, Suite 301
Chicago, Illinois 60661
P 312.496.0000
F 312.496.0001

DKA Project Number: 24-027
MCC Bid Number: IFB#06052025

DIVISION 0 - PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 1 - GENERAL REQUIREMENTS

DIVISION 2 - EXISTING CONDITIONS

DIVISION 3 – CONCRETE

DIVISION 00 00 00

PEPPER CONSTRUCTION

CONSTRUCTION MANUAL

McHENRY COUNTY COLLEGE ENGAGEMENT HALL
8900 US Highway 14
Crystal Lake, IL 60012

FOR

McHENRY COUNTY COLLEGE
8900 US Highway 14
Crystal Lake, IL 60012

CONSTRUCTION MANAGER:
PEPPER CONSTRUCTION COMPANY
411 Lake Zurich Road
Barrington, IL 60010
(847) 381-2760

Dated: 5/16/2025

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McHenry County College Engagement Hall

At:
McHenry County College.
8900 US Highway 14
Crystal Lake, IL 60012

Owner:
McHenry County College
8900 US Highway 14
Crystal Lake, IL 60012

The following listed documents comprise the CM Project Manual. When a numerical sequence of sections is interrupted, such interruptions are intentional.

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McHenry County College Engagement Hall

At:
McHenry County College
8900 US Highway 14
Crystal Lake, IL 60012

Owner:
McHenry County College
8900 US Highway 14
Crystal Lake, IL 60012

Architect:
DEMONICA KEMPER ARCHITECTS
125 HALSTED ST., SUITE 301
CHICAGO, IL 60661

GENERAL PROJECT DESCRIPTION

The Scope of Work includes providing all labor, materials, machinery, tools, equipment, and other means of construction necessary for the **McHenry County College Engagement Hall** project indicated in the Bid Documents.

BID PACKAGES:

1) Demolition
2) Excavation and Site Utilities
3) Landscaping and Irrigation Concrete
4) Concrete
5) Masonry & AVB
6) Steel
7) General Carpentry (Heavy Timbers, Fencing, Asphalt, DFH, and Casework are included)
8) Roofing and Metal Panels
9) Storefront and Glazing
10) Ceilings
11) Flooring
12) Painting
13) Fire Protection
14) Plumbing
15) HVAC
16) Electrical and LV

Refer to the Contract Documents for additional information related to the Scope of Work associated with the Contract.

LEGAL NOTICE

Official notice is hereby given that sealed bids will be received in the office of the Director of Procurement Services, McHenry County College, 8900 US Highway 14, Crystal Lake, IL 60012 **until 10:00 AM local time on June 5, 2025, and then publicly opened and read aloud thereafter.**

Sealed Bids must be submitted on the bid form provided as part of this CM Manual. All blank spaces on the Bid Form must be completed in ink, must be submitted in a sealed envelope and marked as follows:

McHenry County College
8900 US Highway 14
Building A, Room 246
Crystal Lake, IL 60012

McHenry County College – Engagement Hall
Bid Package Number and Name
Bidder's Company Name and Address

All bids are due by the time and date identified herein. Bids submitted by mail or messenger are at bidder's risk and will not be considered unless received by the designated deadline.

No employee of MCC or student at MCC can assume responsibility for the delivery of bids to the designated location. Bids may be sent by certified mail to the **McHenry County College**. A bid mailed with "restricted delivery" may be disqualified. Please make sure you put your companies name on the envelope.

Bids received in the designated room after the time for the opening of bids will not be accepted and returned unopened to the sender. The College recommends that you send your bid through UPS, FedEx, USPS priority mail with tracking number. You may also drop off your bid.

BID SECURITY

Bid security in the form of a bid bond made payable to McHenry County College in an amount equal to ten percent (10%) of the base bid is required of all parties submitting a bid. Contractors shall guarantee their submitted Bid Proposal for a ninety (90) day period from the date of bid Opening. The successful bidder will be required to furnish a Performance and Payment Bond for 100%.

BID DOCUMENTS

Documents may be obtained online at the McHenry County College Website: www.mchenry.edu/bid.

Bidders are responsible for checking daily for additional information and addenda related to this project at the above website.

PRE-SUBMISSION CONFERENCE & WALKTHROUGH

A NON-MANDATORY pre-bid meeting will be held on May 22, 2025, at 10:00 AM CST at the **MCC Scot Room B178**

Contractors interested in bidding this work are urged to attend the pre-bid conference. Attendance at this meeting is not mandatory; however, contractors are warned that no allowance will be granted to bidders unfamiliar with the work.

ADDITIONAL INFORMATION

Should the bidder require additional information about this bid, please submit questions via email to the following:

JWarriner@pepperconstruction.com

Questions are required no later than 3:00 PM CST on May 28, 2025.

ANY and ALL changes to these specifications are valid only if they are included by written addendum. No interpretation of the meaning of the scope of work will be made orally.

LEED Project

This project will be LEED certified. Bidders are to review all bid documents and include all costs associated with assisting the project in meeting the LEED goals.

OWNER'S RIGHTS

The Owner reserves the right to accept or reject any and all bids, and to waive informalities to any bid when such is deemed by the Owner to be in the owner's best interest as well as meeting their participation requirements.

This invitation is issued in the name of McHenry County College

END OF SECTION 00 11 00

SECTION 00 11 50
BID NOTICE

McHenry County College , herein after known as Owner, is seeking bids for the **McHenry County College Engagement Center** project at **McHenry County College** located in **Crystal Lake, IL** respectively.

The base bid for the project includes the construction of a new one-story, Engagement Hall. See the contract document for additional information.

All bids must be accompanied by a Bid Bond of ten percent (10%) of the amount of the Base Bid made payable to **McHenry County College**. Contractors shall guarantee their submitted Bid Proposal for a ninety (90) day period from the date of Bid Opening. The successful bidder will be required to furnish a Performance and Payment Bond for 100%. Contractor's Qualifications Statement must be submitted at time of bid or already be on file with Pepper Construction

All bidders must comply with applicable Illinois Law requiring the payment of prevailing rate of wage to all laborers, workmen, and mechanics working on public funded projects. If during the time period of work, these rate changes, the contractor shall be responsible for additional costs without any change to the contract amount.

Sealed bids are due no later than 10:00 AM on June 5, 2025, to McHenry County College, 8900 US Highway 14, Building A, Room 246, Crystal Lake, IL 60012, and shall be marked "SEALED BID, Bids will ONLY be accepted at Building A, Room 246. **Bids received after the designated due date and time will not be considered. Bids to be publicly open and read aloud directly thereafter.**

McHenry County College is not obligated to accept the lowest or any other bid and reserves the right to reject any and all bids, reject non-conforming bids, reject conditional bids, waive any informalities and irregularities in bidding procedure, and to award the contract to the lowest responsible bidder, as determined by the College.

This solicitation includes a specific **Business Enterprise Program (BEP)** participation **goal** of 30% of the total dollar amount awarded to MBEs and FBEs, based on the availability of BEP certified vendors to perform or provide the anticipated services and/or supplies required by this solicitation. See section 00 80 00 of this CM Manual for additional information.

All prospective bidders are urged to attend the **NON-MANDATORY** pre-bid meeting scheduled for **May 22, 2025 at 10:00 AM**. The pre-bid meeting will be held at **McHenry County College, Scot Room, B178. 8900 US Highway 14, Crystal Lake, IL 60012.**

Documents may be obtained online at the McHenry County College Purchasing & Contracts' Website: www.mchenry.edu/bid

Bidders are responsible for checking daily for additional information and addenda related to this project at the above website.

The Construction Manager for this project is Pepper Construction Company. All questions concerning this project or those concerning bidding requirements should be directed to **Josh Warriner** via email at Jwarriner@pepperconstruction.com.

END SECTION 00 11 00

SECTION 00 12 00
INSTRUCTIONS TO BIDDERS

Project:
McHenry County College – Engagement Center
At:
McHenry County College
8900 US Highway 14
Crystal Lake, IL 60012

Owner:
McHenry County College
8900 US Highway 14
Crystal Lake, IL 60012

Architect:
DEMONICA KEMPER ARCHITECTS
125 HALSTED ST., SUITE 301
CHICAGO, IL 60661

GENERAL PROJECT DESCRIPTION
The Scope of Work includes providing all labor, materials, machinery, tools, equipment and other means of construction necessary for the **McHenry County College Engagement Center** project indicated in the Bid Documents.

BID PACKAGES
1) Demolition
2) Excavation and Site Utilities
3) Landscaping and Irrigation Concrete
4) Concrete
5) Masonry & AVB
6) Steel
7) General Carpentry (Includes Heavy Timbers, Fencing, Asphalt, DFH, and Casework)
8) Roofing and Metal Panels
9) Storefront and Glazing
10) Ceilings
11) Flooring
12) Painting
13) Fire Protection
14) Plumbing
15) HVAC
16) Electrical and LV

2. PREPARATION OF BIDS/ BID FORMAT
Sealed Bids including a 10% BID BOND are to be delivered by:
June 5, 2025 at 10:00 AM (local time)

Bids will be publicly opened and read aloud thereafter.

Bids must be submitted in a sealed envelope and marked as follows:

McHenry County College
Building A, Room 246
8900 US Highway 14
Crystal Lake, IL 60012

McHenry County College Engagement Center
Bid Package Number and Name
Bidder's Company Name and Address

All bids are due by the time and date identified herein. Bids submitted by mail or messenger are at bidder's risk and will not be considered unless received by the designated deadline.

No employee of MCC or student at MCC can assume responsibility for the delivery of bids to the designated location. Bids may be sent by certified mail to McHenry County College. A bid mailed with "restricted delivery" may be disqualified. Please make sure you put your companies name on the envelope.

Bids received in the designated room after the time for the opening of bids will not be accepted and returned, unopened to the sender. The College recommends that you send your bid through UPS, FedEx, USPS priority mail with tracking number. You may also drop off your bid.

All bids shall be submitted in a sealed envelope in duplicate with USB Copy. The included bid form (see section 00 31 00 Bid Form in the Project Manual) must be filled out in its entirety. If the bid form and all other required documents and forms provided as part of this CM manual are not filled out in their entirety, the bid may be considered as not responsive and could result in disqualification of your submission. **Please refer to provided checklist with Bid Form for list of all required documents to be included as part of your sealed bid.**

Bid security in the form of a bid bond made payable to **McHenry County College** in an amount equal to ten percent (10%) of the base bid is required of all parties submitting a proposal. Bids may not be withdrawn for a period of (90) ninety days after the Bid Opening date without the consent of the College.

3. PREBID MEETING
All prospective bidders are urged to attend the NON-MANDATORY pre-bid meeting scheduled for May 22, 2025, at 10:00am. The pre-bid meeting will be held at McHenry County College, Scot Room, B178 8900 US Highway 14, Crystal Lake, IL 60012. There will also be a virtual attendance option via Zoom that will be provided to all subcontractors via message.

4. BID DOCUMENTS
Bidding contractors may obtain an electronic set of the Bidding Documents in PDF format on or after _____ 2025, via digital download from the College's website listed below.

Documents may be obtained online at the **McHenry County College** contract's Website:
www.mchenry.edu/bid

Bidders are responsible for checking daily for additional information and addenda related to this project at the above website.

> *NOTE: It is the responsibility of the Prime Trade Contractor to review the drawings and specifications and advise Pepper Construction Company, the Construction Manager (CM) if additional documents are needed for the Prime Trade Contractor to complete pricing of the work.*

5. QUESTIONS

Bidder and supplier questions that arise during bidding should be directed to the Construction Manager VIA EMAIL to assure proper receipt, response and documentation of all inquiries. All questions must be submitted in writing to the Construction Manager and answered by a written addendum.

Submit questions/RFI's concerning the project, to the attention of **Josh Warriner** jwarriner@pepperconstruction.com and copy _____, and **MCC** Procurement _____

RFIs Due Date – May 28, 2025 by 3:00pm.

ANY and ALL changes to these specifications are valid only if they are included by written addendum. No interpretation of the meaning of the scope of work will be made orally.

Failure of any Bidder to receive any such addendum or interpretation shall not relieve the Bidder from obligation under this bid as submitted. All addenda so issued shall become part of the proposal documents, Subcontract Agreement Documents, and shall be incorporated in all bids. Failure to request an interpretation constitutes a waiver to later claim that ambiguities or misunderstandings caused a Bidder to improperly submit a bid.

All material and labor required by an addendum shall conform to the requirements of the proposed Contract Documents.

The College recognizes that in some cases the information conveyed in this IFB may provide an insufficient bass for performing a complete analysis of the IFB Requirements.

Prospective bidders are therefore requested to make the best possible use of the information provided, without the expectation that the College will be able to answer every request for further information, or that the schedule for receipt and evaluation of bids will be modified to accommodate such requests.

6. LIQUIDATED DAMAGES

This project is subject to liquidated damages. Liquidated damages can commence (30) days after the date of Substantial completion until the date Substantial Completion actually occurs. The rate per day at 31 days on is $1,000/day. Bidding contractors to be aware of these liquidated damages and note that awarded prime trade contractors will be responsible for all losses, damages, penalties, and fines incurred by Pepper Construction as Construction Manager as a consequence of a Prime Trade Contractor's default.

7. TAXES
This project is ***tax exempt***. A tax-exempt form is available upon request to award bidders.

8. PRIME TRADE AGREEMENT
Upon award the Contracts will be assigned by **McHenry County College** to Pepper Construction Company, the Construction Managers (CM), and administration of the Contract by the CM and enter into a Prime Trade Agreement Contract with the CM according to the terms and conditions of Pepper Construction Company Prime Trade Agreement and all other requirements set forth in the bid documents.

9. INSURANCE REQUIREMENTS
See requirements included in this manual under section 00 61 00 INSURANCE REQUIREMENTS.

10. BID REJECTION
McHenry County College of Trustees reserves the right to accept or reject any or all bids, reject nonconforming bids, reject conditional bids, waive irregularities in the bidding procedures, or to accept any bid that, in its sole opinion, best serves the interests of the College.

11. AWARD
Award shall be made to the lowest responsive and responsible bidder who best meets the specifications and requirements as identified in the bidding documents, including financial capacity to perform, experience and qualifications performing similar work, and scheduling based upon the criteria specified in the bidding documents. **All forms required with submission MUST be submitted at the time of bid to be considered responsive**.

The College will award in the best interest of the College and will be the sole determiner of what is in its best interest.

12. MODIFICATIONS
Bidders shall be allowed to modify/withdraw their bids prior to opening. Once bids have been received and opened, no modifications shall be permitted without the approval of the College.

13. LICENSE
Any license or fees required to perform the work shall be the responsibility of each prime trade contractor.

14. PERMITS AND FEES
All costs associated with permit and fees, shall be paid by the respective prime trade contractor. (Owner will pay for General Building Permit.)

15. CONDITIONS AFFECTING THE WORK
It is required the Bidder familiarize itself with the site and existing conditions under which the work is to be performed, which may impact the work and or the cost of the work. Conditions observed should be correlated with the requirements of the Contract Documents. Existing conditions include, but are not limited to: the existing site, existing structures (if any), obvious obstructions not shown on the Bid Documents, etc. Failure to familiarize itself with local conditions shall in no way relieve the Bidder from the responsibility for properly estimating the difficulty and or costs of successful performing the work

and shall not be construed as a basis for subsequently initiating a change in the contract amount and/or time. All Bidders are to include in their proposal the cost of missing design information or any items necessary for their respective trades, which would be required to fulfill the design intent of the contract documents. The intent of this is to ensure the Owner has purchased a complete and functional system.

16. FOIA NOTICE REGARDING A VENDOR'S PROPRIETARY INFORMATION

By submitting a proposal or otherwise responding in any way to this request for proposals, the proposer acknowledges the following:

A. The public body is subjected to the Freedom of Information Act, 5 ILCS 140/1, et seq. ("FOIA"), and any and all information submitted by the proposer to this public body is subject to disclosure to third parties in accordance with FOIA.

B. If the proposer intends for the public body to withhold the proposer's trade secrets, commercial information, or financial information from disclosure to third party in response to a FOIA request, the proposer must include with its proposal submittal a written notification specially identifying such information, along with a statement that disclosure of such information will cause competitive harm to the proposer, as provided by FOIA Section 7(1)(g), 5 ILCS 140/7(1)(g). Any content not so marked by the proposer at the time of proposal submittal will be presumed to open to public inspection. The proposer may be required to substantiate the basis for its claims at a later time.

C. Notwithstanding timely notice received from the proposer in accordance with Section 7(1)(g), the public body reserves the right, in its sole discretion and subject only to applicable law, to withhold or release the subject information in response to a FOIA request

17. OBLIGATIONS OF BIDDERS

By submitting a bid, each bidder does certify that he/she has read and is thoroughly familiar with the bid documents (including all addenda) and has included in the bid all labor, materials, and delivery costs to complete this contract. The failure of any form, instrument or document shall in no way relieve the bidder from obligations in respect to this bid.

18. SILENCE OF SPECIFICATIONS

The apparent silence of specifications as to any detail or apparent omission from it as detailed description concerning any portion shall be interpreted as meaning that only the best commercial material or practice shall prevail and that only items of the best material or workmanship be used. In the event of discrepancies among any of the contract documents, the most stringent requirement shall apply.

19. PRECEDENCE

Where there appears to be variances or conflicts, the following order of precedence shall prevail: The College's Scope of Work, the Invitation for Bids General Terms & Specifications and the Bid Response.

20. AUDIT / ACCESS TO RECORDS

The contractor shall maintain books, records, documents and other evidence directly pertinent to performance of the work under this agreement consistent with generally accepted accounting standards in accordance with the American Institute of Certified Public Accountants Professional Standards. The contractor shall also maintain the financial information and data used by the contractor in the preparation or support of any cost submissions required under this subsection, (Negotiation of Contract Amendments, Change Orders) and a copy of the cost summary submitted to the owner. The Auditor General, the owner, or an Agency, or any of their duly authorized representatives shall have access to the books, records, documents, and other evidence for purposes of inspection, audit, and copying. The contractor will provide facilities for such access and inspection.

21. DISCLOSURES AND POTENTIAL CONFLICTS OF INTEREST (30 ILCS 500/50-35)

The College prohibits public officials or employees from performing or participating in an official act or action with regard to a transaction in which he has or knows he will thereafter acquire an interest for profit, without full public disclosure of such interest. This disclosure requirement extends to the spouse, children and grandchildren, and their spouses, parents and the parents of a spouse, and brothers and sisters and their spouses.

To ensure full and fair consideration of all proposals, the College requires all bidders, including owners or employees, to investigate whether a potential or actual conflict of interest exists between the bidders and the College, its officials, and/or employees. If the bidder discovers a potential or actual conflict of interest, the bidders must disclose the conflict of interest in its proposal, identifying the name of the College official or employee with whom the conflict may exist, the nature of the conflict of interest, and any other relevant information. The existence of a potential or actual conflict of interest does NOT, on its own, disqualify the disclosing bidder from consideration. Information provided by the bidders in this regard will allow the College to take appropriate measures to ensure the fairness of the proposal process.

The College requires all bidders to submit a certification, enclosed with this bid packet, indicating that the bidder has conducted the appropriate investigation and disclosed all potential or actual conflicts of interest.

By submitting a bid, all bidders acknowledge and accept that if the College discovers an undisclosed potential or actual conflict of interest, the College may disqualify the bidders and/or refer the matter to the appropriate authorities for investigation and prosecution.

22. CHANGE IN STATUS

The Contractor shall notify the College immediately of any change in its status resulting from any of the following a) Contractor is acquired by another party; (b) change in greater than 5% ownership interest; (c) Contractor becomes insolvent; (d) Contractor, voluntarily or by operation law, becomes subject to the provisions of any chapter of the Bankruptcy Act; (e) Contractor ceases to conduct its operations in normal course of business. The College shall have the option to terminate its agreement with the Contractor immediately on written notice based on any such change in status.

23. ILLINOIS HUMAN RIGHTS ACT (775 ILCS 5/)

In the event of the Subcontractor's non-compliance with the provision of the Equal Employment Opportunity Clause, the Illinois Human Rights Act or the Applicable Rules and Regulations of the Illinois

Department of Human Rights ("Department"), the firm may be declared ineligible for future contracts or subcontracts with the State of Illinois or any of its political subdivisions or municipal corporations, and the contract may be cancelled or voided in whole or part, and such other sanctions or penalties may be imposed or remedies invoked as provided by statute or regulation.

24. SEX OFFENDER REGISTRATION REQUIREMENT NOTIFICATION

Illinois Compiled Statutes (730 ILCS 150/2) requires that any person who is required by law to register as a sex offender and who is either a student or an employee at an institution of higher education, must also register with the police department of the institution they are employed by or attending. For purposes of this act, a student or employee is defined as anyone working at or attending the institution for a period of five (5) days or an aggregate period of more than thirty (30) days during a calendar year. This includes persons operating as or employed by an outside contractor at the institution. Anyone meeting the above requirements is required to register at the Campus Police Department located in E166, within five (5) days of enrolling or becoming employed. Persons failing to register are subject to criminal prosecution.

25. NON-SMOKING/ALCOHOL AND CONTROLLED SUBSTANCES

Pursuant to 110 ILCS 64/1 (Smoke Free Campus Act) smoking of any kind is prohibited on all College properties including buildings, grounds, parking lots and vehicles that are owned or operated by the College. This statute shall apply to all contractors, subcontractors and their employees. Penalties for noncompliance of this policy will include but not be limited to disciplinary action, fines and/or contract termination. Additionally, all contractors, subcontractors and their employees are prohibited from using or being under the influence of any controlled substance, including, but not limited to alcohol and cannabis, on all College properties including buildings, grounds, parking lots and vehicles that are owned or operated by the College.

26. FIELD MODIFICATIONS

A field modification is written by the College to the Contractor for purposes of clarification of the specifications or plans. A field modification is limited to items that do not change the scope of the project. Field modifications do not affect either the project cost or completion date.

27. OMISSIONS/HIDDEN CONDITIONS

The drawings and specifications are intended to include all work and materials necessary for completion of the work.

Any incidental item of material, labor, or detail required for the proper execution and completion of the work and omitted from either the drawings or specifications or both, but obviously required by governing codes, federal or state laws, local regulations, trade practices, operational functions, and good workmanship, shall be provided as a part of the contract work at no additional cost to the owner, even though not specifically detailed or mentioned.

28. COMPLIANCE

Vendors/Contractors must conform to all federal, state, local and OSHA Regulations now in effect.

END OF SECTION 00 12 00

SECTION 00 14 00 DRAWING INDEX

Project:
McHenry County College – Engagement Center
At:
McHenry County College
8900 US Highway 14.
Crystal Lake, IL 60012

Owner:
McHenry County College
8900 US Highway 14.
Crystal Lake, IL 60012

Architect:
DEMONICA KEMPER ARCHITECTS
125 HALSTED ST., SUITE 301
CHICAGO, IL 60661

The following listed documents comprise the Contract Documents for this project.
When a numerical sequence of sections is interrupted, such interruptions are intentional.

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P1.01	UNDERFLOOR – PLUMBING – EVENT SPACE	02/03/2025
P1.02	FLOOR PLAN – PLUMBING – EVENT SPACE	02/03/2025
P2.00	PLUMBING DETAILS	02/03/2025
FIRE PROTECTION		
F0.00	FIRE PROTECTION COVER SHEET	02/03/2025
FD1.01	FLOOR PLAN DEMOLITION – FIRE PROTECTION – EVENT SPACE	02/03/2025
F1.01	FLOOR PLAN – FIRE PROTECTION -EVENT SPACE	02/03/2025
F2.00	FIRE PROTECTION DETAILS & SCHEDULES	02/03/2025
ELECTRICAL		
E0.00	ELECTRICAL COVER SHEET	02/03/2025
ED1.01	FLOOR PLAN DEMOLITION - ELECTRICAL	02/03/2025
E1.00	OVERALL PLAN – ELECTRICAL	02/03/2025
E1.01	FLOOR PLAN – LIGHTING	02/03/2025
E1.02	FLOOR PLAN – POWER	02/03/2025
E1.03	FLOOR PLAN – SYSTEMS	02/03/2025

E1.04	ROOF PLAN – POWER & SYSTEMS	02/03/2025
E3.00	ELECTRICAL DETAILS	02/03/2025
E4.00	ELECTRICAL RISER DIAGRAMS	02/03/2025
E5.00	ELECTRICAL SCHEDULES	02/03/2025
E6.00	ELECTRICAL PANLE SCHEDULES	02/03/2025
TECHNOLOGY		
T0.00	TECHNOLOGY COVERSHEET	02/03/2025
TD1.00	OVERALL PLAN DEMOLITION – TECHNOLOGY	02/03/2025
TD1.01	FLOOR PLAN DEMOLITION – TECHNOLOGY – EVENT SPACE	02/03/2025
TD1.02	FLOOR PLAN DEMOLITION – TECHNOLOGY – ENTRY	02/03/2025
T1.00	OVERALL PLAN – TECHNOLOGY	02/03/2025
T1.01	FLOOR P LAN – TECHNOLOGY – EVENT SPACE	02/03/2025
T1.02	FLOOR PLAN DEMOLITION – TECHNOLOGY – ENTRY	02/03/2025
T2.00	TECHNOLOGY ENLARGED PLANS	02/03/2025
T3.00	TECHNOLOGY DETAILS	02/03/2025
T3.01	TECHNOLOGY DETAILS	02/03/2025

END SECTION 00 14 00

SECTION 00 20 00
PREVAILING WAGE REQUIREMENTS

PART 1 - GENERAL

1.01 REQUIREMENTS

A. Each Contractor shall comply with requirements of "An Act regulating wages of laborers, mechanics and other workmen employed in any public works by the State, County, City or by any public body or any political subdivision or by anyone under contract for public works".

B. If, during the course of work under this contract, the Department of Labor revises the prevailing rate hourly wages to be paid under this contract for any trade or occupation, Owner, will notify Contractor and each Subcontractor of the changes in the prevailing rate of hourly wages. Contractor shall have the sole responsibility and duty to ensure that the revised prevailing rate of hourly wages is paid by Contractor and all Subcontractors to each worker to whom a revised rate is applicable. Revisions to the prevailing wage as set forth above shall not result in an increase in the Contract Sum.

1.02 ACTS AND ORDINANCES

A. "An Act regulating wages of laborers, mechanics and other workmen employed in any public works by the State, County, City or by any public body or any political subdivision or by anyone under contract for public works. Illinois Revised Statutes. 1981. Chapter 48. Section 39s-1 through 39s-2".

B. The work of this project will be governed by the Illinois Department of Labor Prevailing Wage Rates for the applicable County, effective at the time of the Project Bid date. In an effort to reduce the number of printable pages in the bid package, this document is excluded from the contract documents.

C. If your firm requires a copy of the document for review, please visit the Illinois Department of Labor's Website.

1.03 PREVAILING WAGE (820 130/0.01 *et. seq.*)

A. It is the policy of the State of Illinois that a wage of no less than the general prevailing hourly rate as paid for work of similar character in the locality in which the work is performed, shall be paid to all laborers, workers and mechanics employed by or on behalf of any and all public bodies engaged in public works.

B. Effective September 1, 2020, the Illinois Department of labor (IDOL) has activated an electronic database (Payroll Portal) capable of accepting and retaining certified payrolls submitted under the State of Illinois Prevailing wage Act (820 ILCS/130/1). All contractors and subcontractors completing work for Lake County pursuant to the Act must submit all certified payroll through the IDOL Payroll Portal.

C. Any contractor or subcontractor subject to this Act and any officer, employee, or agent of suc contractor or subcontractor whose duty as such officer, employee, or agent it is to file such certified payroll who willfully fails to file such a certified payroll on or before the date such certified payroll is required by this paragraph to be filed and any person who willfully files a false certified payroll that is fase as to any material fact is in violation of this Act and guilty of a Class A misdemeanor. (820 ILCS 130/5(2)).

D. Effective September 1, 2020, to receive payment for work conducted in Lake County, contractors must provide the email certification received from their IDOL submittal and any subcontractors working on the project with each of their pay requests.

E. A contractor or subcontractor convicted or found guilty under Section 5 or 6 of this Act shall be subject to an automatic and immediate debarment, thereafter prohibited from participating in any public works project for 4 years, with no right to a hearing (820 ILCS 130/11a).

END OF SECTION 00 20 00

SECTION 00 21 00
LABOR STATUTES, RECORDS AND RATES

LABOR STATUTES, RECORDS, AND RATES – STATE OF ILLINOIS

All Contractors shall familiarize themselves with all provisions of all Acts referred to herein and, in addition, shall make an investigation of labor conditions and all negotiated labor agreements which may exist or are contemplated at this time. Nothing in the Acts referred to herein shall be construed to prohibit the payment of more than the prevailing wage scale.

In the employment and use of labor, the Contractor and any subcontractor of the Contractor shall conform to all Illinois Constitutional and statutory requirements, including, but not limited to, the following:

1. Equal Employment Opportunity:
   1.1 Illinois Constitution, Article I, Section 17, which provides: "All persons shall have the right to be free from discrimination on the basis of race, color, creed, national ancestry and sex in the hiring and promotion practices of any employer or in the sale or rental of property."

   1.2 Illinois Constitution, Article I, Section 18, which provides: "The equal protection of the laws shall not be denied or abridged on account of sex by the state of its units of local government and school districts."

   1.3 The Public Works Employment Discrimination Act, 775 ILCS 10/1, provides in substance that no person may be refused or denied employment by reason of unlawful discrimination, nor may any person be subjected to unlawful discrimination in any manner in connection with contracting for or performance of any work or service of "any kind by, for, on behalf of, or for the benefit of the State, or of any department, bureau, commission, board or other political subdivision or agency thereof."

   1.4 Contractor shall comply with the Illinois Human Rights Act, 775 ILCS 5/1-101 *et seq*., as amended and any rules and regulations promulgated in accordance therewith, including, but not limited to the Equal Employment Opportunity Clause, Illinois Administrative Code, Title 44, Part 750 (Appendix A), which is incorporated herein by reference. Furthermore, the Contractor shall comply with the Public Works Employment Discrimination Act, 775 ILCS 10/0.01 et seq., as amended.

2. The Veterans Preference Act, 330 ILCS 55/1, provides: "In the employment and appointment to fill positions in the construction, addition to, or alteration of all public works undertaken or contracted for by the State, or any of its political subdivisions thereof, preference shall be given to persons who have been members of the Armed Forces of the United States...in times of hostilities with a foreign country..."

3. The Servicemen's Employment Tenure Act, as amended, 330 ILCS 60/2, "safeguarding the employment and the rights and privileges inhering in the employment contract of servicemen."

4. This contract calls for the construction of a “public work,” within the meaning of the Illinois Prevailing Wage Act, 820 ILCS 130/.01 et seq. (“the Act”). The Act requires contractors and subcontractors to pay laborers, workers, and mechanics performing services on public works projects no less than the current “prevailing rate of wages” (hourly cash wages plus amount for fringe benefits) in the county where the work is performed. The Department publishes the prevailing wage rates on its website at http://labor.illinois.gov/. The Department revises the prevailing wage rates, and the contractor/subcontractor has an obligation to check the Department’s website for revisions to prevailing wage rates. For information regarding current prevailing wage rates, please refer to the Illinois Department of Labor’s website. All contractors and subcontractors rendering services under this contract must comply with all requirements of the Act, including but not limited to all wage requirements and notice and record-keeping duties.

5. The Child Labor Law, as amended, 820 ILCS 205/1, which provides: "No minor under 16 years of age...at any time shall be employed, permitted or suffered to work in any gainful occupation...in any type of construction work within this state."

   The Contractor will include verbatim or by reference the provisions contained herein in every subcontract it awards under which any portion of the contract obligations are undertaken or assumed, so that such provisions will be binding upon such subcontractor. The Contractor will be liable for compliance with these provisions by such subcontractors.

   The Contractor and each subcontractor shall keep or cause to be kept an accurate record of names, occupations, and actual wages paid to each laborer, workman, and mechanic employed by them in connection with the contract. This record shall be open at all reasonable hours for inspection by any representative of the College or the Illinois Department of Labor and must be preserved for four (4) years following completion of the contract.

END OF SECTION 00 21 00

SECTION 00 31 00
BID FORM

BIDS DUE: June 5, 2025

PROVIDE DUPLICATE COPIES OF THE BID FORM WITH EACH BID PACKAGE PROPOSAL

BID PACKAGE: _____ - Contract Drawings, Project Manual & Construction Manual

Project:

McHenry County College – Engagement Hall

At:
McHenry County College
8900 Northwest Highway #14
Building A, Room 217
Crystal Lake, IL 60012

Owner:
McHenry County College
8900 Northwest Highway #14
Crystal Lake, IL 60012

Architect:
DEMONICA KEMPER ARCHITECTS
125 HALSTED ST., SUITE 301
CHICAGO IL, 60661

Submitted By:

_____ Date_____ 2025
(Name of bidder)

_____
(Address)

Attn: _____
McHenry County College
8900 Northwest Highway #14
Crystal Lake, IL 60012
(All bid envelopes must contain the project name, College of Lake County IFB# 25018, Bid Opening date & time and bid package description.)

We, the undersigned Bidder, having familiarized ourselves with the sites, the local conditions affecting the cost of the Project and the Bidding and Contract Documents, including Addenda Nos. _____, _____, _____, _____, and all Invitation to Bid Addenda and project Memos for the construction of the project "McHenry Count Collage – Engagement Hall" as prepared by Demonica Kemper Architects and other design consultants do hereby propose to provide and furnish all labor, materials, tools, equipment, utility and transportation services, scaffolding, insurance, supervision and all other services and facilities necessary, as required by said Contract Documents to complete all work as hereinafter designated, for the sum of money enumerated, the said amount, constituting the base bid.

BID SECURITY

Enclosed with this Bid is a Bid security in the form of a bid bond made payable to McHenry County College in an amount equal to ten percent (10%) of the Base Bid plus all additive alternates, in accordance with the Instructions to Bidders.

CONTRACT DOCUMENTS

The Project Manual and all Drawings including the Drawing Index, Invitation to Bid, Bid Notice, Instruction to Bidders, Supplemental Instructions to Bidders, Pepper Construction Company Construction Manual, Prevailing Wage Rate Schedule, Agreement between Owner and Construction Manager (hereinafter the Agreement), Conditions of the Contract (General and Supplementary), Drawings, Schedules, Specifications, and Addenda issued prior to execution of the Contract.

Having examined the site of the work, and having familiarized himself or herself with local conditions and existing site conditions affecting the cost of the work and with all requirements of the Contractor Documents, hereby agrees to perform all work and furnish all labor, material and equipment specifically required of him or her by the Contract Documents and such additional work as may be included as related requirements in other Divisions or Sections of the specifications, and referenced standards.

ALLOWANCES

(See "Bid Package Scope Sheets" Section 00 32 00 for Details)
The base bid includes the allowances as specified in the Project manual and Scope Sheets.

BASE BIDS

All prices quoted represent the entire cost of the project in accordance with the bidding documents, including the performance and payment bonds, and we acknowledge that no subsequent claim will be recognized for any increase in wage scales, material prices, cost or any other rates affecting the construction industry and/or this project.

The undersigned agrees to perform all work for the bid package indicated above as set forth in the bidding documents for the sum listed below:

Total Base Bid:

_____ **Dollars ($_____)**
(Written Text Amount) (Written Numerical Amount)

ALTERNATES

The undersigned hereby proposes to furnish everything required for completion of the Alternates indicated. The following amounts for Alternate construction, as more fully described in the bid documents and Section 00 32 00 of the Construction Manual, may be added to or deducted from the Base Bid, if selected.

Acceptance of any or all of the alternates for inclusion in the contract is the sole prerogative of the Owner. All costs due to the alternates are included in the amount to be added or deducted from the base bid, so that no additional costs will be borne by the Owner due to acceptance of alternates. Each alternate bid amount entered below is for all work required for completion of the specific alternate bid as shown on the Drawings and as described in the Specifications.

Alternate pricing must be held for the entire length of the contract. The Owner maintains the right to award the alternate work prior to, during or after contract award and/or the start/completion of the Base Bid work.

Insert N/A on lines not applicable to the Bidder's area of Work. Alternates are Add Alternates only.

Alt. #1:	Add/Deduct $_____
Alt. #2:	Add/Deduct $_____
Alt. #3:	Add/Deduct $_____

BREAKOUT COSTS

Upon contract award, the undersigned may be required to provide additional bid breakdowns for certain portions of the Base Bid. This breakdown will be for information purposes only.

NONE

UNIT PRICES

The undersigned submits the following unit prices as a proposed basis for additive or deductive adjustment under Allowances in the event contract changes in the Work are required involving items described. It is understood and agreed that unit prices are separately subject to acceptance by the Owner and that such prices are not part of the Contract except as accepted and entered in the Agreement. Unit Prices shall include labor, materials, equipment fees, taxes, bonds, profit and overhead necessary to perform the Work described below and as specified in the Bidding Documents.

NONE

PERFORMANCE & PAYMENT BONDS

Contractors are to include the cost of Performance & Payment Bonds in all Base Bids and Alternate Bids. Performance and Payment bonds are to be in an amount equal to 100 percent (100%) of the contract value. Please provide the following information:

_____ _____

(Name of Company Furnishing Bonds) (Best Insurance Guide Latest Edition Rating)
(A,X Minimum Required)

The undersigned agrees, within 10 days after notice of acceptance of this bid, to provide required Insurance, and performance and payment bonds.

VOLUNTARY ALTERNATES / SUBSTITUTIONS

The Owner maintains the right to accept or reject any/all Voluntary Alternates or Material Substitutions. Voluntary Alternates of Material Substitutions should NOT be included in base bid lump sum.

1. _____ Deduct/Add $_____
2. _____ Deduct/Add $_____
3. _____ Deduct/Add $_____
4. _____ Deduct/Add $_____
5. _____ Deduct/Add $_____

TIME OF COMPLETIONS

If awarded the Contract, the undersigned agrees to complete all work under the Base Bid and Alternates, in accordance with the Schedule, Construction Manual Section 00 33 00.

PURCHASE ORDER TERMS AND CONDITIONS

Supplier responsible for reading and complying with the College's purchase order terms and conditions found at

_____

Initial your understanding of this requirement: _____

CONTACT WITH COLLEGE PERSONNEL / BLACKOUT PERIOD

All bidders are prohibited from making any contact (including sales calls) with the College President, Trustees, or any other official or employee of the College (collectively "College personnel") with regard to the request for bids, other than in the manner and to the person(s) designated herein until after an award has been made. The College Vice President of Business Services and Finance reserves the right to disqualify any Bidder found to have contacted College personnel in any manner with regard to the request for bid.

Additionally, if the Vice President of Business Services and Finance determines that the contact with College personnel was in violation of any provision of 720 ILCS 5/33E, the matter will be turned over to the McHenry County State's Attorney for review and prosecution.

Initial your understanding of this requirement: _____

JURISDICTION, VENUE, CHOICE OF LAW

This contract shall be governed by and construed according to the laws of the State of Illinois. Jurisdiction and venue shall be exclusively found in the **19th Judicial Circuit Court of McHenry County.**

Initial your understanding of this requirement: _____

EXPERIENCE MODIFICATION RATING (EMR)

Provide your firm's Experience Modification Rating (EMR) for the last three (3) years. Please consult your insurance agent for this information.

2022 _____ 2023 _____ 2024 _____

ADMINISTRATION OF CONTRACTS

The undersigned, in submitting this document, agrees that if the undersigned is the successful Bidder, the undersigned Bidder will accept assignment of his contract by **McHenry County College** to Pepper Construction Company and administration of the Contract by the Construction Manager (CM) and enter into a Contract with the CM according to the terms and conditions of Pepper Construction Prime Trade Agreement with Amendments, a sample of which is included in the contract documents, un-altered.

In submitting this proposal, it is hereby understood that the Owner reserves the unrestricted privilege of rejecting any or all Bids, or parts of Bids, and to waive any informalities in Bidding.

It is agreed that this proposal shall be irrevocable for a period of ninety (90) days after the specified date for receiving Bids.

_____
(Firm Name)

_____
(By)

_____ _____
(Witness) (Title)

_____ _____
(Date) (Date)

State whether a Corporation ( )
Partnership ( )
Sole Proprietorship ( )

OFFICIAL ADDRESS

_____

_____

_____ (Telephone No.) _____

BID CONTACT

_____ _____ _____
(Name) (Email) (Phone)

BID SUBMISSION CHECK LIST

Please be sure 2 COPIES AND A USB COPY OF ALL the following documents are included with your bid in a sealed envelope. If this bid form and the documents listed below are not completed in their entirety or not submitted as part of your package, the bid may be considered as not responsive / non-conforming.

- ☐ Bid Bond of 10% of the amount of the Base Bid
- ☐ 00 31 00 Bid Form – ALL PAGES Completed
- ☐ 00 40 00 Bidder's Qualification – A305 and Exhibits
- ☐ 00 41 00 Anti-Collusion Affidavit
- ☐ 00 42 00 Disqualification of Certain Bidders
- ☐ 00 43 00 Conflict of Interest
- ☐ 00 44 00 Participation Affidavit
- ☐ 00 45 00 Bid Bond Form
- ☐ 00 50 00 Contractor References
- ☐ 00 80 00 Completed BEP Participation Utilization Plan Documentation.
  - ☐ **ALL BIDDERS** Submit "BEP Utilization Plan"
  - ☐ **ALL BIDDERS** Submit "Utilization Plan Part I: Bidder/Offeror Signed Commitment"
  - ☐ **IF BDDERS MEET GOAL THROUGH SELF PERFORMANCE** submit documentation of your company's registration as certified firm.
  - ☐ **IF BIDDERS INCLUDE ANY PERCENTAGE OF PARTICIPATION** Complete and submit "Utilization Plan Part II: Subcontracting Participation Agreement."
  - ☐ **IF BIDDERS INCLUDE 0% -29%** Complete and Submit "Utilization Plan Part III: Demonstration of Good Faith Efforts to Achieve Foal and Request for Waiver"
  - ☐ **IF BIDDERS INCLUDE 0% -29%** Provide a letter on your company letter head describing your good faith efforts and why you are unable to meet the 30% goal.

MAKE SURE YOU SUBMIT 2 COPIES AND A USB COPY OF YOUR BID IN YOUR SEALED ENVELOPE

END OF SECTION 00 31 00

DOCUMENT 00 31 32 - GEOTECHNICAL DATA

PART 1 - GENERAL

1.1 GEOTECHNICAL DATA

A. This Document with its referenced attachments is part of the Procurement and Contracting Requirements for Project. They provide Owner's information for Bidders' convenience and are intended to supplement rather than serve in lieu of Bidders' own investigations. They are made available for Bidders' convenience and information. This Document and its attachments are not part of the Contract Documents.

B. Because subsurface conditions indicated by the soil borings are a sampling in relation to the entire construction area, and for other reasons, the Owner, the Architect, the Architect's consultants, and the firm reporting the subsurface conditions do not warranty the conditions below the depths of the borings or that the strata logged from the borings are necessarily typical of the entire site. Any party using the information described in the soil borings and geotechnical report shall accept full responsibility for its use.

C. A geotechnical investigation report for Project, prepared by Rubino Engineering, Inc., dated June 14, 2024, is available for viewing as appended to this Document.

1. The opinions expressed in this report are those of a geotechnical engineer and represent interpretations of subsoil conditions, tests, and results of analyses conducted by a geotechnical engineer. Owner is not responsible for interpretations or conclusions drawn from the data.
2. Any party using information described in the geotechnical report shall make additional test borings and conduct other exploratory operations that may be required to determine the character of subsurface materials that may be encountered.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF DOCUMENT 00 31 32

Geotechnical Engineering Services Report

Drilling
Laboratory Testing
Geotechnical Analysis

McHenry County College

8900 Northwest Highway #14

Crystal Lake, Illinois

Rubino Project No. G24.162

Prepared by:
David T. Lewandowski, PE

rubino ENGINEERING INC.

Michelle A. Lipinski, PE
President
IL No. 062-061241, Exp. 11/30/2025

Prepared For:

Demonica Kemper Architects

125 North Halsted Street

Suite 301

Chicago, Illinois

November 8, 2024

TABLE OF CONTENTS

PROJECT INFORMATION

Rubino Engineering, Inc. (Rubino) understands that Demonica Kemper Architects is planning to construct several improvements to the existing college campus. These improvements are as follows:

- Proposed Building Addition (Event Center) – 1 ½-story structure with slab-on-grade construction
  - 16 – 18 feet in height
  - Finished floor elevation = 917.96 feet
  - Plan area of new addition = 4,000 square feet (Rubino estimate)
  - Individual column loads not exceeding 100 kips (Rubino estimate)
  - Bearing wall loads not exceeding 5 kips per lineal foot (klf) (Rubino estimate)
- Proposed detention basin – preliminary information
  - Bottom of basin elevation = EL. 913.50 feet
  - Top of basin elevation = 919.50 feet
- Proposed sidewalk improvements – north and south of building addition

Site Grading was received. Recommendations in this report are based on the following:

- Site grading includes cuts and fills being less than one foot in the building addition and sidewalk improvement areas.

Documents received:

- MCC Event Space – Building Borings (jpg file)
- MCC Event Space – Site Borings (jpg file)
- MCC Site Location Map (jpg file)
- "2403560_xC-Dsgn-storm-sewer-markup_10022024" – (pdf file)
- "Proposal Boring Locations-HRG-redline-elev" – (pdf file)
- "2403560_Grading_Plan" – Civil Grading Plan, Drawing C-300 dated September 10, 2024
- "2403560_Site_Plan" – Civil Site Plan, Drawing C-200 dated September 10, 2024

Project Correspondence:

- RFP Email from Dominick Demonica, AIA, NCARB, LEED AP of Demonica Kemper Architects on August 26, 2024
- Phone conversation with David Sikorski, AIA, NCARB of Demonica Kemper Architects on September 3, 2024 – project description
- Emails from David Sikorski, AIA, NCARB of Demonica Kemper Architects on October 3, 2024 – finished floor elevation and boring elevations
- Authorization to proceed via signed proposal on September 9, 2024
- Email from Todd Richards, PE of HRGreen on October 21, 2024 – preliminary basin design information / attachments: grading plan and site plan

The geotechnical recommendations presented in this report are based on the available project information and the subsurface materials described in this report. If any of the information on which this report is based is incorrect, please inform Rubino in writing so that we may amend the recommendations presented in this report (if appropriate, and if desired by the client). Rubino will not be responsible for the implementation of our recommendations if we are not notified of changes in the project.

Purpose / Scope of Services

The purpose of this study was to explore the subsurface conditions at the site in order to prepare geotechnical recommendations for foundation design, subgrade preparation, detention design and general site development for the proposed construction. Rubino's scope of services included the following drilling program:

Table 1: Drilling Scope

BORING NOS.	DEPTH (FEET BEG*)	LOCATION
B-01 & B-03	5	Sidewalk Improvements
B-02	15	Detention Basin
B-04 – B-07	20	Building Addition

*BEG = below existing grade

Representative soil samples obtained during the field exploration program were transported to the laboratory for additional classification and laboratory testing.

This report briefly outlines the following:

- *Summary of client-provided project information and report basis*
- *Overview of encountered subsurface conditions*
- *Overview of field and laboratory tests performed including results*
- *Geotechnical recommendations pertaining to:*
  - *Subgrade preparation, stability and cut / fill recommendations*
  - *Shallow Foundations, including suitable foundation type(s), allowable bearing pressure(s), and estimated settlement*
  - *Seismic design site classification parameters*
  - *Estimated IBV value at borings within the proposed sidewalks*
  - *Estimate of infiltration rate based on hydrometer test results*
- *Construction considerations, including temporary excavation and construction control of water*

DRILLING, FIELD, AND LABORATORY TEST PROCEDURES

The client selected the number of borings and the boring depths. Rubino located the borings in the field by measuring distances from known fixed site features. The borings were advanced utilizing 3 ¼ and 2 ¼-inch inside-diameter, hollow stem auger drilling methods and soil samples were routinely obtained during the drilling process.

Selected soil samples were tested in the laboratory to determine material properties for this report. Drilling, sampling, and laboratory tests were accomplished in general accordance with ASTM procedures. The following items are further described in the Appendix of this report.

- *Field Penetration Tests and Split-Barrel Sampling of Soils (ASTM D1586)*
- *Field Water Level Measurements*
- *Laboratory Determination of Water (Moisture) Content of Soil by Mass (ASTM D2216)*
- *Laboratory Determination of Atterberg Limits (ASTM D4318)*
- *Laboratory Determination of Particle Size (Hydrometer) Analysis of Soils (ASTM D422)*
- *Laboratory Organic Content by Loss on Ignition (ASTM D2974)*

The laboratory testing program was conducted in general accordance with applicable ASTM specifications. The results of these tests are to be found on the accompanying boring logs located in the Appendix.

SITE AND SUBSURFACE CONDITIONS

Site Location and Description

The project sites are located within the campus of McHenry County College in Crystal Lake, Illinois. Historical imagery from Google Earth Pro dating back to April 1988 indicated that the existing building complex was not present. The plan for the new building addition appears to be a parking lot.

The midpoint of the project site has an approximate latitude and longitude of 42.2594º and -88.3680º, respectively.

SUMMARY OF GEOTECHNICAL CONSIDERATIONS

The main geotechnical design and construction considerations at this site are:

- **Subgrade soils** generally consisted of undocumented fill and brown well-graded sandy GRAVEL / gravelly SAND. See the *Subsurface Conditions* and *Undocumented Fill Discussion* sections for more detailed information.
- **Free groundwater was observed** within several borings during drilling operations. See the *Groundwater Conditions* section for more information.
- **Shallow Foundations** are a possible foundation design option at this site with the possibility of undercuts due to the presence of undocumented fill. See the *Shallow Foundation Recommendations* section for more detailed information.
- The soils in the area of the proposed detention pond area were classified as undocumented fill (granular) underlain by well-graded sandy gravel (loamy sand per USDA) which typically has a **higher permeability rate**. See the *Detention Basin Recommendations* and *Infiltration Rate Discussion* sections for more detailed information.
- **Undercuts** may be needed to achieve subgrade stability in the areas of the proposed sidewalk improvements. See the *Subgrade Stability / Undercut Recommendations* section for more detailed information.

The geotechnical-related recommendations in this report are presented based on the subsurface conditions encountered and Rubino's understanding of the project. Should changes in the project criteria occur, a review must be made by Rubino to determine if modifications to our recommendations will be necessary.

Subsurface Conditions

Beneath the existing surficial topsoil, subsurface conditions generally consisted of undocumented fill (granular and cohesive) underlain by brown well-graded sandy gravel / gravelly sand.

- The **topsoil** thickness ranged between approximately 6 and 11 inches
- The **undocumented fill** soils were both granular and cohesive in nature
- The native **granular** soils were generally loose to dense in apparent density

Table 2: Subsurface Conditions Summary

Approximate Elevation Range (feet)	Soil Description	SPT N-values (blows per foot)	Moisture Content (%)	Estimated Shear Strength
Sidewalk Improvements (B-01 & B-03)				
917 - 913	FILL: gray sandy gravel, with bricks *Rock chips observed. Possible cobbles/boulders encountered (B-01)*	46 - 76	3 - 4	---
916 – 913 ½	FILL: dark brown silty clay, trace sand and gravel *(B-03)*	5	27	---
913 ½ - 912	Medium dense, brown well-graded gravelly SAND *(B-03)*	16	14	$\phi \cong 31 - 33°$
Detention Basin (B-02)				
918 ½ - 915 ½	FILL: brown and gray sandy gravel *Rock chips observed. Possible cobbles/boulders encountered (B-02)*	52	2	---
915 ½ - 904	Medium dense to dense, brown well-graded sandy GRAVEL	22 - 33	3 - 13	$\phi \cong 34 - 37°$
Building Addition (B-04 – B-07)				
917 - 914	FILL: brown and gray sandy gravel *Rock chips observed. Possible cobbles/boulders encountered (B-04)*	45	6	---
917 – 914 ½	FILL: dark brown and brown silty clay, trace to with sand and gravel *(B-06 & B-07)*	5 - 19	12 - 23	——
917 ½ - 897	Medium dense to dense, brown well-graded sandy GRAVEL / gravelly SAND *Rock chips observed. Possible cobbles/boulders encountered*	13 - 53	3 - 12	$\phi \cong 31 - 40°$

The native soils were visually classified as well-graded gravelly sand (SW) and sandy gravel (GW) according to the Unified Soil Classification System (USCS). The above table is a general summary of subsurface conditions. Please refer to the boring logs for more detailed information. Estimated shear strength of clay soils is based on empirical correlations using N-values, as applicable.

Groundwater Conditions

Groundwater was encountered in some of the borings during drilling operations. The following table summarizes groundwater observations from the field:

Table 3: Groundwater Observation Summary

BORING NUMBER	APPROXIMATE GROUNDWATER ELEVATION DURING DRILLING (FEET)	APPROXIMATE GROUNDWATER ELEVATION UPON AUGER REMOVAL (FEET)
B-02	905 ½	Not Observed
B-04	909	Not Observed
B-05	905	Not Observed
B-06	909 ½	Not Observed
B-07	909 ½	Not Observed

It should be noted that fluctuations in the groundwater level should be anticipated throughout the year depending on variations in climatological conditions and other factors not apparent at the time the borings were performed. Groundwater may not have been observed in some areas due to the low permeability of soils. Additionally, discontinuous zones of perched water may exist within the soils. The possibility of groundwater level fluctuation should be considered when developing the design and construction plans for the project.

When bidding this project, the contractor should anticipate that groundwater will be present during excavation.

Seasonal High Water Table Level Discussion

A seasonal high water table level is defined as a zone of water-saturated soil at the highest average depth during the wettest season. The seasonal high water table level persists in the soil for more than a few weeks. some of the more important factors that can influence the seasonal high water table elevation are the drainage characteristics of the soils; the land surface elevation; relief points such as adjacent ponds, swales, channels, culverts, etc.; and distance to relief points. Soil color change from brown to gray is a potential indicator of a seasonal high water table.

Seasonal High Ground Water is estimated to be approximately at elevations EL. 906 - EL. 905 feet (13 - 14 feet below the existing grade) in the area of the proposed detention basin (boring B-02).

Undocumented Fill Discussion

Undocumented fill was observed in the borings to elevations ranging from approximately EL. 915 ½ - EL. 913 feet (depths ranging from approximately 3 ½ to 5 feet below existing grade).

Where existing fill is encountered, Rubino recommends that structure foundations extend through the fill materials and be supported on suitable soils or compacted and documented structural fill. See the *Shallow Foundation Recommendations* section for more details.

Undocumented fill is defined as fill that has been placed without being documented as to its placed density and moisture content.

Deleterious materials could include, but are not limited to, bricks, asphalt, concrete, metal, wood, or other building debris.

Undocumented fill materials should be carefully evaluated by proof-rolling and subgrade stability testing (as recommended herein) at the time of construction to document the in-place consistency of these materials.

Deleterious materials (i.e. brick pieces) were observed within the undocumented fill materials during the drilling operations. Although deleterious materials were not encountered in all the undocumented fill materials, this does not eliminate the possibility that deleterious materials could be present within the undocumented fill materials at other locations within the project limits.

If encountered during construction, fill with deleterious materials should be removed and replaced with structural fill at the geotechnical field engineer's discretion at the time of construction.

Topsoil Discussion

Topsoil materials as described in this report have not been analyzed for quality according to any minimum specifications. If topsoil is to be imported to or exported from this site, Rubino recommends that it meet the minimum specifications defined in **Section 1081.05** of the *IDOT Standard Specifications for Road and Bridge Construction*, adopted by the Illinois Department of Transportation, January 1st, 2022.

Rubino has reported topsoil thicknesses at each boring based on visual observation of surficial soils. Surficial topsoil thickness was visually observed to be between approximately 6 and 11 inches.

EVALUATION AND RECOMMENDATIONS

The geotechnical-related recommendations in this report are presented based on the subsurface conditions encountered and Rubino's understanding of the project. Should changes in the project criteria occur, a review must be made by Rubino to determine if modifications to our recommendations will be necessary.

Site Preparation Recommendations

The following comments are considered site-specific. To reference general subgrade preparation recommendations and compaction recommendations, please refer to the Appendix of this report.

- During construction, the site should be stripped of existing topsoil, concrete, foundations, abandoned utilities, and pavement sections including asphalt, subbase, and curbs if applicable.

- Cohesive soils were encountered in the upper profile at several locations (B-03, B-06 and B-07). Cohesive soils are sensitive to moisture and can be easily disturbed by precipitation, groundwater, or construction equipment. Therefore, extra care should be used to avoid disturbing fine-grained soils during construction activities.

Shallow Foundation Recommendations

Design – Soil Bearing Pressure

The proposed Building Addition (Event Center) can be supported on shallow, spread footing foundations. As discussed previously, Rubino recommends that foundations extend through undocumented fill soils and be supported on the natural, medium dense well-graded gravelly sand soils or compacted and documented structural fill.

Table 4: Bearing Capacity Recommendations

DESCRIPTION	PROPOSED BUILDING ADDITION RECOMMENDATIONS	
Anticipated Foundation Type:	Wall Footing	Column Footing
Max Net Allowable Bearing Pressure (psf):	3,500 psf	4,000 psf
Minimum Dimensions:	2 ft.	3 ft. x 3 ft.
Anticipated Bearing Soil Classification:	Natural, brown well-graded gravelly SAND; DCP ≥ 6 blows per 6 in.	
Anticipated Undercuts	See *Construction – Estimated Undercut Thicknesses* section below	
Boring #'s Referenced:	B-04 - B-07	

The net allowable soil bearing pressure is based on dead load plus design live load and represents the pressure that is in excess of the minimum surrounding overburden pressure at the footing base elevation.

Construction – Estimated Undercut Thicknesses

Undercut thicknesses have been estimated based on existing and proposed elevations. They will likely vary between borings in the field.

Table 5: Estimated Undercut Thicknesses

BORING #	BORING ELEVATION (FEET)	FINISHED FLOOR ELEVATION (FEET)	EXTERIOR FOOTING ELEVATION (FEET)	INTERIOR FOOTING ELEVATION (FEET)	SUITABLE BEARING ELEVATION (FEET)	INTERIOR UNDERCUT THICKNESS (FEET)	RECOMMENDED BACKFILL MATERIAL
B-04	917.35	917.96	~914	~916	~914	~2	Compacted and Documented CA-06 stone*
B-05	918.40	917.96	~914	~916	~917 ½	N/A	
B-06	917.85	917.96	~914	~916	~914 ½	N/A	
B-07	917.80	917.96	~914	~916	~914 ½	N/A	

*The use of lean concrete / flowable fill is not recommended. The granular materials, existing fill and natural soils, will be prone to sloughing and caving. The integrity of the undercut excavation can be compromised.

Undercut excavations should be widened and backfilled as described in *Foundation Construction Recommendations* Appendix to this report.

Construction Considerations

Granular soils can lose relative density due to disturbance by excavation equipment or removal of overburden. Therefore, Rubino recommends that the native gravelly sand soils be compacted in place prior to the construction of footings or placement of structural fill.

Care should be taken to not undermine existing foundations in building addition areas. New footings adjacent to the existing buildings should bear at the same elevation as the existing soil bearing foundations. Construction joints should be provided between the existing building and the additions. In the event excavations extend below the existing foundations within their zone of influence, shoring or underpinning may be required to protect the integrity of the existing structure.

Design / Construction – Frost Protection

Exterior footings should be located at a depth of at least 3 ½ feet below the outside final exterior grades to provide adequate frost protection. If the building is constructed during winter months or if the footings will likely be subjected to freezing temperatures after construction is completed, then the footings should be protected from freezing.

Interior footings should be founded at least 2 feet below the final floor slab level for proper confinement of the bearing soils or as recommended above. Both depths should bear on soils described above.

- **Fine-grained soils such as silts and clays are susceptible to moisture fluctuations and freezing weather**, therefore concrete for the foundations should ideally be poured right after the foundations have been dug and formed if rain is being predicted. Otherwise, foundations that have already been excavated should be protected from rain or surface runoff water.

Design – Settlement Estimate

Based on the known subsurface conditions, laboratory testing, and past experience, Rubino anticipates that properly designed and constructed footings supported on the recommended, observed and documented natural soils, or properly compacted structural fill should experience maximum total and differential settlements between adjacent columns of less than 1 inch and ¾ inches, respectively.

Seismic Site Classification

The 2018 International Building Code references ASCE 7-16 which requires a site class for the calculation of earthquake design forces. This class is a function of soil type (i.e., depth of soil and strata types). Based on the estimated depth to rock and the estimated shear strength of the soil at the boring locations, Site Class "D" is recommended.

This site class is recommended based on Rubino's opinion and experience in the area that the consistency of the soils below the depth explored remain consistent or improve in density. Actual determination of soil properties to a depth of 100 feet was beyond the scope of this project.

The SEAOC/OSHPD probabilistic ground motion values near latitude 42.2594° and longitude –88.3680° are shown in the table to the right.

Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	0.112	MCE_R ground motion. (for 0.2 second period)
S_1	0.059	MCE_R ground motion. (for 1.0s period)
S_{MS}	0.18	Site-modified spectral acceleration value
S_{M1}	0.141	Site-modified spectral acceleration value
S_{DS}	0.12	Numeric seismic design value at 0.2 second SA
S_{D1}	0.094	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	B	Seismic design category
F_a	1.6	Site amplification factor at 0.2 second
F_v	2.4	Site amplification factor at 1.0 second
PGA	0.057	MCE_G peak ground acceleration

Floor Slab Recommendations

Based on the finished floor elevation provided by the client and the encountered subsurface conditions, the anticipated floor slab will bear on tested (using the DCP) and approved existing undocumented fills (granular and cohesive), native brown gravelly sand or compacted and documented structural fill. Subgrade soils should be proof-rolled and documented by the

geotechnical engineer of record prior to placing the floor slab, or inspected and approved newly placed, properly compacted and documented structural fill which extends to original soils as described herein.

Provided that the subgrade consists of native soils (or tested and approved undocumented fill or properly compacted and documented structural fill) as described herein or properly compacted and documented structural fill, a modulus of subgrade reaction, *k* value, of 115 pounds per cubic inch (psi/inch) may be used in the grade slab design. This value is calculated using empirical correlations based on a 1 ft. x 1 ft. plate load test. However, depending on how the slab load is applied, the value will have to be geometrically modified as outlined in the Floor slab section of the *Slab-on-Grade Considerations* Appendix to this report.

Floor slab subgrade preparation should be in accordance with the recommendations outlined in the *Site Preparation* and *Fill Recommendations* in the Appendices of this report.

Subgrade Stability / Undercut Recommendations

The recommendations located in this report are based on the data obtained at each particular soil boring location. Soil subgrade stability at the proposed sidewalk improvement locations may vary in the field between the borings and could be affected by the weather or equipment traffic at the time of construction.

Subgrade soils, including undocumented fill, should be carefully evaluated by subgrade stability testing at the time of construction to document the in-place consistency of these materials (*see Appendix B: Site Preparation*). Rubino has estimated the IBV values as follows:

Table 6: Estimated IBV at Sidewalk Locations

LOCATION	IBV VALUE	GEOTECHNICAL CONSIDERATIONS
B-01 / Sidewalk	9+	Undocumented fill with deleterious materials inclusions
B-03 / Sidewalk	3 – 5	Cohesive soil with low to moderate shear strength / Moisture content exceeding 25%

Detention Basin Recommendations

Near-surface soils in the area of the proposed Detention Basin consisted of: undocumented fill (granular) and well-graded sandy gravel (loamy sand per USDA Classification) (*see boring log B-02 in Appendix for more detailed information*).

The side slopes of the basin should be designed to be 1V:3H or flatter. Detailed slope stability analysis was outside of the scope of this project but can be performed as a supplemental report.

The slopes will require permanent protection to prevent erosion and storm water runoff. The slope protection system should provide a structurally stable topsoil environment for grass growth.

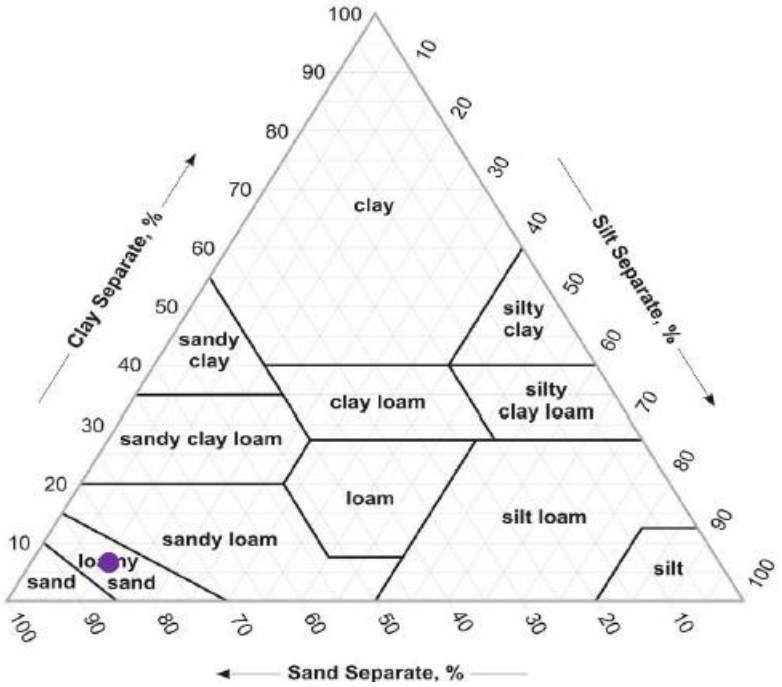
Infiltration Rate Discussion

Soils within the area of exploration (B-02) were used to run a hydrometer lab test. The test results were then characterized by the USDA soil texture classification in order to estimate the infiltration rate of the soil. Results from the hydrometer test are included in the Appendix. The following table includes soil classification for the soil sample based on the USDA as well as recommendations for design infiltration rate for soil based on the *Chicago Stormwater Management Ordinance Manual, 2024*.

Table 7: Design Infiltration Rates

KEY	BORING	ELEVATION (FEET)	USDA SOIL TEXTURE CLASSIFICATION	DESIGN INFILTRATION RATE (IN/HR)
●	B-02	~912	Loamy Sand	1.63 – 3.60*

* Based on the hydrometer testing, the USDA Soil Texture classification ranges between Sand and Loamy Sand if the Gravel Correction factor is applied. The infiltration rate range in the table above is an estimate based on the soil classifications. Upon request, Rubino can remobilize to the site and perform a field infiltration test to determine in situ rates.



USDA Soil Texture	Design Infiltration Rate (in/hr)
Sand	3.60
Loamy Sand	1.63
Sandy Loam	0.50
Loam	0.24
Silt Loam	0.13
Sandy Clay Loam	0.11
Silty Clay Loam	0.19
Clay Loam	0.03
Sandy Clay	0.04
Silty Clay	0.07
Clay	0.07

Dewatering Recommendations

Dewatering may be necessary during excavation of soils due to precipitation, surficial runoff, and the presence of sand seams or other conditions not apparent at the time of drilling. Shoring or trench boxes may be required where the soils are granular, saturated, or have low shear strengths. Please reference the anticipated groundwater levels on the attached boring logs and in the *Groundwater Conditions* section of this report.

Recommendations for Additional Testing

Once the structural loads, site plan and grading plans are finalized, please notify Rubino so that we can review our recommendations for the direct use of the structure and development of the site. Changes in building location, foundation depth, and structural loading can affect the geotechnical recommendations for this site.

During construction, Rubino recommends that one of our representatives be onsite for typical **observations and documentation** of exposed subgrade for trench excavation, support of floor slabs, foundations, and sidewalk slabs, including proofrolling, DCP and penetrometer testing.

CLOSING

The recommendations submitted are based on the available subsurface information obtained by Rubino Engineering, Inc. and design details furnished by Demonica Kemper Architects for the proposed project. If there are any revisions to the plans for this project or if deviations from the subsurface conditions noted in this report are encountered during construction, Rubino should be notified immediately to determine if changes in the foundation recommendations are required. If Rubino is not retained to perform these functions, we will not be responsible for the impact of those conditions on the project.

The scope of services did not include an environmental assessment to determine the presence or absence of wetlands, or hazardous or toxic materials in the soil, bedrock, surface water, groundwater or air on, below, or around this site. Any statements in this report and/or on the boring logs regarding odors, colors, and/or unusual or suspicious items or conditions are strictly for informational purposes.

After the plans and specifications are more complete, the geotechnical engineer should be retained and provided the opportunity to review the final design plans and specifications to check that our engineering recommendations have been properly incorporated into the design documents. At this time, it may be necessary to submit supplementary recommendations. This report has been prepared for the exclusive use of Demonica Kemper Architects and their consultants for the specific application to the proposed improvements at the McHenry County College campus in Crystal Lake, Illinois.

Appendix A – Drilling, Field, and Laboratory Test Procedures

ASTM D1586 Penetration Tests and Split-Barrel Sampling of Soils

During the sampling procedure, Standard Penetration Tests (SPT's) were performed at regular intervals to obtain the standard penetration (N-value) of the soil. The results of the standard penetration test are used to estimate the relative strength and compressibility of the soil profile components through empirical correlations to the soils' relative density and consistency. The split-barrel sampler obtains a soil sample for classification purposes and laboratory testing, as appropriate for the type of soil obtained.

Water Level Measurements

Water level observations were attempted during and upon completion of the drilling operation using a 100-foot tape measure. The depths of observed water levels in the boreholes are noted on the boring logs presented in the appendix of this report. In the borings where water is unable to be observed during the field activities, in relatively impervious soils, the accurate determination of the groundwater elevation may not be possible even after several days of observation. Seasonal variations, temperature and recent rainfall conditions may influence the levels of the groundwater table and volumes of water will depend on the permeability of the soils.

Ground Surface Elevations

The client provided Rubino with elevations at the boring locations. The depths indicated on the attached boring logs are relative to the existing ground surface for each individual boring at the time of the exploration. Copies of the boring logs are located in the Appendix of this report.

ASTM D2216 Water (Moisture) Content of Soil by Mass (Laboratory)

The water content is an important index property used in expressing the phase relationship of solids, water, and air in a given volume of material and can be used to correlate soil behavior with its index properties. In fine grained cohesive soils, the behavior of a given soil type often depends on its natural water content. The water content of a cohesive soil along with its liquid and plastic limits as determined by Atterberg Limit testing are used to express the soil's relative consistency or liquidity index.

ASTM D2974 Standard Test Method for Organic Soils using Loss on Ignition (Laboratory)

These test methods cover the measurement of moisture content, ash content, and organic matter in peats and other organic soils, such as organic clays, silts, and mucks. Ash content of a peat or organic soil sample is determined by igniting the oven-dried sample from the moisture content determination in a muffle furnace at 440°C (Method C) or 750°C (Method D). The substance remaining after ignition is the ash. The ash content is expressed as a percentage of the mass of the oven-dried sample. 2.4 Organic matter is determined by subtracting percent ash content from 100.

ASTM D4318 Atterberg Limits (Laboratory)

Atterberg limit testing defines the liquid limit (LL) and plastic limit (PL) states of a given soil. These limits are used to determine the moisture content limits where the soil characteristics change from behaving more like a fluid on the liquid limit end to where the soil behaves more like individual soil particles on the plastic limit end. The liquid limit is often used to determine if a soil is a low or high plasticity soil. The plasticity index (PI) is the difference between the liquid limit and the plastic limit. The plasticity index is used in conjunction with the liquid limit to determine if the material will behave like a silt or clay.

ASTM D422 Particle Size Analysis (Laboratory)

The Particle Size Analysis of Soils determines the distribution of particle sizes in order to further classify the soil. The distribution of particle sizes larger than 75µm (retained on the No. 200 sieve) is determined by sieving, while the distribution of particle sizes smaller than 75µm is determined by a sedimentation process, using a hydrometer to secure the necessary data. These soils are then classified more accurately based on the distribution information.

Appendix B – Site Preparation

Rubino recommends that unsuitable soils or fill be removed from the site, as applicable. Unsuitable soils or fills can be described as, but are not limited to:

- organic soil / topsoil / plants / trees / shrubs / grass
- frozen soil
- existing asphalt or concrete pavement sections
- existing foundations
- building debris
- existing curbs

Stripping operations should extend a minimum of: **10** feet beyond proposed building addition limits

Exceptions: where property limits allow. Notify geotechnical engineer if there are property boundary limitations. Stripping operations should be monitored and documented by a representative of the geotechnical engineer at the time of construction.

Proofrolling:

After stripping and excavating to the proposed subgrade level, as required, the subgrade of the floor slab / sidewalk improvement areas should be proof-rolled and scarified and compacted to at least 95 percent of the standard Proctor maximum dry density ASTM D 698 for a depth of at least 8 inches below the surface during a period of dry weather.

Proofrolling Equipment:

Tandem-axle dump truck or similar rubber-tired vehicles are acceptable and should be loaded with at least 9 tons per axle.

Benefits of Proofrolling:

- Aids in providing a firm base for compaction of fill soils
- Helps to delineate soft, loose, or disturbed areas that may exist below subgrade level.

Subgrade Stability:

Soils which are observed to rut or deflect excessively (typically greater than 1 inch) under the moving load should either be scarified and re-compacted, or undercut and replaced.
Subgrade soils may be **stabilized** by one of the following **options**:

- **Scarifying and re-compacting** the existing subgrade soil to at least 95% compaction per ASTM D698 Standard Proctor (12-inch depth).
- **Remove and replace** with non-woven filter fabric and 3-inch stone capped with CA-06 stone.
  - A layer of non-woven filter geotextile should be placed between silty clay soil and an open-graded stone.
  - The contractor can also attempt to stabilize the existing subgrade in place by “losing” 3-inch stone into the subgrade until the until the voids of the 3-inch stone are filled with the soft soil and the subgrade “locks up,” showing minimal deflection under a proofroll.
- **Geogrid and a stone mat** per manufacturer’s installation specifications could reduce the amount of stone required and provide additional lateral support for foundation loads in service.
- **Lime or other chemical additive** stabilization (12 to 14 inches). This can be done as part of a lift structure. Compaction requirements still apply.

Appendix C – Fill Recommendations

In general, fill materials should meet the following:

- Standard Proctor maximum dry density >100 pcf
- Free of organic or other deleterious materials
- Have a maximum particle size no greater than 3 inches
- Have a liquid limit <45 and plasticity index <25
- Testing should include areas at least 5 feet outside the parking area perimeters, if applicable
- Each lift of compacted, engineered fill should be tested and documented by a representative of the geotechnical engineer prior to placement of subsequent lifts

Suitable Soil Classifications:

CL, SC, GW, and SW will generally be suitable for use as structural fill under pavements.

Unsuitable Soil Classifications:

OL, OH, MH, ML, SM, CH and PT should be considered unsuitable.

- If a fine-grained silt or clay soil is used for fill (CL or ML), close moisture content control will be essential to achieve the recommended degree of compaction
- If water must be added, it should be uniformly applied and thoroughly mixed into the soil by disking or scarifying

Structural fill added to the site shall be evaluated in accordance with the following table:

Material Tested	Proctor Type*-1	Min % Dry Density	Placement Moisture Content Range	Frequency of Testing*-2	Maximum Loose Lift Height
Structural Fill (Cohesive & Well-graded Granular)	Standard	98%	-2 to +3 %	1 per 2,500 yd^2 of fill placed	8 inches
Random Fill (non-load bearing)	Standard	95%	-3 to +3 %	1 per 5,000 yd^2 of fill placed	8 inches
Utility Trench Backfill	Standard	95%	-2 to +2 %	1 per 200 LF of fill placed	4 – 6 inches

*-1 The test frequency for the laboratory reference shall be one laboratory Proctor or Relative Density test for each material used on the site. If the borrow or source of fill material changes, a new reference moisture/density test should be performed.

*-2A minimum of one test per lift is recommended unless otherwise specified.

Tested fill materials that do not achieve either the required dry density or moisture content range shall be recorded, the location noted, and reported to the Contractor and Owner. A re-test of that area should be performed after the Contractor performs remedial measures. The above test frequencies should be discussed with the contractor prior to starting the work.

The geotechnical engineer of record can only certify work that was performed under their direct observation, or under the observation of a competent person under their specific direction.

Appendix D – Foundation Construction Recommendations

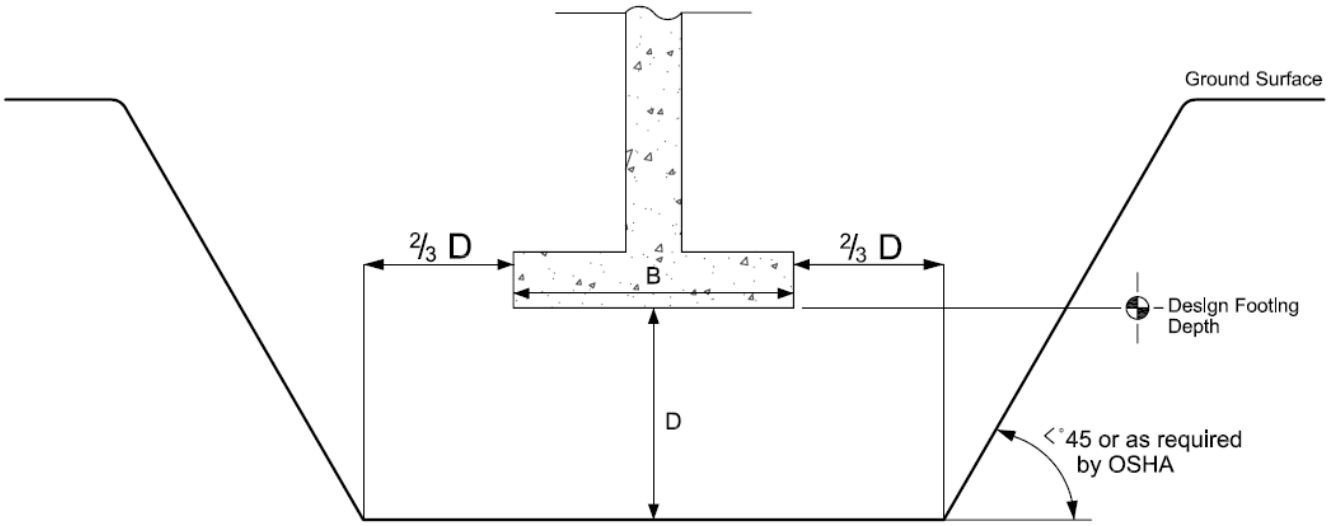
Rubino recommends that soils at the bottom of the footing design elevation be observed, documented, and tested by a representative of Rubino prior to concrete placement to evaluate the consistency of the soils in the field with the geotechnical report findings. The remedial procedures described in the following paragraph can be used to provide suitable foundation support where unsuitable material such as soft or loose soils, existing fill, or organic soils are encountered.

After opening, footing excavations should be observed and concrete placed as quickly as possible to avoid exposure of the footing bottoms to wetting and drying. Surface runoff water should be drained away from the excavations and not be allowed to pond. If possible, the foundation concrete should be placed during the same day the excavation is made. If it is required that footing excavations be left open for more than one day, the soils in the excavation should be protected to reduce evaporation or entry of moisture.

If unsuitable bearing soils are encountered in a footing excavation, the footing should be deepened to competent bearing soil and the footing could be lowered, or an over excavation and backfill procedure could be performed. If an over excavation and backfill procedure will be utilized, it would require widening the deepened excavation in all directions at least 8 inches beyond the edges of the footing for each 12 inches of over excavation depth (See "Over Excavation and Backfill Procedure" diagram below).

The over excavation should then be backfilled in a maximum of 8-inches thick loose lifts with suitable granular fill material, such as ¾ -inch stone with fines (CA-6), compacted to at least 98% of the maximum Standard Proctor dry density (ASTM D 698).

Over Excavation and Backfill Procedure



* Drawing not to scale

Appendix E – Slab-on-Grade Considerations

The subgrade modulus provided in the main report should be adjusted for larger areas of loading using the following expression for cohesive and cohesionless soil:

Modulus of Subgrade Reaction, $k_s = (\frac{k}{B})$ for cohesive soil and

$$k_s = k\,(\frac{B+1}{2B})^2 \text{ for cohesionless soil}$$

where: k_s = coefficient of vertical subgrade reaction for loaded area,
k = coefficient of vertical subgrade reaction for 1x1 square foot area, and
B = width of area loaded, in feet

The precautions listed below should be followed for construction of slab-on-grade pads.

- Cracking of slab-on-grade concrete is normal and should be expected.
- Cracking can occur not only as a result of heaving or compression of the supporting soil and/or fill material, but also as a result of concrete curing stresses.
- The occurrence of concrete shrinkage cracks and problems associated with concrete curing may be reduced and/or controlled by:
  - Limiting the slump of the concrete
  - Proper concrete placement, finishing, and curing
  - The placement of crack control joints at frequent intervals, particularly where re-entrance slab corners occur.
    - The American Concrete Institute (ACI) recommends a maximum panel size (in feet) equal to approximately three times the thickness of the slab (in inches) in both directions.
- The floor slab should be independent of the foundation walls.
- Areas supporting slabs should be properly moisture conditioned and compacted. Backfill in all interior and exterior water and sewer line trenches should be carefully compacted to reduce the shear stress in the concrete extending over these areas.
- Exterior slabs should be isolated from the building. These slabs should be reinforced to function as independent units. Movement of these slabs should not be transmitted to the building foundation or superstructure.
- Rubino recommends that a minimum 4-inch thick, free-draining granular mat be placed beneath the floor slab to enhance drainage. The floor slabs should have an adequate number of joints to reduce cracking resulting from differential movement and shrinkage. Floor slabs should not be rigidly connected to columns, walls, or foundations.
- A vapor retarder should be considered in areas of tile, carpet, or other moisture sensitive floor finishes. Appropriate curing procedures should be followed to reduce the risk of slab "curling" if a vapor retarder is used.

These details will not reduce the amount of movement but are intended to reduce potential damage should some settlement of the supporting subgrade take place. Some increase in moisture content in the floor slab is inevitable as a result of development and associated landscaping. However, extreme moisture content increases can be largely controlled by proper and responsible site drainage, building maintenance and irrigation practices.

Appendix F – Report Limitations

Subsurface Conditions:

The subsurface description is of a generalized nature to highlight the major subsurface stratification features and material characteristics. The boring logs included in the appendix should be reviewed for specific information at individual boring locations. These records include soil descriptions, stratifications, penetration resistances, locations of the samples and laboratory test data as well as water level information. The stratifications shown on the boring logs represent the conditions only at the actual boring locations. Variations may occur and should be expected between boring locations. The stratifications represent the approximate boundary between subsurface materials and the actual transition between layers may be gradual. The samples, which were not altered by laboratory testing, will be retained for up to 60 days from the date of this report and then will be discarded.

Geotechnical Risk:

The concept of risk is an important aspect of the geotechnical evaluation. The primary reason for this is that the analytical methods used to develop geotechnical recommendations do not comprise an exact science. The analytical tools that geotechnical engineers use are generally empirical and must be used in conjunction with engineering judgment and experience. Therefore, the solutions and recommendations presented in the geotechnical evaluation should not be considered risk-free, and more importantly, are not a guarantee that the interaction between the soils and the proposed structure will perform as planned. The engineering recommendations, presented in the preceding section, constitute Rubino's professional estimate of the necessary measures for the proposed structure to perform according to the proposed design based on the information generated and reference during this evaluation, and Rubino's experience in working with these conditions.

Warranty:

The geotechnical engineer warrants that the findings, recommendations, specifications, or professional advice contained herein have been made in accordance with generally accepted professional geotechnical engineering practices in the local area. No other warranties are implied or expressed.

Federal Excavation Regulations:

In Federal Register, Volume 54, No. 209 (October 1989), the United States Department of Labor, Occupational Safety and Health Administration (OSHA) amended its "Construction Standards for Excavations, 29 CFR, part 1926, Subpart P". This document was issued to better ensure the safety of workmen entering trenches or excavations. This federal regulation mandates that all excavations, whether they be utility trenches, basement excavation or footing excavations, be constructed in accordance with the new OSHA guidelines. It is our understanding that these regulations are being strictly enforced and if they are not closely followed, the owner and the contractor could be liable for substantial penalties.

The contractor is solely responsible for designing and constructing stable, temporary excavations and should shore, slope, or bench the sides of the excavations as required to maintain stability of both the excavation sides and bottom. The contractor's "responsible person," as defined in 29 CFR Part 1926, should evaluate the soil exposed in the excavations as part of the contractor's safety procedures. In no case should slope height, slope inclination, or excavation depth, including utility trench excavation depth, exceed those specified in local, state, and federal safety regulations. Rubino is providing this information solely as a service to our client. Rubino is not assuming responsibility for construction site safety or the contractor's activities; such responsibility is not being implied and should not be inferred.

Appendix G – Soil Classification General Notes

DRILLING & SAMPLING SYMBOLS:

SS:	Split Spoon - 1 3/8" I.D., 2" O.D., unless otherwise noted	PS:	Piston Sample
ST:	Thin-Walled Tube - 3" O.D., Unless otherwise noted	WS:	Wash Sample
PM:	Pressuremeter	HA:	Hand Auger
RB:	Rock Bit	HS:	Hollow Stem Auger
DB:	Diamond Bit - 4", N, B	BS:	Bulk Sample

Standard "N" Penetration: Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split spoon sampler (SS), except where noted.

WATER LEVEL MEASUREMENT SYMBOLS:
Water levels indicated on the boring logs are the levels measured in the borings at the times indicated. In pervious soils, the indicated levels may reflect the location of groundwater. In low permeability soils, the accurate determination of ground water levels is not possible with only short-term observations.

DESCRIPTIVE SOIL CLASSIFICATION:
Soil Classification is based on the Unified Soil Classification System as defined in ASTM D-2487 and D-2488. Coarse Grained Soils have more than 50% of their dry weight retained on a #200 sieve; they are described as: boulders, cobbles, gravel or sand. Fine Grained Soils have less than 50% of their dry weight retained on a #200 sieve; they are described as: clays, if they are plastic, and silts if they are slightly plastic or non-plastic. Major constituents may be added as modifiers and minor constituents may be added according to the relative proportions based on grain size. In addition to gradation, coarse grained soils are defined on the basis of their relative in-place density and fine-grained soils on the basis of their consistency. Example: Lean clay with sand, trace gravel, stiff (CL); silty sand, trace gravel, medium dense (SM).

CONSISTENCY OF FINE-GRAINED SOILS:

Unconfined Compressive Strength, Qu (tsf)			N-Blows/ft.			Consistency
	<	0.25	< 2			Very Soft
0.25	-	0.5	2	-	4	Soft
0.5	-	1	4	-	8	Medium Stiff
1	-	2	8	-	15	Stiff
2	-	4	15	-	30	Very Stiff
4	-	8	30	-	50	Hard
>	-	8	> 50			Very Hard

RELATIVE DENSITY OF COARSE-GRAINED SOILS

N-Blows/ft.			Relative Density
0	-	3	Very Loose
4	-	9	Loose
10	-	29	Medium Dense
30	-	49	Dense
50	-	80	Very Dense
		80+	Extremely Dense

RELATIVE PROPORTIONS OF SAND & GRAVEL

Descriptive Term	% of Dry Weight		
Trace		<	15
With	15	-	29
Modifier		>	30

RELATIVE PROPORTIONS OF FINES

Descriptive Term	% of Dry Weight		
Trace		<	5
With	5	-	12
Modifier		>	12

*Descriptive Terms apply to components also present in sample

GRAIN SIZE TERMINOLOGY

Major Component	Size Range
Boulders	Over 12 in. (300mm)
Cobbles	12 in. To 3 in. (300mm to 75mm)
Gravel	3 in. To #4 sieve (75mm to 4.75mm)
Sand	#4 to #200 sieve (4.75mm to 0.75mm)

SOIL CLASSIFICATION CHART

NOTE: DUAL SYMBOLS ARE USED TO INDICATE BORDERLINE SOIL CLASSIFICATIONS

MAJOR DIVISIONS			SYMBOLS: GRAPH	SYMBOLS: LETTER	TYPICAL DESCRIPTIONS
COARSE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS LARGER THAN NO. 200 SIEVE SIZE	GRAVEL AND GRAVELLY SOILS — MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVELS (LITTLE OR NO FINES)		GW	WELL-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
				GP	POORLY-GRADED GRAVELS, GRAVEL - SAND MIXTURES, LITTLE OR NO FINES
		GRAVELS WITH FINES (APPRECIABLE AMOUNT OF FINES)		GM	SILTY GRAVELS, GRAVEL - SAND - SILT MIXTURES
				GC	CLAYEY GRAVELS, GRAVEL - SAND - CLAY MIXTURES
	SAND AND SANDY SOILS — MORE THAN 50% OF COARSE FRACTION PASSING ON NO. 4 SIEVE	CLEAN SANDS (LITTLE OR NO FINES)		SW	WELL-GRADED SANDS, GRAVELLY SANDS, LITTLE OR NO FINES
				SP	POORLY-GRADED SANDS, GRAVELLY SAND, LITTLE OR NO FINES
		SANDS WITH FINES (APPRECIABLE AMOUNT OF FINES)		SM	SILTY SANDS, SAND - SILT MIXTURES
				SC	CLAYEY SANDS, SAND - CLAY MIXTURES
FINE GRAINED SOILS — MORE THAN 50% OF MATERIAL IS SMALLER THAN NO. 200 SIEVE SIZE	SILTS AND CLAYS	LIQUID LIMIT LESS THAN 50		ML	INORGANIC SILTS AND VERY FINE SANDS, ROCK FLOUR, SILTY OR CLAYEY FINE SANDS OR CLAYEY SILTS WITH SLIGHT PLASTICITY
				CL	INORGANIC CLAYS OF LOW TO MEDIUM PLASTICITY, GRAVELLY CLAYS, SANDY CLAYS, SILTY CLAYS, LEAN CLAYS
				OL	ORGANIC SILTS AND ORGANIC SILTY CLAYS OF LOW PLASTICITY
	SILTS AND CLAYS	LIQUID LIMIT GREATER THAN 50		MH	INORGANIC SILTS, MICACEOUS OR DIATOMACEOUS FINE SAND OR SILTY SOILS
				CH	INORGANIC CLAYS OF HIGH PLASTICITY
				OH	ORGANIC CLAYS OF MEDIUM TO HIGH PLASTICITY, ORGANIC SILTS
HIGHLY ORGANIC SOILS				PT	PEAT, HUMUS, SWAMP SOILS WITH HIGH ORGANIC CONTENTS

Appendix I – Site Vicinity Map & Boring Location Plan

rubino ENGINEERING INC.

425 Shepard Drive
Elgin, Illinois 60123

Project Name:	**McHenry County College Soil Borings**
Project Location:	McHenry County College Crystal Lake, Illinois
Client:	**Demonica Kemper Architects**
Rubino Project # :	G24.162

Site Vicinity Map

rubino ENGINEERING INC.

425 Shepard Drive
Elgin, Illinois 60123

Project Name:	**McHenry County College Soil Borings**
Project Location:	McHenry County College Crystal Lake, Illinois
Client:	**Demonica Kemper Architects**
Rubino Project # :	G24.162

Boring Location Plan

Appendix J – Borings Logs

Rubino Engineering, Inc.
425 Shepard Drive
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-01

Rubino Job No.:	G24.162	Drilling Method:	3 ¼ Hollow Stem Auger
Project:	McHenry County College Soil Borings	Sampling Method:	Split Spoon
Location:	McHenry County College	Hammer Type:	Automatic
City, State:	Crystal Lake, Illinois	Boring Location:	Proposed sidewalk improvements near terrace
Client:	Demonica Kemper Architects		

WATER LEVELS***	
While Drilling	N/A
Upon Completion	N/A
Delay	N/A

Station: N/A
Offset: N/A

Surface Elev.: 917.90 ft

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	Classification	SPT Blows per 6-inch	Moisture, %	STANDARD PENETRATION TEST DATA: Moisture (×), PL, LL (0 / 25 / 50); STRENGTH, tsf: Qu (Rimac) ▲, Qp/Qr ✳ (0 / 2.0 / 4.0)	Additional Remarks
	0					Approximately 11 inches of TOPSOIL: dark brown silty clay with organic matter					
				1	10	FILL: gray sandy gravel, with bricks *Rock chips observed. Possible cobbles/boulders encountered.*		17-38-38 N=76	4	×	>>
915											
				2	12			20-25-21 N=46	3	×	
	5					End of boring at approximately 5 feet below existing grade.					

Completion Depth:	5.0 ft	Latitude:	42.2595638
Date Boring Started:	9/27/24	Longitude:	-88.3681437
Date Boring Completed:	9/27/24	Drill Rig:	Geoprobe 3126GT
Logged By:	P.P.	Remarks:	
Drilling Contractor:	Rubino Engineering, Inc.	Log Entry:	P. Patel
		Checked By:	J. Ignarski

Sample Types: Auger Cutting; Split-Spoon; Rock Core; Pressuremeter; Shelby Tube; Grab Sample; No Recovery

The stratification lines represent approximate boundaries. The transition may be gradual.
***Please reference the geotechnical report text for specific groundwater / dewatering recommendations.

Rubino Engineering, Inc.
425 Shepard Drive
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-02

Rubino Job No.:	G24.162
Project:	McHenry County College Soil Borings
Location:	McHenry County College
City, State:	Crystal Lake, Illinois
Client:	Demonica Kemper Architects

Drilling Method:	3 ¼ Hollow Stem Auger
Sampling Method:	Split Spoon
Hammer Type:	Automatic
Boring Location:	Proposed detention basin

WATER LEVELS***	
While Drilling	13.5 ft
Upon Completion	N/A
Delay	N/A

Station: N/A
Offset: N/A

Surface Elev.: 919.05 ft

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	Classification	SPT Blows per 6-inch	Moisture, %
	0	1	10	Approximately 8 inches of TOPSOIL: dark brown silty clay with organic matter FILL: brown and gray sandy gravel *Rock chips observed. Possible cobbles/boulders encountered.*		21-31-21 N=52	2
915	5	2	12	Medium dense to dense, brown well-graded sandy GRAVEL		9-11-11 N=22	3
		3	14			9-10-23 N=33	3
910	10	4	15		GW	13-15-11 N=26	5
905	15	5	6			15-13-12 N=25	13
				End of boring at approximately 15 feet below existing grade.			

STANDARD PENETRATION TEST DATA
Moisture | PL | LL (0 – 25 – 50)
STRENGTH, tsf
Qu (Rimac) | Qp/Qr (0 – 2.0 – 4.0)

Additional Remarks

Completion Depth:	15.0 ft
Date Boring Started:	9/27/24
Date Boring Completed:	9/27/24
Logged By:	P.P.
Drilling Contractor:	Rubino Engineering, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Pressuremeter
Shelby Tube
Grab Sample
No Recovery

Latitude: 42.2597554
Longitude: -88.3675234
Drill Rig: Geoprobe 3126GT
Remarks: Hole collapse at 3½ feet B.E.G.
Log Entry: P. Patel
Checked By: J. Ignarski

The stratification lines represent approximate boundaries. The transition may be gradual.
***Please reference the geotechnical report text for specific groundwater / dewatering recommendations.

rubino ENGINEERING INC.

Rubino Engineering, Inc.
425 Shepard Drive
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-03

Rubino Job No.:	G24.162	Drilling Method:	3 ¼ Hollow Stem Auger
Project:	McHenry County College Soil Borings	Sampling Method:	Split Spoon
Location:	McHenry County College	Hammer Type:	Automatic
City, State:	Crystal Lake, Illinois	Boring Location:	Proposed sidewalk improvements near entrance
Client:	Demonica Kemper Architects		

WATER LEVELS***	
While Drilling	N/A
Upon Completion	N/A
Delay	N/A

Station: N/A
Offset: N/A

Surface Elev.: 917.00 ft

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	Classification	SPT Blows per 6-inch	Moisture, %	STANDARD PENETRATION TEST DATA / STRENGTH, tsf	Additional Remarks
	0					Approximately 10 inches of TOPSOIL: dark brown silty clay with organic matter and mulch					
915				1	18	FILL: dark brown silty clay, trace sand and gravel		0-2-3 N=5	27		Qp=1.3 tsf LL = 44 PL = 20 2% Organic Content
	5			2	13	Medium dense, brown well-graded gravelly SAND	SW	3-5-11 N=16	14		
						End of boring at approximately 5 feet below existing grade.					

STANDARD PENETRATION TEST DATA: Moisture, PL, LL (0, 25, 50); STRENGTH, tsf: Qu (Rimac), Qp/Qr (0, 2.0, 4.0)

Completion Depth:	5.0 ft
Date Boring Started:	9/27/24
Date Boring Completed:	9/27/24
Logged By:	P.P.
Drilling Contractor:	Rubino Engineering, Inc.

Sample Types:
- Auger Cutting
- Split-Spoon
- Rock Core
- Pressuremeter
- Shelby Tube
- Grab Sample
- No Recovery

Latitude: 42.2590072
Longitude: -88.3679006
Drill Rig: Geoprobe 3126GT
Remarks:
Log Entry: P. Patel
Checked By: J. Ignarski

The stratification lines represent approximate boundaries. The transition may be gradual.
***Please reference the geotechnical report text for specific groundwater / dewatering recommendations.

Rubino Engineering, Inc.
425 Shepard Drive
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-04

Rubino Job No.:	G24.162	Drilling Method:	2 ¼ Hollow Stem Auger
Project:	McHenry County College Soil Borings	Sampling Method:	Split Spoon
Location:	McHenry County College	Hammer Type:	Automatic
City, State:	Crystal Lake, Illinois	Boring Location:	Proposed building addition
Client:	Demonica Kemper Architects		

WATER LEVELS***	
While Drilling	8.5 ft
Upon Completion	N/A
Delay	N/A

Station: N/A
Offset: N/A

Surface Elev.: 917.35 ft

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	Classification	SPT Blows per 6-inch	Moisture, %	STANDARD PENETRATION TEST DATA: Moisture / PL / LL (0, 25, 50); STRENGTH, tsf: Qu (Rimac) / Qp/Qr (0, 2.0, 4.0)	Additional Remarks
	0					Approximately 6 inches of TOPSOIL: dark brown silty clay with organic matter					
915				1	6	FILL: brown and gray sandy gravel *Rock chips observed. Possible cobbles/boulders encountered.*		19-32-13 N=45	6		
	5			2	14	Medium dense, brown well-graded gravelly SAND		7-11-12 N=23	4		
910				3	13			12-13-13 N=26	4		
				4	15		SW	10-13-15 N=28	8		
	10										
905											
	15			5	8	Medium dense, brown well-graded sandy GRAVEL		17-14-7 N=21	6		
900							GW				
				6	10			23-15-13 N=28	3		
	20					End of boring at approximately 20 feet below existing grade.					

Completion Depth:	20.0 ft	Sample Types:	Pressuremeter, Auger Cutting, Shelby Tube, Split-Spoon, Grab Sample, Rock Core, No Recovery
Date Boring Started:	9/25/24		
Date Boring Completed:	9/25/24		
Logged By:	P.P.		
Drilling Contractor:	Rubino Engineering, Inc.		

Latitude: 42.2593889
Longitude: -88.3681216
Drill Rig: Geoprobe 7822DT
Remarks: Hole collapse at 4 feet B.E.G.
Log Entry: P. Patel
Checked By: J. Ignarski

The stratification lines represent approximate boundaries. The transition may be gradual.
***Please reference the geotechnical report text for specific groundwater / dewatering recommendations.

Rubino Engineering, Inc.
425 Shepard Drive
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-05

Rubino Job No.:	G24.162	Drilling Method:	3 ¼ Hollow Stem Auger
Project:	McHenry County College Soil Borings	Sampling Method:	Split Spoon
Location:	McHenry County College	Hammer Type:	Automatic
City, State:	Crystal Lake, Illinois	Boring Location:	Proposed building addition
Client:	Demonica Kemper Architects		

WATER LEVELS***

While Drilling	13.5 ft
Upon Completion	N/A
Delay	N/A

Station: N/A
Offset: N/A

Surface Elev.: 918.40 ft

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	Classification	SPT Blows per 6-inch	Moisture, %	STANDARD PENETRATION TEST DATA: Moisture (×), PL, LL (0 / 25 / 50); STRENGTH, tsf: Qu (Rimac) (▲), Qp/Qr (✳) (0 / 2.0 / 4.0)	Additional Remarks
	0					Approximately 10 inches of TOPSOIL: dark brown silty clay with organic matter and mulch					
				1	14	Medium dense to dense, brown well-graded gravelly SAND		6-9-10 N=19	4		
915				2	16			4-12-16 N=28	4		
	5			3	15		SW	16-20-21 N=41	3		
910				4	12			9-10-13 N=23	12		
	10										
905				5	5	Medium dense to dense, brown well-graded sandy GRAVEL	GW	8-14-22 N=36	6		
	15										
900				6	12			8-9-11 N=20	7		
	20					End of boring at approximately 20 feet below existing grade					

Completion Depth:	20.0 ft
Date Boring Started:	9/27/24
Date Boring Completed:	9/27/24
Logged By:	P.P.
Drilling Contractor:	Rubino Engineering, Inc.

Sample Types:
- Auger Cutting
- Split-Spoon
- Rock Core
- Pressuremeter
- Shelby Tube
- Grab Sample
- No Recovery

Latitude: 42.2594385
Longitude: -88.3679536
Drill Rig: Geoprobe 3126GT
Remarks: Hole collapse at 5½ feet B.E.G.
Log Entry: P. Patel
Checked By: J. Ignarski

The stratification lines represent approximate boundaries. The transition may be gradual.
***Please reference the geotechnical report text for specific groundwater / dewatering recommendations.

Rubino Engineering, Inc.
425 Shepard Drive
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-06

Rubino Job No.:	G24.162	Drilling Method:	2 ¼ Hollow Stem Auger
Project:	McHenry County College Soil Borings	Sampling Method:	Split Spoon
Location:	McHenry County College	Hammer Type:	Automatic
City, State:	Crystal Lake, Illinois	Boring Location:	Proposed building addition
Client:	Demonica Kemper Architects		

WATER LEVELS***	
While Drilling	8.5 ft
Upon Completion	N/A
Delay	N/A

Station: N/A
Offset: N/A

Surface Elev.: 917.85 ft

Elevation (feet)	Depth, (feet)	Graphic Log	Sample Type	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	Classification	SPT Blows per 6-inch	Moisture, %	STANDARD PENETRATION TEST DATA: Moisture (×), PL, LL (0 / 25 / 50); STRENGTH, tsf: Qu (Rimac) (▲), Qp/Qr (✳) (0 / 2.0 / 4.0)	Additional Remarks
	0					Approximately 10 inches of TOPSOIL: dark brown silty clay with organic matter and mulch					
				1	4	FILL: dark brown silty clay, trace sand and gravel		2-2-3 N=5	12		
915											
				2	10	Medium dense, brown well-graded gravelly SAND		8-5-8 N=13	5		
	5										
				3	12			8-10-13 N=23	4		
910											
				4	10			10-13-14 N=27	7		
	10						SW				
905											
				5	18			18-14-21 N=35	9		
	15										
900											
				6	0	*No recovery* **Spoon refusal at approximately 18¾ feet below existing due to possible cobbles/boulders.**		50/3"--		>>	
	20					End of boring at approximately 18¾ feet below existing grade.					

Completion Depth:	20.0 ft	Sample Types:	Auger Cutting, Split-Spoon, Rock Core, Pressuremeter, Shelby Tube, Grab Sample, No Recovery
Date Boring Started:	9/25/24		
Date Boring Completed:	9/25/24		
Logged By:	P.P.		
Drilling Contractor:	Rubino Engineering, Inc.		

Latitude: 42.2592668
Longitude: -88.3680166
Drill Rig: Geoprobe 7822DT
Remarks: Hole collapse at 7½ feet B.E.G.
Log Entry: P. Patel
Checked By: J. Ignarski

The stratification lines represent approximate boundaries. The transition may be gradual.
***Please reference the geotechnical report text for specific groundwater / dewatering recommendations.

Rubino Engineering, Inc.
425 Shepard Drive
Elgin, IL 60123
Telephone: 847-931-1555
Fax: 847-931-1560

LOG OF BORING B-07

Rubino Job No.: G24.162
Project: McHenry County College Soil Borings
Location: McHenry County College
City, State: Crystal Lake, Illinois
Client: Demonica Kemper Architects

Drilling Method: 2 ¼ Hollow Stem Auger
Sampling Method: Split Spoon
Hammer Type: Automatic
Boring Location: Proposed building addition

WATER LEVELS***
While Drilling 8.5 ft
Upon Completion N/A
Delay N/A

Station: N/A
Offset: N/A

Surface Elev.: 917.80 ft

Elevation (feet)	Depth, (feet)	Sample No.	Recovery (inches)	MATERIAL DESCRIPTION	Classification	SPT Blows per 6-inch	Moisture, %	Additional Remarks
	0			Approximately 10 inches of TOPSOIL: dark brown silty clay with organic matter and mulch				
		1	10	FILL: brown silty clay, with sand and gravel		4-8-11 N=19	23	LL = 25 PL = 17
915								
		2	9	Medium dense, brown well-graded gravelly SAND		10-13-12 N=25	5	
	5							
		3	15			11-14-14 N=28	8	
910					SW			
		4	14			6-8-8 N=16	8	
	10							
905								
		5	8	Very dense, brown brown well-graded gravelly SAND *Rock chips observed. Possible cobbles/boulders encountered.*		13-26-27 N=53	8	
	15				SW			
900								
		6	15	Medium dense, brown brown well-graded gravelly SAND	SW	11-13-13 N=26	8	
	20			End of boring at approximately 20 feet below existing grade.				

STANDARD PENETRATION TEST DATA
Moisture, PL, LL (0, 25, 50)
STRENGTH, tsf
Qu (Rimac) Qp/Qr (0, 2.0, 4.0)

Completion Depth: 20.0 ft
Date Boring Started: 9/25/24
Date Boring Completed: 9/25/24
Logged By: P.P.
Drilling Contractor: Rubino Engineering, Inc.

Sample Types:
Auger Cutting
Split-Spoon
Rock Core
Pressuremeter
Shelby Tube
Grab Sample
No Recovery

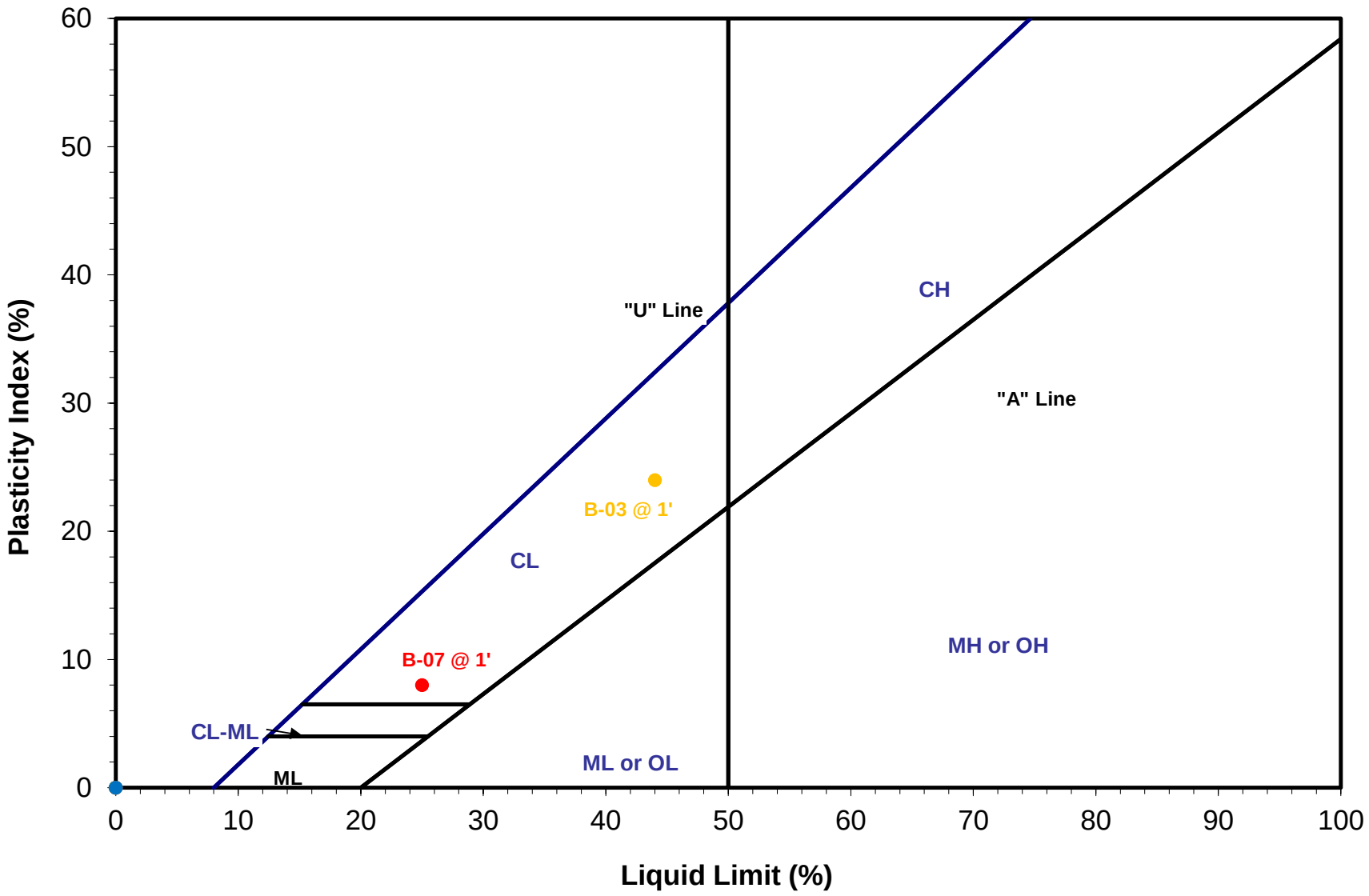
Latitude: 42.2593452
Longitude: -88.3678577
Drill Rig: Geoprobe 7822DT
Remarks: Hole collapse at 5 feet B.E.G.
Log Entry: P. Patel
Checked By: J. Ignarski

The stratification lines represent approximate boundaries. The transition may be gradual.
***Please reference the geotechnical report text for specific groundwater / dewatering recommendations.

Appendix K – Laboratory Results

rubino ENGINEERING INC.

Report of Atterberg Limits Test (ASTM D4318)

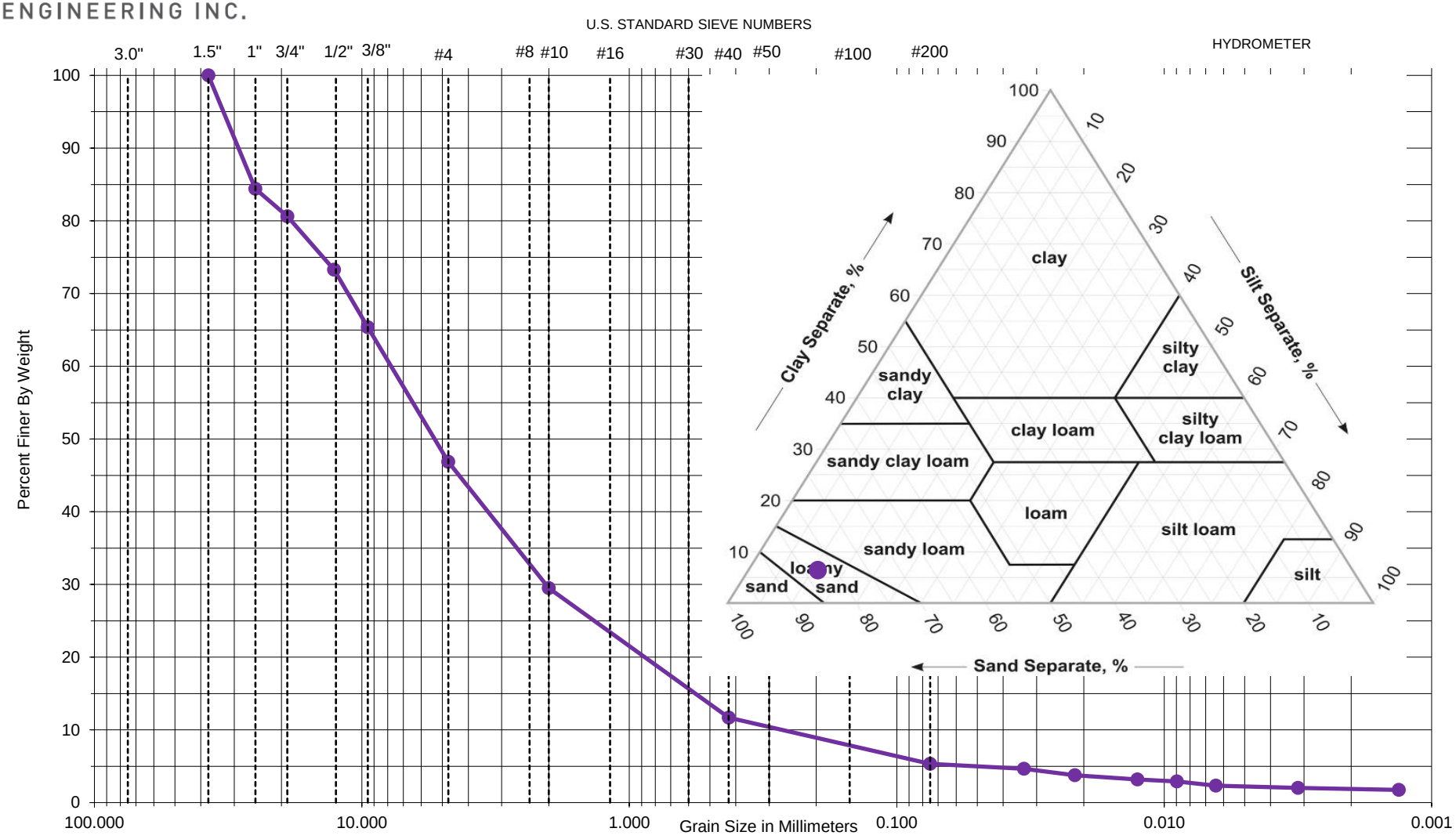


Boring #	B-03 @ 1'	B-07 @ 1'				
LL	44	25				
PL	20	17				
PI	24	8				

Project: McHenry County College
Location: Crystal Lake, Illinois
Client: Demonica Kemper Architects
Project #: G24.162

rubino ENGINEERING INC.

REPORT OF PARTICLE-SIZE ANALYSIS OF SOIL



Key	Boring No.	Depth	USDA Classification	WC%	ORG%	Cc	Cu	%Gravel	%Sand	%Silt	%Clay	D60	D30	D10
●	B-02	6 - 7.5	LOAMY SAND	3	N/A	1.6	24.41	70.5	24.6	3.1	1.9	8.123	2.079	0.333

REPORT OF PARTICLE-SIZE ANALYSIS OF SOIL	McHenry County College	File No. G24.162

Rubino Engineering Inc ● 425 Shepard Drive ● Elgin, IL 60123 ● 847-931-1555 ● 847-931-1560 (Fax)

00 32 00 - Scope of Work

McHenry County College
Engagement Hall

05/16/2025
Pepper Construction Company

This Section Contains:

A. Scope of Work – All Bid Packages
   i. All bids for all Bid Packages must be inclusive of all requirements outlined in the All Scope of Work

B. Scope of Work – Trade Specific Bid Packages
   i. All bids must be inclusive of all requirements outlined in the trade specific Bid Packages outlined below:

1. Demolition
2. Excavation and Site Utilities
3. Landscaping and Irrigation
4. Concrete
5. Masonry and AVB
6. Steel
7. General Carpentry
8. Roofing and ACM
9. Storefronts and Glazing
10. Ceilings
11. Flooring
12. Paint
13. Fire Protection
14. Plumbing
15. HVAC
16. Electrical and Low Voltage

All SCOPE OF WORK

For

ALL BID PACKAGES

All bids for all Bid Packages must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work below:

Specifications

All Division 00 .....Procurement and Contracting Requirements

All Division 01 .....General Requirements

Bid Group	Bid Package	Scope Item	Description	
4	ALL	0.01	Each Trade Contractor shall submit one fully executed copy of AIA Document A305 "Contractor's Qualification Statement" prior to the bid due date as identified in the Notice to Bidders. Faxed submittals are acceptable. A305 document copies may be obtained from the Chicago AIA office located at 222 Merchandise Mart Plaza, Suite 1049, Chicago, IL 60654. Each Trade Contractor shall also be prequalified with Pepper Construction Company. Please visit www.pepperconstruction.com/about --> Financials Look for the "Sub Prequalification form" link to complete online which is on the left hand side about half way down the page under financial strength. Below the link you can find prequal informational PDF's for each specific office (informational packet attached). All submissions are confidential. **NEW SUBS MUST UPLOAD A W9 TO COMPLETE THE APPLICATION.** If you are an existing sub a password will need to be reset for you to access the system. Please email the request **including** your Tax ID number to prequal@pepperconstruction.com. A computer generated email/password will be sent.	
4	ALL	0.02	Each Trade Contractor shall coordinate all on-site activities including but not limited to site access, site parking, deliveries, etc. with Pepper Construction Company on-site supervision.	
4	ALL	0.03	Each Trade Contractor shall exclude any costs of required dumpsters in their bid for non-demolition related work. Dumpsters will be procured and managed by the Construction Manager. **Each TRADE CONTRACTOR shall be responsible to provide their own dumpsters for any demolition/removal work include within their trade specific scopes of work. Each TRADE CONTRACTOR is responsible to haul off all boxes and packaging from delivered material.**	
4	ALL	0.04	ALL TRADE CONTRACTORS shall be responsible for keeping scrap, debris, cleared from the construction site on a continuing basis. **TRADE CONTRACTORS will be required to list their respective dollar value for clean up on the Schedule of Values Form G703**. Each TRADE CONTRACTOR providing work during any week period will be required to furnish one person DAILY, for the needed time to clean the building as directed by the Construction Manager. If this clean up is not completed to the satisfaction of the Construction Manager, the Construction Manager will contract clean up to be done, and the TRADE CONTRACTOR will be back-charged accordingly.	
4	ALL	0.05	All Trade Contractors shall be responsible for safety for this portion of the work. Provide all necessary scaffolding, handrails, ladders, equipment, etc. necessary to perform the described work. Comply with all O.S.H.A., local, state, or federal safety authorities having jurisdiction. All contractors have read and understand P epper Construction's Job Site Safety Handbook included within the CM/Prime Trade Agreement draft included in the project manual. Refer to section 005050 in the project manual.	
4	ALL	0.06	Each Trade Contractor shall exclude tax payment of Retailers' Occupation Tax, the Service Occupation Tax (both state and local), the Use Tax and the Service Use Tax, as required by IL Law. The Tax exemption identification number issued to the McHenry	

			County College is E99950332	
4	ALL	0.07	Control line monuments will be by OTHER. All Trade Contractors shall protect and maintain all survey work by others. All Trade Contractors shall be responsible for **ALL** layout related to this Trade Contractor's work and shall coordinate this layout work with the layout of adjacent work by others.	
4	ALL	0.08	Each Trade Contractor shall conduct all contract related activities within the guidelines for phasing and scheduling established on this project. It is the responsibility of each Trade Contractor to review and accept, as part of contract, the regular and ongoing schedule updates on this project. All work is per the project Schedule dated **April 22, 2025.** This schedule may be updated by future adjustments that will become part of ALL contractors' agreement. If a date on this schedule is not meet, all cost associated with making this lost time up will be back charge to the responsible trade contractor. Each Trade Contractor shall complete a schedule for their work that coincides with the overall project schedule within two weeks after notice of award to proceed. Construction Manager's supervision is required for all work performed on-site. Contractor shall cover any additional supervision costs resulting from failure to meet the contract schedule. If contractor elects to perform work, is required to perform work to meet schedule, or indirectly forces another trade to perform work on an overtime basis, contractor shall assume costs for extra Pepper Construction supervision.	
4	ALL	0.09	The industry rule of thumb term "Use is Acceptance" will be enforced. a) When work is performed, it will be assumed this Trade Contractor has inspected and accepted the quality and coordination of the work of other trade contractors that this Trade Contractor is working on or against. b) Start of work by this Trade Contractor on top of or against any other surface means this Trade Contractor has accepted the quality and completeness of that surface. c) This Trade Contractor is responsible for preparing (i.e. cleaning) adjacent surfaces including but not limited to those surfaces completed by others prior to proceeding.	
4	ALL	0.10	ALL TRADE CONTRACTORS furnishing material for delivery and installation at any time on this project shall be responsible for the purchase and storage of that material at no additional cost to the Owner. Payment for stored material will be according to Specification.	
4	ALL	0.11	ALL TRADE CONTRACTORS shall promptly notify the Construction Manager of any damage caused to their work by another TRADE CONTRACTOR and shall be responsible to remedy their claim with the party causing the damage. Should the responsible party, within 24 hours notice, fail to remedy all damages or loss, the Construction Manager shall have the right to remedy the situation and the cost thereof will be back charged to the TRADE CONTRACTOR responsible for the damage or loss.	
4	ALL	0.12	If the work of this Trade Contractor is determined by Construction Manager to be deficient in any way this Trade Contractor understands and accepts that in-progress and/or completed work will be redone at the full expense of this Trade Contractor on a time line as established by Construction Manager.	
4	ALL	0.13	Warranty will be executed upon substantial completion of the entire project. Based on the sequencing of work this Trade Contractor understands that portions of the work may be completed well in advance of this substantial completion date. All TRADE CONTRACTORS shall provide at a minimum, 1 year labor and materials warranty from substantial completion for the project. Please review the specifications to verify if longer labor and material warranties are required. The specifications shall supersede the 2 year warranty period referenced above if specifically noted within the specifications.	
4	ALL	0.14	All TRADE CONTRACTORS are required to schedule and conduct a preliminary punch list walk through with the Construction Manager. TRADE CONTRACTORS will have an allotted time frame to complete deficiencies. TRADE CONTRACTOR is also required to conduct a final walk through with the Construction Manager and Owner and correct and complete those deficiencies within 2 weeks of final punch list. If the TRADE CONTRACTOR fails to complete punch list within allotted time frame, the Construction Manager reserves the right to hire a separate trade contractor to make the corrections to complete those punch list items not addressed and back charge the TRADE CONTRACTOR at the cost of the work.	
4	ALL	0.15	It is the responsibility of each TRADE CONTRACTOR to assure that his respective area of construction is watertight and protected from the elements, as necessary and as a result of	

			his work, throughout the construction period.	
4	ALL	0.16	All drawings, specification sections, and scopes of work should be referenced for the extent of the work under all accounts.	
4	ALL	0.17	Although Specifications are allocated to the respective "Scopes of Work", it is the intention of the Construction Manager that each TRADE CONTRACTOR read all Specification Sections, and that the Scopes of Work shall take precedence over any allocation of work made by the Architect/Engineer.	
4	ALL	0.18	All TRADE CONTRACTORS shall be responsible for repair of ruts and removal of trapped water on a continuous basis caused by the use of their motorized equipment.	
4	ALL	0.19	All TRADE CONTRACTORS shall be responsible for damage caused by the use of their motorized lifts, rolling scaffold or other elevated type equipment used on the project.	
4	ALL	0.20	All TRADE CONTRACTORS shall be responsible for cleaning mud and stone off of the tires and tracks of their vehicles and construction equipment prior to entering public roadways off of the project site. This shall be done daily by each TRADE CONTRACTOR as necessary	
4	ALL	0.21	A detailed submittal log referencing all required submittals, specification numbers, specification sections, and anticipated submission dates MUST be submitted to the Construction Manager's office within 5 business days after the date of bid opening. All submittals required for that TRADE CONTRACTOR must be submitted on or before the agreed upon anticipated submission date. **Sample O&M manuals and sample Manufacturer's warranties shall also be listed on the submittal log and submitted for review prior to substantial completion.**	
4	ALL	0.22	It is hereby acknowledged that this TRADE CONTRACTOR will provide the following primary and non-contributory insurance coverage as noted in the project manual: Please see the Prime Trade Contract sample within the project manual for insurance requirements. This TRADE CONTRACTOR has read section 10 of the Prime Trade Agreement and Exhibit C Prime Trade Contractor Insurance Requirements included within the bidding documents and understands all requirements including but not limited to insurance limits, which trades are defined as "Major Trades" and the associated insurance requirements, which endorsements will only be accepted, who is required to provide pollution insurance, etc. The required insurances must be maintained for a period of two years after project final completion. Additional Insured's shall be the McHenry County College, their respective Board members, employees, elected officials, officers or representatives, Pepper Construction Company (Construction Manager), and **Demonica Kemper Architects** (Architect).	
4	ALL	0.23	Provide sufficient equipment, material, skilled manpower, supervision and/or **premium time/shift work** (all without additional compensation) as may be required to complete the work of this Trade Contractor in accordance with the overall project substantial completion date and as referenced in the current construction schedule. **NOTE: Each TRADE CONTRACTOR is responsible to provide detailed man power schedule of all contractual activates that correlate with the overall Construction Schedule per school and per area within 10 business days after the date of the bid opening. Durations, man hours, and associated cost value represented on G703 shall also be provided for each activity.** **NOTE: This TRADE CONTRACTOR shall be responsible to pay for Pepper Site supervision for any hours required to be worked outside of 7:00 AM to 3:30 PM on Monday thru Friday.**	
4	ALL	0.24	TRADE CONTRACTOR shall be prepared to meet within one week of bid due date to conduct scope reviews, provide submittal log and discuss award of contract.	
4	ALL	0.25	Contact JULIE 72 hours minimum prior to any excavation work. Record and document all contact with JULIE including but not limited to Dig Number; present JULIE dig number and all other JULIE related documentation to the Construction Manager 24-hours minimum prior to any excavation. All JULIE documentation shall be included as part of the close out documentation. **NOTE: This TRADE CONTRACTOR shall be responsible for all costs associated with any private locates required by this TRADE CONTRACTOR. Any damage of exusting utilities, etc. shall be this TRADE CONTRACTOR'S cost to repair.**	
4	ALL	0.26	Contractors to provide all necessary signage to alert traffic or other of the work being performed and to provide all related traffic control items as shown on the drawings and/or	

			contract documents or required by state or local codes. Contractors shall provide a flagger for construction vehicles during school hours. **Any TRADE CONTRACTOR not adhering to the traffic control requirements will result in the Construction Manager bringing a flagger onsite at the cost of the TRADE CONTRACTOR(S).**	
4	ALL	0.27	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	
4	ALL	0.28	The construction site hours are from **7:00 AM to 3:30 PM.** Contractors requiring off hours access shall acquire written permission in advance from the CONSTRUCTION MANAGER. Construction traffic in to and out of site is limited due to college traffic. No construction traffic will be allowed from **7:30 am to 8:30 am and 3:30 pm to 4:30 pm** during day**.** The site construction hours and traffic times are subject to change by the college and will be confirmed prior to the start of work.	
4	ALL	0.29	All TRADE CONTRACTORS shall be responsible for all temporary power needed by this TRADE CONTRACTOR.	
4	ALL	0.30	All TRADE CONTRACTORS shall be responsible for the coordination of all work with all other contractors through the Pepper superintendent to achieve final results. The bidding documents are deigned around "basis of design" manufacturers. Each TRADE CONTRACTOR is responsible to request submittals of equipment, etc. being provide by OTHER contractors that impact the work of the contractor prior to installation, wiring, etc. to verify different requirements. All submittals can be reviewed through Plans & Specs. Any costs associated rework will be the responsibility of the contractor installing, wiring, etc. Trade Contractors providing material, equipment, etc. from approved manufacturer, but not the basis of design manufacturers are responsible for all costs associated with additional work created but not using the "basis of Design" manufacturers.	
4	ALL	0.31	ALL Trade Contractors are required to send a project manager company representative to attend weekly Trade Contractors coordination and safety meetings held by the Construction Manager. Date and location to be determined.	
4	ALL	0.32	ALL Trade Contractors are required to submit a site specific safety plan and MSDS for review by Construction Manager at least 1 month prior to mobilization. No contractors will be permitted onsite without an approved Site Specific Safety Plan. Each trade foreman and all workforce MUST review the site specific safety plan onsite with the Construction Manager prior to starting work. Each tradesman MUST attend a one-hour site orientation with the Construction Manager onsite prior to beginning work unless they have already done so on a previous project with Pepper Construction and have the current safety sticker to verify completion. ALL TRADE CONTRACTORS are required to attend a site specific safety meeting and site specific quality/preinstallation meeting and provide plans for both.	
4	ALL	0.33	All Trade Contractors are required to provide all submittals electronically. Hard Copies of all samples and color selection charts shall be delivered directly to Pepper's Barrington office. All TRADE CONTRACTORS shall supply (1) set of approved construction shop drawings on-site for use by Pepper Construction and field labor MUST work from these drawings. **NOTE: Submittals MUST be provided referencing the associated specification number. Each individual submittal required per the specifications MUST be submitted as individual PDFs and not a combined file of all required. Submittals not meeting these requirements will not be reviewed and will be returned. Delays caused by not submitting correctly are the responsibility of the TRADE CONTRACTOR.**	
4	ALL	0.34	Submit Close out Documentation on material furnished, owner's manuals, and product information including maintenance and care and all items listed in the specifications. All information must be submitted as a PDF document either via email or on a disc. Submittals required for approval at the start of the Project will NOT be acceptable as close out documentation. All Close Out documentation must be "New as provided and installed" documentation. Submit Record Drawings in PDF and AutoCAD. Drawings must be stamped "Record Drawings", signed, and dated. In-progress as-built drawings MUST be maintained onsite-during construction. Executed Warranty & Guarantee letters will be submitted with the required documentation as PDF files. Warranty must commence from Project Substantial Completion date, and not when the TRADE CONTRACTOR's work is complete or when equipment is started up. All warranties must be 1 year, or as specified in the specifications (whichever is greater) from substantial completion on workmanship and materials.	

			ACM letters will be submitted with the required documentation as a PDF file. All training manuals must be submitted and training sessions scheduled, per owner's direction, before substantial completion. O&M manuals should be treated as the training meeting agendas. TRADE CONTRACTOR shall submit a sign in sheet of attendees present during the meeting. The TRADE CONTRACTOR is responsible to **video tape** all training sessions and submit video files with closeout. All attic stock required in the specifications must be delivered, inventoried with Pepper's superintendent, and placed in a secure location within the building as directed by the Owner. Attic stock not signed off by Pepper Construction will not be considered received. All keys MUST be submitted to Pepper Construction as a formal submittal. Keys left onsite or not transmitted to Pepper will not be considered received. If required per the specifications, maintenance agreements must be accompanied with the closeout documents. Closeout information and attic stock MUST be provided within two weeks of the substantial completion date. **Sample O&M manuals and Manufacturer's warranties MUST be submitted for review prior during the submittal process and not just submitted with closeout.**	
4	ALL	0.35	ALL TRADE CONTRACTORS shall be responsible for all work required by them for installation of their products but not shown on the bid documents. All costs associated with this work shall be the responsibility of the contractor requiring the work. This TRADE CONTRACTOR shall include in this bid all cost for work that is reasonably inferred from the drawings, specifications, and trade specific scopes of work.	
4	ALL	0.36	All TRADE CONTRACTORS shall be responsible for all testing, preinstallation meetings, and quality control listed in the specifications.	
4	ALL	0.37	All TRADE CONTRACTORS are responsible for all requirements listed in the A134 Standard Form Agreement Between Owner and Construction Manager as Constructor, A201 General Conditions of the Contract for Construction, and the Prime Trade Contract for Public Work. All TRADE CONTRACTORS will agree to sign the Prime Trade Agreement as provided in Section 005000 in the specifications with no modification.	
4	ALL	0.38	All TRADE CONTRACTORS shall be responsible for all information included in the specifications. There are no exclusions allowed and any substitutions must be pre-approved by the architect of record.	
4	ALL	0.39	ALL TRADE CONTRACTORS are responsible for meeting the current Illinois Department of Labor Prevailing Rates and Hourly Wages for McHenry County. ALL TRADE CONTRACTORS are responsible for keeping all certified payroll documents for a minimum of 3 years or as dictated by the Illinois statute, whichever is longer.	
4	ALL	0.40	All TRADE CONTRACTORS MUST provide Performance and Payment bonds to Construction Manager within 10 days of the contract award. Refer to specifications for bond requirements.	
4	ALL	0.41	All TRADE CONTRACTORS are responsible to fill out daily activity reports which include all work completed and man power onsite.	
4	ALL	0.42	All TRADE CONTRACTORS that require the use of a crane shall have onsite coordination meeting with Construction Manager 48 hours prior to crane showing up onsite. Due to location and limited construction site, larger than anticipated crane's may be needed for specific lifts and shall be at the expense of this TRADE CONTRACTOR.	
4	ALL	0.43	For work that is required in the existing buildings/areas that are still occupied, considerations for overtime must be included in this bid to perform the work off-hours. If the work corresponds with planned non-attendance days, then the work may be coordinated with the school and the Construction Manager. Refer to school schedule, construction schedule, and scopes of work for this possibility.	
4	ALL	0.44	Indoor air quality requirements must be met and monitored (i.e. no gas-powered vehicles).	
4	ALL	0.45	All TRADE CONTRACTORS are encouraged to visit the site prior to submitting bid to verify existing conditions which will affect his work.	
4	ALL	0.46	All TRADE CONTRACTORS are to provide a fire watch and incorporate the use of fire blankets during cutting operations and be responsible for any damage due to falling spark and also provide smoke eaters in area during work operations.	
4	ALL	0.47	Proper procedures (Critical Dig Procedures) for underground work must be followed. This includes a meeting to develop a Critical Dig Plan and location and protection of all existing utilities prior to start of work. Private locates are the responsibility of the	

			contractor performing the work. Any repairs related to damage caused to any underground materials are the responsibility of the contractor performing the underground work.	
4	ALL	0.48	All TRADE CONTRACTORS will be required to complete trade item checklists as a part of the Construction Manager's Job Specific Quality Plan throughout construction.	
4	ALL	0.49	Proper procedures for slab removal must be followed. This includes slab x-ray, scoring of existing slab, and jack hammering for complete removal. Repairs related to damage caused to any underground materials are the responsibility of the contractor performing the slab removal.	
4	ALL	0.50	All TRADE CONTRACTORS are responsible to check with local authorities for street load limitations and obtain any permits required to complete the work as planned in the bid documents.	
4	All	0.51	Prior to starting work, each Trade Contractor needs to provide a letter confirm that each individual has passed drug screening within the six (6) months prior to the start of work is also required. Testing by the hall is acceptable if that individual is specifically tested. If hall has random testing, but that individual has not been tested within that 6 month time period, then the trade contractor will be responsible to have them tested prior to beginning of any work at the trade contractor's expense. It is advisable to have your personnel tested well prior to work to avoid any delay. Any falsification of drug screening testing documentation would result in trade contractor being liable for any issues that arise.	

SCOPE OF WORK

For

BID PACKAGE 1

Demolition

All bids for the Demolition Bid Package 1 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

All Division 2 .....Existing Conditions

Bid Group	Bid Package	Scope Item	Description	
1	Demolition	1.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Group may be updated by future adjustments that will become part of said contractors' agreement. **NOTE: This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics and Phasing plan and Construction Schedule included within the project manual.**	
1	Demolition	1.02	This TRADE CONTRACTOR shall be responsible to provide Contractor's Pollution Liability Insurance. Please see Exhibit C for Insurance Requirements included in the project manual.	
1	Demolition	1.03	This TRADE CONTRACTOR shall be responsible for taking appropriate measures to protect existing conditions including but not necessary limited to perimeter landscaping, fencing, curbs, gutters, parking lot surfaces, drives and walks, buildings, etc. not required to be removed in the contract documents.	
1	Demolition	1.04	This TRADE CONTRACTOR shall include all costs and work required to acquire the necessary permits required for demo.	
1	Demolition	1.05	This TRADE CONTRACTOR shall be responsible for all layout work, measuring and field dimensioning associated with this Trade Contractor's work.	
1	Demolition	1.06	This TRADE CONTRACTOR shall be responsible for applications, inspection coordination, scheduling, testing and all things required for satisfying the requirements of local code	

			enforcement inspection services. This TRADE CONTRACTOR to submit verification of conversations, inspections, and/or approvals to Construction Manager within 72 hours of said occurrence.	
1	Demolition	1.07	This TRADE CONTRACTOR shall furnish all required dumpsters for the demolished materials and shall haul off in a timely manner. Dumpster locations are to be determined by Construction Manager. This TRADE CONTRACTOR shall be responsible for any associated hauling and disposal fees. This TRADE CONTRACTOR shall make efforts to recycle demolished materials.	
1	Demolition	1.08	This TRADE CONTRACTOR shall be responsible for all work associated with providing Pepper Construction a site specific safety plan fully addressing issues including but not limited to occupants of existing building, equipment to be used, dust and noise control, etc. based on active school being in session. This TRADE CONTRACTOR shall comply with all OSHA, local, state, and federal safety codes applicable to the demolition work.	

SCOPE OF WORK

For

BID PACKAGE 2

Excavation and Site Utilities

All bids for the Excavation and Site Utilities Bid Package 2 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

Division 2 .....Existing Conditions
Division 31 .....Earthwork
Division 33 .....Utilities

Bid Group	Bid Package	Scope Item	Description	
1	Excavation and Site Utilities	2.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Group may be updated by future adjustments that will become part of said contractors' agreement. **NOTE: This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics and Phasing plan and Construction Schedule included within the project manual.**	
1	Excavation and Site Utilities	2.02	This TRADE CONTRACTOR shall be responsible for taking appropriate measures to protect existing conditions including but not necessarily limited to perimeter landscaping, curbs, gutters, drives and walks, buildings, light poles, hydrants, etc. from damage that may be caused by this work.	
1	Excavation and Site	2.03	This TRADE CONTRACTOR shall be responsible for all mass grading, earth moving, excavation, rough grading, fine grading of sub-grade (to +/- 0.1 foot), re-spread, hauling, importing, final	

	Utilities		grade, backfill, and compaction, etc. under sidewalks, curbs, gutters, asphalt, pads, and detention ponds as shown on the drawings and specifications, to achieve the final working subgrade. **NOTE:** This TRADE CONTRACTOR shall be responsible to bring any VOIDS left in the site from removals to fine grade. This TRADE CONTRACTOR shall leave sod restoration areas, including stone removal, at fine grade for the sod to be installed per the allowance below.	
1	Excavation and Site Utilities	2.04	This TRADE CONTRACTOR shall provide all necessary signage to alert traffic or other of the work being performed and to provide all related traffic control and flagging items as shown on the drawings and/or contract documents	
1	Excavation and Site Utilities	2.05	This TRADE CONTRACTOR shall be responsible to provide its own project layout according to the drawings, considering the benchmarks locations that will be given by the Construction Manager. This TRADE CONTRACTOR shall protect and maintain all survey stakes.	
1	Excavation and Site Utilities	2.06	This TRADE CONTRACTOR shall be responsible for topsoil and/or non-topsoil stockpiling and management/maintenance thereof for all excavation spoils by this TRADE CONTRACTOR. This TRADE CONTRACTOR shall be aware of site stockpiling limitations onsite as reflected on the bid documents and/or site logistics plan and the construction schedule sequencing and shall haul material offsite and import material as required due to the phasing of the project. If proposing to stockpile onsite, this TRADE CONTRACTOR shall also include costs for site fencing, erosion control measures, and site restoration if proposing to store on site. Contractor to propose a stockpiling strategy as an attachment to the bid form at the time of bid. Any stockpiling onsite must be approved by the Construction Manager. This TRADE CONTRACTOR shall be responsible to remove and haul off all spoils generated by this scope of work an orderly manner from the jobsite if it cannot be reused when restoring the site.	
1	Excavation and Site Utilities	2.07	This TRADE CONTRACTOR shall be responsible for scheduling of all required testing for compaction, etc. This TRADE CONTRACTOR shall be responsible for adherence with all testing procedures and/or Geo-Technical Engineering findings and recommendations. Testing by the CONSTRUCTION MANAGER. This TRADE CONTRACTOR has read and understands all responsibilities of these reports and is responsible for all remediation and relocating excavated materials onsite as required. This TRADE CONTRACTOR shall provide any necessary lifts/proof rolling to complete scope of work to meet the proper compaction of sub-grade and/or backfill materials.	
1	Excavation and Site Utilities	2.08	This TRADE CONTRACTOR shall be responsible for all public access (streets, roads, aprons, curb-cuts, sidewalks, roads, etc) maintenance on a daily basis and for the duration of all on site activities that is clear of dirt, dust, debris, mud, stones, rocks, sediment and/or project related materials of any kind caused by this TRADE CONTRACTOR.	
1	Excavation and Site Utilities	2.09	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	
1	Excavation and Site Utilities	2.10	This TRADE CONTRACTOR shall contact JULIE 72 hour minimum prior to any excavation work. Record and document all contact with JULIE including but not limited to Dig Number; present JULIE dig number and all other JULIE related documentation to the Construction Manager 24-hours minimum prior to any excavation. All this JULIE documentation shall be included as part of the close out documentation. **NOTE: This TRADE CONTRACTOR shall be responsible for private locates on all sites as required by this TRDAE CONTRACTOR'S work.**	
1	Excavation and Site Utilities	2.11	This TRADE CONTRACTOR is responsible for all permits, and fees required for the completion of his/her work.	
1	Excavation and Site Utilities	2.12	This TRADE CONTRACTOR shall provide all trucking of imported and exported materials as required by Construction Documents and pay all dump fees.	
1	Excavation and Site Utilities	2.13	This TRADE CONTRACTOR shall include all dewatering costs associated with the work	
1	Excavation and Site Utilities	2.14	As-built drawings must be submitted to the Construction Manager for review and approval following the construction of this building, within 2 weeks of substantial completion. As-built drawings must include the following drawings at a minimum: Dimension Plan and Grading Plan plus all site utility/plumbing work. As-Built is also required for the detention basin if applicable.	

			The as-builts shall indicate the design information with a line through the text and the as-built elevation written next to it. Should the information be constructed as designed, the text shall be circled, indicating full compliance. As-built information is expected to be provided for the following items at a minimum: Spot elevations and contours. Hand written as-builts will not be accepted. As-builts shall be submitted in AutoCAD and PDF.	
1	Excavation and Site Utilities	2.15	This TRADE CONTRACTOR shall be responsible for all work associated with all SWPPP Legend items and SWPPP Notes. This TRADE CONTRACTOR shall be responsible for all work associated with the furnish, install, maintenance, and removal of silt fence.	
1	Excavation and Site Utilities	2.16	This TRADE CONTRACTOR shall provide silt screen over all inlets to prevent clogging of underground piping, and be responsible to remove at substantial completion.	
1	Excavation and Site Utilities	2.17	This TRADE CONTRACTOR shall provide and comply with all life safety OSHA standards and Pepper Construction's Safety procedures.	
1	Excavation and Site Utilities	2.18	This TRADE CONTRACTOR shall be responsible for all work GPUP requirements. Please see PCC Safety plan for additional information.	
1	Excavation and Site Utilities	2.19	**ALLOWANCE**: This TRADE CONTRACTOR shall include $25,000 in the base bid for removal of unsuitable soils as determined by the Soils Engineer. **NOTE**: **The cost of coordination, supervision, overhead, and profit for any such work shall be included in the bidder's cost, as it is not included in this listed allowance value. All allowance work will be completed only in the direction of PCC. All allowances not expended will be returned to the Owner 100%.**	

SCOPE OF WORK

For

BID PACKAGE 3

Landscaping and Irrigation

All bids for the Landscaping and Irrigation Bid Package 3 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

32 92 23 .....Sodding

Bid Group	Bid Package	Scope Item	Description	
1	Landscaping and Irrigation	3.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Group may be updated by future adjustments that will become part of said contractors' agreement. **NOTE: This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics and Phasing plan and Construction Schedule included within the project manual.**	
1	Landscaping and Irrigation	3.02	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	

1	Landscaping and Irrigation	3.03	This TRADE CONTRACTOR shall be responsible for all layout work, field measuring, and field dimensioning associated with this Trade Contractor's work.	
1	Landscaping and Irrigation	3.04	This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and install of all trees, shrubs, grass, perennials, detention seed, mulch, plant bed material, and sod as shown on sheet L-100 and through the bid documents.	
1	Landscaping and Irrigation	3.05	This TRADE CONTRACTOR shall be responsible for all work in all details and all General Notes on sheet L-101.	
1	Landscaping and Irrigation	3.06	This TRADE CONTRACTOR shall be responsible to import all needed topsoil and fine grading.	
1	Landscaping and Irrigation	3.07	This TRADE CONTRACTOR shall be responsible for all irrigation work. This TRADE CONTRACTOR shall install empty sleeves for future irrigation at all planted beds.	
1	Landscaping and Irrigation	3.08	**ALLOWANCE**: This TRADE CONTRACTOR shall include $15,000 in the base bid for misc site restoration. **NOTE: The cost of coordination, supervision, overhead, and profit for any such work shall be included in the bidder's cost, as it is not included in this listed allowance value. All allowance work will be completed only in the direction of PCC. All allowances not expended will be returned to the Owner 100%.**	

SCOPE OF WORK

For

BID PACKAGE 4

Concrete

All bids for the Concrete Bid Package 4 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

031000……Concrete Formwork
031000……Concrete Forming and Accessories
032000……Concrete Reinforcement
033000……Cast-In-Place Concrete
321313……Concrete Paving
321726……Tacctile Warning Surface

Bid	Bid	Scope	Description	

Group	Package	Item		
1	Concrete	4.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Release may be updated by future adjustments that will become part of said contractors' agreement. **NOTE:** This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics and Phasing plan and Construction Schedule included within the project manual.	
1	Concrete	4.02	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	
1	Concrete	4.03	This TRADE CONTRACTOR shall be responsible to provide Contractor's Pollution Liability Insurance. Please see Exhibit C for Insurance Requirements included in the project manual.	
1	Concrete	4.04	This TRADE CONTRACTOR shall be responsible for all layout work, field measuring, and field dimensioning associated with this Trade Contractor's work.	
1	Concrete	4.05	This TRADE CONTRACTOR shall provide and comply with all life safety OSHA standards and Pepper Construction's Safety procedures.	
1	Concrete	4.06	This TRADE CONTRACTOR shall be responsible for taking appropriate measures to protect existing conditions including but not necessarily limited to perimeter landscaping, curbs, gutters, drives and walks, buildings, light poles, hydrants, etc. from damage that may be caused by this work.	
1	Concrete	4.07	This TRADE CONTRACTOR shall be responsible for scheduling of all required testing for compaction, etc. This TRADE CONTRACTOR shall be responsible for adherence with all testing procedures and/or Geo-Technical Engineering findings and recommendations. Testing by the OWNER. This TRADE CONTRACTOR has read and understands all responsibilities of these reports and is responsible for all remediation and relocating excavated materials onsite as required. This TRADE CONTRACTOR shall provide any necessary lifts/proof rolling to complete scope of work to meet the proper compaction of sub-grade and/or backfill materials. All concrete testing costs will be paid by the OWNER. This TRADE CONTRACTOR shall be responsible to coordinate all testing and provide required cylinders, etc.	
1	Concrete	4.08	This TRADE CONTRACTOR shall be responsible for all public access (streets, roads, aprons, curb-cuts, sidewalks, roads, etc.) maintenance on a daily basis and for the duration of all on site activities that is clear of dirt, dust, debris, mud, stones, rocks, sediment and/or project related materials of any kind caused by this TRADE CONTRACTOR.	
1	Concrete	4.09	This TRADE CONTRACTOR shall provide a concrete washout box and coordinate location with PCC superintendent. This TRADE CONTRACTOR shall include haul away and removal from the project site.	
1	Concrete	4.10	Once mobilized, THIS CONTRACTOR shall be responsible for dewatering of casual/rainwater until entire installation is completed. This scope is based on this subcontractor being able to utilize a standard pump (up to 6") with a 2" discharge. Dewatering discharge to be handled by this TRADE CONTRACTOR in accordance with all state and local requirements.	
1	Concrete	4.11	This TRADE CONTRACTOR is responsible for all permits, and fees required for the completion of this work.	
1	Concrete	4.12	This TRADE CONTRACTOR shall be responsible to provide all required accelerators and add-mixtures for cold weather concrete pouring according to ACI Standards. Winter blankets shall be included, when required.	
1	Concrete	4.13	This TRADE CONTRACTOR shall provide silt screen over all inlets to prevent clogging of underground piping, and be responsible to remove at substantial completion.	
1	Concrete	4.14	This TRADE CONTRACTOR shall be responsible for all work associated with providing As-Built drawings of anchor bolts and spot checks of heights at top of foundations.	
1	Concrete	4.15	This TRADE CONTRACTOR shall be responsible for providing any temporary bulkheads, edge forms, shoring, etc. as required for the proper completion of this TRADE CONTRACTOR'S work. This TRADE CONTRACTOR shall be responsible for all stair concrete toppings and tread infills.	
1	Concrete	4.16	This TRADE CONTRACTOR shall be responsible to furnish and install all new concrete including footings, thickened footings as required, foundations walls, grade beams, piers, shear walls, elevator pits, columns concrete slab on grade, slab on metal deck, elevated slabs, elevated beams, toppings, thickened slabs as required by bid documents.	
1	Concrete	4.17	This TRADE CONTRACTOR shall include minor excavation (footing trim) required to maintain footing depth and thickness.	

1	Concrete	4.18	This TRADE CONTRACTOR shall provide specified brick ledge as shown on bid documents for all foundation wall work. Any modifications to foundation wall thicknesses must be reviewed and approved by structural engineer and coordinated with enclosure subcontractors (masonry, curtainwall, EIFS, partitions, etc.) prior to placement.	
1	Concrete	4.19	This TRADE CONTRACTOR shall provide grouting of all base plates. All non-shrink grout intended for steel work, whether noted or not, shall be furnished and installed by this TRADE CONTRACTOR. Steel to be furnished and installed by the STEEL CONTRACTOR.	
1	Concrete	4.20	This TRADE CONTRACTOR shall complete flatness and levelness testing prior to removing formwork.	
1	Concrete	4.21	This TRADE CONTRACTOR shall furnish and install site concrete per sizes, profiles, details for curbs, gutters, sidewalks, stamped concrete, etc.as shown throughout the bid documents.	
1	Concrete	4.22	This TRADE CONTRACTOR shall be responsible for the furnish and install of slab on grade vapor retarder.	
1	Concrete	4.23	This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and install of all dampproofing and waterproofing.	
1	Concrete	4.24	All stone by excavator.	

SCOPE OF WORK

For

BID PACKAGE 5

Masonry and AVB

All bids for the Masonry and AVB Bid Package 5 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

Div 4.....Masonry
074265……Thermal and Air Barrier System
079200 .....Joint Sealants
123623.13……Plastic-Laminate-Clad Countertops
123661.16……Solid Surfacing Countertops

Bid Group	Bid Package	Scope Item	Description	
1	Masonry and AVB	5.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Group may be updated by future adjustments that will become part of said contractors' agreement. **NOTE: This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics and Phasing plan and Construction Schedule included within the project manual.**	
1	Masonry and AVB	5.02	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	
1	Masonry and AVB	5.03	This TRADE CONTRACTOR shall be responsible to provide Contractor's Pollution Liability Insurance. Please see Exhibit C for Insurance Requirements included in the project manual.	
1	Masonry and AVB	5.04	This TRADE CONTRACTOR shall be responsible for all layout work, measuring and field dimensioning associated with this Trade Contractor's work. Construction Manager will provide building offsets. All other engineering or layout as required to complete this scope of work is the sole responsibility of this TRADE CONTRACTOR.	
1	Masonry and AVB	5.05	This TRADE CONTRACTOR shall be responsible for furnishing and installing all reinforcing requirements, including reinforcing bars, dowels, wall ties, straps, anchors, and other items required for completion of contractors work.	
1	Masonry and AVB	5.06	This TRADE CONTRACTOR shall be responsible to install all masonry wall embeds and lintels.	
1	Masonry and AVB	5.07	This TRADE CONTRACTOR shall be responsible for all rigid insulation, thru-wall flashing, caulking/ filler/ sealant/backer rod, and weep vents as required for this TRADE CONTRACTOR'S work	
1	Masonry and AVB	5.08	This TRADE CONTRACTOR shall be responsible for all tooled joints in all exposed masonry work as required.	
1	Masonry and AVB	5.09	This TRADE CONTRACTOR shall be responsible for all expansion and/ or control joints required, including expansion/ control joint fillers/ sealant/soft joints shown throughout the bid documents and as required. NOTE: This TRADE CONTRACTOR shall be responsible to submit a control joint shop drawing **for review and approval by the architect prior to proceeding with the installation.**	
1	Masonry and AVB	5.10	This TRADE CONTRACTOR shall be responsible to review all demolition drawings and patch all areas where items are removed from existing masonry walls.	
1	Masonry and AVB	5.11	This TRADE CONTRACTOR will maintain streets, sidewalks, and roads, free from debris and waste material resulting from their operation in accordance with local regulations and Contractor staff. This TRADE CONTRACTOR will assume all responsibility for any permits required for hauling and / or trucking of material required for this scope of work. This TRADE CONTRACTOR to contact the City having jurisdiction over this site for information on all trucking routes and permit information. This TRADE CONTRACTOR will comply with all regulations concerning dust control, clean tires, traffic control, etc. as it relates to the hauling of material for this scope of work.	
1	Masonry and AVB	5.12	This TRADE CONTRACTOR will replace and repair, at no additional cost, any construction damaged by this TRADE CONTRACTOR's field operations and/or personnel.	
1	Masonry and AVB	5.13	This TRADE CONTRACTOR shall be required to provide a mockup onsite for approval by the designer/owner as stated in the specification.	
1	Masonry and AVB	5.14	This TRADE CONTRACTOR shall be responsible for all work associated with all required masonry cleaning. This TRADE CONTRACTOR shall be responsible to properly rub and scrape new CMU walls in preparation of receiving other finish product.	
1	Masonry and AVB	5.15	This TRADE CONTRACTOR shall provide all compressible filler where CMU butts steel members as indicated.	
1	Masonry and AVB	5.16	This TRADE CONTRACTOR shall provide labor and material to assist Owner's testing agency.	
1	Masonry and AVB	5.17	This TRADE CONTRACTOR shall furnish and install fire-resistive joint system to all head-of-wall joints and control joints at fire rated masonry partitions including all misc. components (Pleates, angles, sealants, compounds, stabilizing anchors, batt insulation, etc.). Provide UL assemblies at	

			fire rated walls as needed. NOTE: Any caulking required where new masonry abuts existing is by this CONTRACTOR.	
1	Masonry and AVB	5.18	NOTE: This TRADE CONTRACTOR shall be responsible for patching into existing masonry walls where new walls tie into the existing building.	
1	Masonry and AVB	5.19	Lintels are furnished by the STEEL CONTRACTOR and received, inventoried and installed by this TRADE CONTRACTOR.	
1	Masonry and AVB	5.20	ALL Air and Weather Barrier is by this TRADE CONTRACTOR. This TRADE CONTRACTOR shall include 3 mobilizations.	

SCOPE OF WORK

For

BID PACKAGE 6

Steel

All bids for the Steel Bid Package 6 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

051223 .....Structural Steel
053100 .....Steel Deck

Bid Group	Bid Package	Scope Item	Description	
1	Steel	6.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Release may be updated by future adjustments that will become part of said contractors' agreement. **NOTE:** This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics and Phasing plan and Construction Schedule included within the project manual.	
1	Steel	6.02	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	
1	Steel	6.03	This TRADE CONTRACTOR shall be responsible to provide Contractor's Pollution Liability Insurance. Please see Exhibit C for Insurance Requirements included in the project manual.	
1	Steel	6.04	This TRADE CONTRACTOR shall be responsible for all layout work, field measuring, and field dimensioning associated with this Trade Contractor's work.	
1	Steel	6.05	This TRADE CONTRACTOR shall provide and comply with all life safety OSHA standards and Pepper Construction's Safety procedures.	
1	Steel	6.06	This TRADE CONTRACTOR shall provide all necessary lifts/scaffolds to reach all areas required by this scope of work. This TRADE CONTRACTOR shall provide all manpower, tools, equipment, accessories, and hoisting required to complete its scope of work. Including any on site storage for this TRADE CONTRACTORS materials and equipment.	
1	Steel	6.07	This TRADE CONTRACTOR shall perform daily clean-up operations and shall comply with all Pepper and OSHA safety requirements especially including but not limited to PPE and fall protection.	
1	Steel	6.08	This TRADE CONTRACTOR to provide sufficient equipment, material, skilled manpower, supervision, and/or premium time/shift work (all without additional compensation) as may be required to complete the work of this Trade Contractor in accordance with the overall project schedule.	
1	Steel	6.09	This TRADE CONTRACTOR will replace and repair, at no additional cost, any construction damaged by this TRADE CONTRACTOR's field operations and/or personnel.	
1	Steel	6.10	The fabricator, erector and decker must agree to the Instruction to Bidders document which specifically requires 100% fall protection at 15' and above.	
1	Steel	6.11	Erector must complete the Project Safety Plan for Steel Erection with the Pepper Safety Dept. prior to job start.	
1	Steel	6.12	All ironworkers must receive training in and be knowledgeable of the specific requirements of the Project Safety Dept. prior to beginning work.	
1	Steel	6.13	This TRADE CONTRACTOR shall furnish all labor, material, tools, equipment, etc. as required to provide a full and complete building miscellaneous steel package as shown in the bid documents.	
1	Steel	6.14	This TRADE CONTRACTOR shall be responsible for all shop drawings and calculations, indicating embed design, embedded layout connection and connection details, other structural and miscellaneous iron items, etc. with stamped certification and seal of a licensed structural engineer in the State of Illinois. Any dimensional or verification questions will not be an acceptable excuse for the delaying the shop drawing process. Any dimensional questions or verification items will be answered during the shop drawing review process.	
1	Steel	6.15	This TRADE CONTRACTOR shall be responsible for all field welding, bolts, washers, expansion anchors and ancillary materials required for the miscellaneous and structural steel connections indicated in the contract documents.	
1	Steel	6.16	All materials are to be finished with a shop primed finish unless otherwise noted	
1	Steel	6.17	**Testing:** Adhere to all testing procedures and/or findings and recommendations. All costs associated with all required testing according to the ASTM standards and to the division 5 specification sections are by the owner. This TRADE CONTRACTOR shall be responsible for	

			adherence with all testing procedures and/or findings and recommendations.	
1	Steel	6.18	This TRADE CONTRACTOR is responsible to coordinate with the HVAC CONTRACTOR for layout of all misc. steel. This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and install of all HVAC equipment support steel. This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and delivery of all lintels to the MASONRY contractor.	

SCOPE OF WORK

For

BID PACKAGE 7

General Carpentry

All bids for the General Carpentry Bid Package 7 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

034900……Glass-Fiber Reinforced Concrete
054000……Cold Formed Metal Framing
Div 6……..Wood, Plastics, and Composites
078100……Applied Fire Protection
078123……Intumescent Fire Protection
079200……..Joint Sealants
0799513.13……Interior Expansion Joint Cover Assemblies
0799513.19……Exterior Expansion Joint Cover Assemblies
081113……Hollow Metal Doors and Frames
081416……..Flush Wood Doors
087100…….……Door Hardware
092116.23……Gypsum Board Shaft Wall Assemblies
092216…….……Non Structural Metal Framing
092900…….……Gypsum Board
Div 10……Specialties
Div 12……Furnishings
321123……..Aggregate Base Course
321216…….……Asphalt Paving

Bid Phase	Bid Package	Scope Item	Description	
1	General Carpentry	7.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Group may be updated by future adjustments that will become part of said contractors' agreement. **NOTE: This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics plan and Construction Schedule included within the project manual.**	
1	General Carpentry	7.02	This TRADE CONTRACTOR shall be responsible to provide **Contractor's Pollution Liability Insurance.** Please see section 11.1.5 of the Sample Prime Trade Agreement included in section 005200 of the project manual.	
1	General Carpentry	7.03	This TRADE CONTRACTOR is responsible for all layout work, measuring and field dimensioning associated with this TRADE CONTRACTOR'S work.	
1	General Carpentry	7.04	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	
1	General Carpentry	7.05	This TRADE CONTRACTOR shall be responsible for furnishing, lay-out, and installation of all required blocking and framing at mechanical, electrical, and plumbing through wall penetrations; at all roof curbs, roofing including parapet nailers and coping along the entire perimeter of the roof parapet, doors, windows, soffits, canopies, skylights/smoke vents, toilet accessories and partitions, drinking fountains, lockers, grab bars, casework, window sills, visual display boards, and display cases based on proper construction. This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and install of all wood blocking/backing as shown on the drawings. All Roof Blocking, sheathing, etc is by this TRADE CONTRACTOR.	
1	General Carpentry	7.06	This TRADE CONTRACTOR shall complete all pre-construction due-diligence required for the work of this trade contractor including but not limited to verification of adequacy and location of blocking/backing for attachments and installation, proper clearances, floor/wall/ceiling/equipment and device locations.	
1	General	7.07	This TRADE CONTRACTOR shall provide clean cut, and tight trim edging for preparation of	

	Carpentry		the painting trade contractor finishes. It is this TRADE CONTRACTOR who will provide all the necessary filler/caulk of his/her finished work.	
1	General Carpentry	7.08	This TRADE CONTRACTOR shall include all Wall/Partition Gypsum Board assemblies including but not necessarily limited to all light gauge metal framing, light gauge metal framing slip connections, light gauge metal framing deflection connection, all related bracing, all related light gauge bridging, all required insulation, all walls/partitions gypsum board furring, all types of gypsum board, metal stud kickers where required, fire rated drywall partition assemblies, caulking, gypsum board expansion joint covers, water resistant gypsum backing board, drywall finishing, furring channels, fire retardant furring, drywall sills, corner guards, all drywall partition types, drywall ceilings, abuse/impact resistant drywall, break metal, etc. All work according to the drawings and construction documents.	
1	General Carpentry	7.09	This TRADE CONTRACTOR is responsible to furnish and Install all full height, full width interior and/or exterior Carpentry related sealants, caulking, and fire caulking/safing, including but not necessarily limited to sealant/caulking of joints as part of this trade contractors work where indicated and/or required, including where the work of this trade contractor intersects dissimilar materials (i.e. drywall to masonry, drywall to precast, plaster to masonry, gypsum board to masonry, plaster to gypsum board, plastic laminate to plaster, plaster laminate to masonry, plastic laminate to gypsum board, gypsum board to glass block, and any material provided by this TRADE CONTRACTOR with any other material, etc.) Sealant and caulking shall comply with the fire rating requirements of the wall where installed. This TRADE CONTRACTOR shall be responsible for all caulking for items this TRADE CONTRACTOR installs.	
1	General Carpentry	7.10	**Casework:** **This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and install of ALL casework and millwork and wood wall panels.** **NOTE: This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and install of all blocking required for the installation of the casework/millwork scope required, but not shown on the bid documents.**	
1	General Carpentry	7.11	**Drywall and Soffits:** **This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and install of all framing, insulation, drywall, taping etc as shown throughout the bid documents for walls, ceilings, soffits, etc.**	
1	General Carpentry	7.12	**Doors, Frames and Hardware** **This TRADE CONTRACTOR is responsible for furnishing, unloading, inventory, and distribution of wood doors, HM doors, HM frames and hardware furnished by the Doors/Frames/Hardware CONTRACTOR.** **This TRADE CONTRACTOR shall attend hardware coordination meeting(s) held between Owner, Architect, Supplier and Construction Manager. This TRADE CONTRACTOR shall attend keying meeting held between Owner, Architect, Supplier and Construction Manager. This TRADE CONTRACTOR shall be responsible for the installation of permanent cores per final keying information. The DOORS/FRAMES/HARDWARE CONTRACTOR shall be responsible to provide all cores and keys. This TRADE CONTRACTOR shall receive all cores and install prior to substantial completion.** **TRADE CONTRACTOR shall provide blocking as required at all jambs and shall caulk all HM frames prior to painting. All glass in doors and frames is by the Storefronts Contractor.**	
1	General Carpentry	7.13	**Wood Timbers**	

			This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and install of ALL wood timbers and accessories.	
1	General Carpentry	7.14	**Asphalt:** **This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and install of ALL asphalt and stone.**	
1	General Carpentry	7.15	**Spray Fireproofing:** **This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and install of ALL fireproofing**	

BID PACKAGE 8

Roofing and ACM

All bids for the Roofing and ACM Bid Package 8 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

Division 7 .....Thermal and Moisture Protection

Bid Group	Bid Package	Scope Item	Description	
1	Roofing and ACM	8.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Group may be updated by future adjustments that will become part of said contractors' agreement.	
1	Roofing and ACM	8.02	NOTE: This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics and Phasing plan and Construction Schedule included within the project manual.	
1	Roofing and ACM	8.03	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	
1	Roofing and ACM	8.04	This TRADE CONTRACTOR shall be responsible for temporary protection of this TRADE CONTRACTOR'S material whether installed or not. This TRADE CONTRACTOR shall properly protect the roofing system at the end of each workday and upon completion of the work to ensure moisture does not penetrate the roofing system.	
1	Roofing and ACM	8.05	This TRADE CONTRACTOR shall furnish and install all roofing of the project and related assemblies, including but not limited to: all roof membranes, all required roof blocking, crickets, saddles, scuppers, all required roof vapor barrier, all roofing pads, all flashing and counter flashing, coping, all gutters/downspouts, steel pipe downspouts, splash blocks termination bars, all sheet metal associated with the roofing, all roof expansion joints, and all roof system fasteners as required to provide manufacturer's warranty. **NOTE: All roof wood and blocking associated with the LMC addition is by the GENERAL CARPENTER. All roof wood and blocking associatred with the 1966 building and 2000 addition are to be furnished and installed by this TRADE CONTRACTOR.**	
1	Roofing and ACM	8.06	This TRADE CONTRACTOR shall furnish and install all work required for all roof curbs and parapet walls, including but not necessarily limited to, all bonding adhesives, flashing membranes, pre-finished metal coping, all fasteners, splicing cement, lap sealant, and other roofing materials not specifically mentioned.	
1	Roofing and ACM	8.07	Note: curbs for all RTUs are furnished by HVAC TRADE CONTRACTOR but flashing is by Roofing contractor.	
1	Roofing and ACM	8.08	This TRADE CONTRACTOR shall furnish and install all flashing for all roof penetrations and equipment posts.	
1	Roofing and ACM	8.09	This TRADE CONTRACTOR shall strip-in all roof drains.	
1	Roofing and ACM	8.10	Roofing debris will not be allowed to accumulate on the project and must be disposed of daily in the proper container. This TRADE CONTRACTOR shall police the surrounding off-set neighborhood removing any roofing and steel metal debris, which may have been carried off-site by wind.	
1	Roofing and ACM	8.11	This TRADE CONTRACTOR shall be responsible for all necessary tapering of insulation materials as to provide proper drainage. At TRADE CONTRACTOR'S expense shall immediately address any ponding conditions.	
1	Roofing and ACM	8.12	This TRADE CONTRACTOR is responsible for providing all work, necessary testing, field inspection and final inspection report from manufacturer for all required warranties. Testing to include	

			water testing & pull-out test for roof fastening system (to be witnessed by Construction Manager).	
1	Roofing and ACM	8.13	This TRADE CONTRACTOR is responsible to furnish all scaffolding, hoisting, lifts, etc. necessary to complete work in accordance with project schedule.	
1	Roofing and ACM	8.14	This TRADE CONTRACTOR shall provide a system as required by the manufacturer to provide a warranty.	
1	Roofing and ACM	8.15	This TRADE CONTRACTOR shall be responsible to coordinate and attend coordination, safety, and quality meetings as required.	
1	Roofing and ACM	8.16	This TRADE CONTRACTOR is responsible to furnish and install all MEP penetration flashing and accessories as required. Review the MEP documents for a complete scope.	
1	Roofing and ACM	8.17	This TRADE CONTRACTOR is responsible to notify the roof system warranty holders as required to maintain the current roof warranties. If this TRADE CONTRACTOR is not a certified installer of the existing roof manaufacturer, this TRADE CONTRACTOR must subcontract the work at the existing roof to a roofing contractor that is certified.	
1	Roofing and ACM	8.18	This TRADE CONTRACTOR is responsible to furnish and install all metal panels.	

SCOPE OF WORK
For
BID PACKAGE 9

Storefronts and Glazing

All bids for the Storefronts & Glazing Bid Package 9 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

079200..... Joint Sealants
084113.....Aluminum-Framed Entrances and Storefronts
084413.....Glazed Aluminum Curtainwall
087100.....Door Hardware
088000..... Glazing

Bid Phase	Bid Package	Scope Item	Description	
1	Storefronts & Glazing	9.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Group may be updated by future adjustments that will become part of said contractors' agreement. **NOTE: This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics and Phasing plan and Construction Schedule included within the project manual.**	
1	Storefronts & Glazing	9.02	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation. This TRADE CONTRACTOR shall assume multiple mobilizations.	
1	Storefronts & Glazing	9.03	This TRADE CONTRACTOR shall perform all the required scope of work according to the drawings, specifications, contract documents, local and state codes, etc.	
1	Storefronts & Glazing	9.04	TRADE CONTRACTOR is responsible for all joint sealant as they apply to any and all work of this TRADE CONTRACTOR. This TRADE CONTRACTOR shall furnish and install all caulking and backer rods related to the installation of this work, per specification.	
1	Storefronts & Glazing	9.05	All wood blocking shown in the bid documents to be furnished and installed by OTHER. Any wood blocking required for the installation of this TRADE CONTRACTOR'S work, but not shown on the drawings, will be furnished and installed by this TRADE CONTRACTOR.	
1	Storefronts & Glazing	9.06	This TRADE CONTRACTOR shall submit all required samples, product data, and shop drawings with calculations for review by architect and engineer as required in the specifications in order to meet the construction schedule and assuming a two week review period.	
1	Storefronts & Glazing	9.07	This TRADE CONTRACTOR shall provide all tools, equipment, manpower, and hoisting for this TRADE CONTRACTORS scope of work.	
1	Storefronts & Glazing	9.08	This TRADE CONTRACTOR shall clean all window systems and glazing as outlined in the specifications prior to turn over.	
1	Storefronts & Glazing	9.09	This TRADE CONTRACTOR shall provide all glass to be installed within hollow metal frames, wood doors, and hollow metal doors. This TRADE CONTRACTOR shall field measure these items.	
1	Storefronts	9.10	This TRADE CONTRACTOR shall work with Construction Manager and Owner to	

	& Glazing		coordinate the keying schedule for doors this TRADE CONTRACTOR provides. This TRADE CONTRACTOR shall provide construction cores for all openings and will be swapped out at the end of the project by this TRADE CONTRACTOR with the final cores.	

SCOPE OF WORK

For

BID PACKAGE 10

Ceilings

All bids for the Ceilings Bid Package 10 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

095113 .....Acoustical Panel Ceilings

Bid Group	Bid Package	Scope Item	Description	
1	Ceilings	10.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Group may be updated by future adjustments that will become part of said contractors' agreement. **NOTE: This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics plan and Construction Schedule included within the project manual.**	
1	Ceilings	10.02	This TRADE CONTRACTOR is responsible for all layout work, measuring and field dimensioning associated with this TRADE CONTRACTOR'S work.	
1	Ceilings	10.03	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	
1	Ceilings	10.01	This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and install of all acoustical ceiling systems as shown throughout the bid documents.	

SCOPE OF WORK
For
BID PACKAGE 11

Flooring

All bids for the Flooring Bid Package 11 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

096513……..Resilient Base and Accessories
096519……..Resilient Tile Flooring
096813……..Tile Carpeting

Bid Phase	Bid Package	Scope Item	Description	
1	Flooring	11.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Release may be updated by future adjustments that will become part of said contractors' agreement. **NOTE:** This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics and Phasing plan and Construction Schedule included within the project manual.	
1	Flooring	11.02	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	
1	Flooring	11.03	This TRADE CONTRACTOR shall be responsible for all layout work, field measuring, and field dimensioning associated with this Trade Contractor's work.	
1	Flooring	11.04	This TRADE CONTRACTOR shall provide and comply with all life safety OSHA standards and Pepper Construction's Safety procedures.	
1	Flooring	11.05	This TRADE CONTRACTOR shall provide all necessary lifts/scaffolds to reach all areas required by this scope of work. This TRADE CONTRACTOR shall provide all manpower, tools, equipment, accessories, and hoisting required to complete its scope of work. Including any on site storage for this TRADE CONTRACTORS materials and equipment.	
1	Flooring	11.06	This TRADE CONTRACTOR shall perform daily clean-up operations and shall comply with all Pepper and OSHA safety requirements especially including but not limited to PPE and fall protection.	
1	Flooring	11.07	This TRADE CONTRACTOR to provide sufficient equipment, material, skilled	

			manpower, supervision, and/or premium time/shift work (all without additional compensation) as may be required to complete the work of this Trade Contractor in accordance with the overall project schedule.	
1	Flooring	11.08	This TRADE CONTRACTOR will replace and repair, at no additional cost, any construction damaged by this TRADE CONTRACTOR's field operations and/or personnel.	
1	Flooring	11.09	This TRADE CONTRACTOR shall furnish all labor, material, tools required to provide a full and complete installation of all Resilient Tile, Carpet and Linoleum flooring including but not necessarily limited to layout, samples, patterns, binder bar, base, floor preparation, rubber wall base (at casework toe spaces, sides, etc.), coordination with expansion joint/ control joint/ isolation joint work, floor tile selection based on manufacturer's full range, all required accessories, in accordance with manufacturer's recommendation, final cleaning, furnish/ delivery & staging of attic stock, etc.	
1	Flooring	11.10	This TRADE CONTRACTOR shall provide all protection and cleaning as listed in the specifications.	
1	Flooring	11.11	This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and install of all transitions as shown throughout the bid documents.	
1	Flooring	11.12	This TRADE CONTRACTOR shall be responsible to furnish and install CPT-1, CPT-2, LN-1, LN-2, LN-3, LVT-1, LVT-2, RST-R-1, RST-R-2, RST-S-1, RST-T-1, RST-T-2, RT-1, RT-2T, SDT-1 and TW-1 per sheets A8.1.1E, A8.2.1E, A8.3.1E, the room finish schedule on sheet A8.5.0E, the finish legend A8.6.0E and throughout the bid documents.	
1	Flooring	11.13	This TRADE CONTRACTOR shall protect existing wood floor system in gym along areas of new work, typical. This TRADE CONTRACTOR shall remove and salvage existing wood floor system as required to install new foundations and complete new scope of work. This TRADE CONTRACTOR shall reinstall wood floor system, patch and repair wood floor system to match existing as required per Floor Plan Note A8 on sheet A1.1.1E and throughout the bid documents. Per G1/A4.1.2E, this TRADE CONTRACTOR shall be responsible to furnish and install new wood wall base patch to matching existing.	
1	Flooring	11.14	- *ALLOWANCE - Flooring Treatment (Moisture Mitigation and Floor Prep) - $40,000*	

SCOPE OF WORK
For
BID PACKAGE 12

Painting

All bids for the Painting Bid Package 12 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:
099123……..Interior Painting

Bid Phase	Bid Package	Scope Item	Description	
1	Painting	12.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Group may be updated by future adjustments that will become part of said contractors' agreement. **NOTE: This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics and Phasing plan and Construction Schedule included within the project manual.**	
1	Painting	12.02	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	
1	Painting	12.03	This TRADE CONTRACTOR shall provide all necessary lifts/scaffolds to reach all areas scheduled for painting.	
1	Painting	12.04	This TRADE CONTRACTOR shall be responsible for all painting per the specification whether shown on the drawings or not. This TRADE CONTRACTOR shall be responsible to paint all items calling for paint on the bid documents.	
1	Painting	12.05	**ALLOWANCE:** This TRADE CONTRACTOR shall include 40 man hours in the base bid value for misc. touch up painting above and beyond the punchlist.	

SCOPE OF WORK

For

BID PACKAGE 13

Fire Protection

All bids for the Fire Protection Bid Package 13 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

079200……..Joint Sealants
Division 21……..Fire Suppression

Bid Phase	Bid Package	Scope Item	Description	
1	Fire Protection	13.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Group may be updated by future adjustments that will become part of said contractors' agreement. **NOTE: This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics and Phasing plan and Construction Schedule included within the project manual.**	
1	Fire Protection	13.02	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	
1	Fire Protection	13.03	This TRADE CONTRACTOR shall provide all necessary lifts/scaffolds to reach all areas required by this scope of work. This TRADE CONTRACTOR shall provide all manpower, tools, equipment, accessories, and hoisting required to complete its scope of work. Including any on site storage for this TRADE CONTRACTORS materials and equipment.	
1	Fire Protection	13.04	This TRADE CONTRACTOR shall furnish and install a complete fire protection system as outlined in the construction documents and specifications. This TRADE CONTACTOR is responsible for furnishing, all materials, skilled/licensed labor,	

			coordination, lay-out, and installation requirements of all work for a complete and properly functioning fire protection system including but not limited to control panels, hose valves, pumps, alarm devices, Siamese connections, hydrants, test hydrants, gauges, hangers, heads, fire hose cabinets, fire hose valve cabinets, guards, flow alarms, flow detectors, backflow preventers, tamper switches, pressure switches, alarm bells, controllers, gauges, sight glasses, valves, alarm panels, transfer switches, grout, all welding certifications, and other items of work as indicated on construction documents and/or as shown in the plans and specifications.	
1	Fire Protection	13.05	This TRADE CONTRACTR shall clean the streets on an ongoing basis of dirt and debris caused by this TRADE CONTRACTORS scope of work. Streets will be free of dirt and debris at **all** times. If this TRADE CONTRACTOR is unwilling to or unable to meet this requirement the CONSTRUCTION MANAGER will hire street sweeping and or labor to complete this scope of work even if the same day as the dirt and debris is generated and all costs will be backcharged to this TRADE CONTRACTOR. This TRADE CONTRACTOR shall provide necessary signage and flaggers associated with this TRADE CONTRACTORS scope of work while working within the right-of-way.	
1	Fire Protection	13.06	This TRADE CONTRACTOR shall be responsible for coordinating with proper authorities and providing all testing as required in obtaining approval or acceptance of the CONSTRUCTION MANAGER, owner, inspection authorities and other agencies required. All tests must be conducted in the presence of the CONSTRUCTION MANAGER and/or other inspection authorities having jurisdiction.	
1	Fire Protection	13.07	This TRADE CONTRACTOR shall be responsible for all permits, fees, and tests associated with its scope of work. Including but not limited to trucking, street closure permits, parking permits, fire alarm, hydrostatic, hydraulic, flushes, pump start-up, and others not specified but required to provide a complete system. This TRADE CONTRACTOR shall be responsible for calling and coordination of all inspections need or required to complete its scope of work.	
1	Fire Protection	13.08	This TRADE CONTRACTOR shall prepare all submittals, calculations, design drawings, pipe hanger calculations, and shop drawings as specified in the documents and specifications including coordination drawings with the other MEP contractors. All design documents must be stamped by licensed professional engineer in the state of Illinois. All submittals, calculations, and designed shop drawings to be submitted and approved by Cary Fire Prevention.	
1	Fire Protection	13.09	This TRADE CONTRACTOR shall provide all sleeves and coring of walls, floors, etc., including caulking, patching of walls and floors, packing and safing of sleeves and openings as indicated on construction documents and/or specified. This TRADE CONTRACTOR shall protect all floor openings left in floors for passage of piping and other items. If this TRADE CONTRACTOR supplies sleeves for the mason to install then this TRADE CONTRACTOR shall provide drawings including locations and elevations for the sleeves to be installed.	
1	Fire Protection	13.10	This TRADE CONTRACTOR shall be responsible for fire stopping all thru wall penetrations in rated walls as indicated on construction documents and/or as specified in the project manual.	
1	Fire Protection	13.11	This TRADE CONTRACTOR shall be responsible for sprinkler piping, including loop, laterals, branch piping and sprinkler heads as indicated on construction documents and/or as specified.	
1	Fire Protection	13.12	This TRADE CONTRACTOR shall coordinate all piping to avoid conflicts with areas required for other trade contractor's work (i.e., light fixtures, ductwork, etc…).	
1	Fire Protection	13.13	This TRADE CONTRACTOR shall complete all pre-construction due-diligence required for the work of this trade contractor including but not limited to verification of adequacy and location of blocking/backing for attachments, installation,	

			resolve/coordinate any conflicts with other work, and ensure proper clearances.	
1	Fire Protection	13.14	This TRADE CONTRACTOR shall be responsible for the furnish and install of any housekeeping pads required for its equipment not shown on the drawings.	
1	Fire Protection	13.15	This TRADE CONTRACTOR shall review and construct according to ALL of the construction documents pertaining to this scope of work and all other items/systems (**IE: Electrical, Mechanical, Plumbing, Carpentry, Concrete, etc.)** to be coordinated with this scope of work. **NOTE: The HVAC CONTRACTOR shall lead in the coordination effort of all of these trades. This shall include obtaining the AutoCAD files from the plumbing, fire protection, and electrical contractor and plotting all systems in color on one drawing to verify coordination, which is required by all MEP/FP contractors alike. This TRADE CONTRACTOR shall provide coordination, shop, and as-built drawings in AutoCAD and as PDFs.**	
1	Fire Protection	13.16	This TRADE CONTRACTOR shall coordinate installation with all adjoining work and system's materials and tolerances pertaining to existing conditions and new construction as shown in the plans and specifications. **NOTE: Any tolerances or limitations more stringent than those pertaining to this TRADE CONTRACTOR's work shall prevail.**	
1	Fire Protection	13.17	This TRADE CONTRACTOR shall be responsible for protecting any and all Fire Protection materials and equipment on-site and as specified: prior to installation, during installation and/or until final acceptance by Construction Manager.	
1	Fire Protection	13.18	This TRADE CONTRACTOR shall perform daily clean-up operations and shall comply with all Pepper and OSHA safety requirements especially including but not limited to PPE and fall protection.	
1	Fire Protection	13.19	This TRADE CONTRACTOR shall be responsible for contacting jurisdictional inspection agencies (ie. local code enforcement, testing agency's) associated with the work of this Trade Contractor to: A) Schedule any and all required inspections so as not to delay project schedule, B) Complete all work required for acceptance of this Trade Contractors work by the jurisdictional inspecting agency (at no additional cost, including incidentals) and C) Submit all inspecting agency ruling related documentation/correspondence to Construction Manager before close of business the day of occurrence.	
1	Fire Protection	13.20	This TRADE CONTRACTOR shall provide all closeout documents, including but not limited to as-built drawings, extra material, attic stock, training, demonstration, reporting, test reports, service agreements, start up with manufacturer reps, warranties including any special warranties outlined in the specifications.	
1	Fire Protection	13.21	This TRADE CONTRACTOR to provide sufficient equipment, material, skilled manpower, supervision and/or premium time/shift work (all without additional compensation) as may be required to complete the work of this Trade Contractor in accordance with the overall project schedule.	
1	Fire Protection	13.24	The work of this trade contractor is limited to the interior portion of building and connections to the water services at a point 5' from the building shall be by the PLUMBING CONTRACTOR.	
1	Fire Protection	13.25	Any work needing to take place in the existing school must be done after school or on a weekend. This TRADE CONTRACTOR shall be responsible for all work associated with removing ceiling tile and grid and reinstalling to access any work above ceiling in the existing school where ceilings are not scheduled to be demolished. Any damage done to these ceilings will be replaced at the cost of this TRADE CONTRACTOR.	

SCOPE OF WORK

For

BID PACKAGE 14

Plumbing

All bids for the Plumbing Bid Package 14 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

079200……..Joint Sealants
All Division 22 Specifications

Bid Group	Bid Package	Scope Item	Description	
1	Plumbing	14.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Group may be updated by future adjustments that will become part of said contractors' agreement. **NOTE: This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics plan and Construction Schedule included within the project manual.**	
1	Plumbing	14.02	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	

1	Plumbing	14.03	This TRADE CONTRACTOR shall provide all necessary lifts/scaffolds to reach all areas required by this scope of work. This TRADE CONTRACTOR shall provide all manpower, tools, equipment, accessories, and hoisting required to complete its scope of work. Including any on site storage for this TRADE CONTRACTORS materials and equipment.	
1	Plumbing	14.04	This TRADE CONTRACTOR shall responsible to install valves and other accessible devices in locations that are ACCESSIBLE. This TRADE CONTRACTOR shall be responsible to furnish and install access panels as necessary.	
1	Plumbing	14.05	This TRADE CONTRACTOR shall be responsible for layout of all plumbing fixtures.	
1	Plumbing	14.06	This TRADE CONTRACTOR shall be responsible for all pipe identification and valve tagging as required and indicated on drawings. Final valve tag list and as-built documentation will reflect the final room numbers as designated by the Owner.	
1	Plumbing	14.07	This TRADE CONTRACTOR is responsible for firestopping at all penetrations.	
1	Plumbing	14.08	This TRADE CONTRACTOR shall be responsible for all sleeves and coring of walls, floors, roofs, etc. including caulking, packing, grouting, sealing and/or firesafing of sleeves, openings and other items as required. This Trade Contractor shall provide safety protection at all openings left in floors for passage of piping and other items. Any additional cutting or patching necessitated by this Trade Contractor's failure to properly locate and coordinate sleeves and coring shall be completed at the expense of this Trade Contractor.	
1	Plumbing	14.09	This TRADE CONTRACTOR is responsible for shop drawings, layout, and field layout of piping concrete contractor. Plumbing Trade Contractor shall also provide dedicated shop drawings for shear wall openings, masonry openings, slab openings and penetrations. This drawing shall indicate the size of openings and shall locate the openings with respect to column lines. This TRADE CONTRACTOR shall be responsible for furnishing, lay-out, and installation of all plumbing fixtures including water closets, lavatories, sinks, urinals, water coolers, mop sink basins, and other plumbing fixtures and appurtenances, including trim, faucets, drains, etc. unless otherwise noted, as listed in the specifications and shown on the construction documents.	
1	Plumbing	14.10	This TRADE CONTRACTOR shall be responsible for all below grade, above grade rough and finish plumbing according to the drawings, specifications and contract documents including but not limited to all piping, hangers, valves, insulation, etc. with all work to be completed per applicable codes and standards.	
1	Plumbing	14.11	This TRADE CONTRACTOR shall be responsible for all clip hangers, angles, and miscellaneous metal of any nature, which is required for the work of this TRADE CONTRACTOR.	
1	Plumbing	14.12	This TRADE CONTRACTOR shall be responsible for ALL final adjustments of floor drains/clean-outs to accommodate the various types of floor finishes for a neat and tight finish.	
1	Plumbing	14.13	This TRADE CONTRACTOR shall include all insulation required for their work including all CW, HW, HWR and horizontal storm lines as indicated on construction documents and/or as specified in the project manual.	
1	Plumbing	14.14	This TRADE CONTRACTOR to provide sufficient equipment, material, skilled manpower, supervision and/or **premium time/shift work (all without additional compensation) as may be required to complete the work of this Trade Contractor in accordance with the overall project schedule.**	
1	Plumbing	14.15	This TRADE CONTRACTOR shall review and become familiar with ALL documents included in this bid group. This Trade Contractor shall furnish, install, complete and/or otherwise comply with all associated Plumbing work and requirements shown on the plans and specifications.	
1	Plumbing	14.16	This TRADE CONTRACTOR shall be responsible for taking appropriate measures to protect existing conditions including but not necessarily limited to all new and existing construction, utilities, perimeter landscaping, curbs, gutters, drives and walks, buildings, light poles, hydrants, etc. from damage that may be caused by this work.	
1	Plumbing	14.17	This TRADE CONTRACTOR shall construct in accordance with ALL of the construction documents pertaining to this scope of work and all other items/systems (IE: Controls, HVAC, Electrical, FP, roofing, carpentry, etc.) to be coordinated with this TRADE CONTRACTOR's scope of work.	
1	Plumbing	14.18	All systems will be chlorinated and disinfected in accordance with the Illinois Safe Drinking Water Standards. This TRADE CONTRACTOR shall be responsible for all coordination with the Illinois State Plumbing Inspector and **MUST** ensure that all inspections are scheduled in advance in order to keep all construction schedules accurate and on time. It should be assumed that all inspections will take 2 weeks to schedule with the State Plumbing Inspector, plan accordingly.	

			This TRADE CONTRACTOR shall be responsible for all work associated with checking the temperature at **ALL** sinks, showers, etc throughout the entire school prior to the state plumbing inspectors inspections. Any repairs prior to inspection will be addressed via allowances.	
1	Plumbing	14.19	All piping shall have pipe markers showing the type of service in them. All valves shall be tagged with a directory mounted in boiler room under glass and one copy furnished to the Owner.	
1	Plumbing	14.20	This TRADE CONTRACTOR shall be responsible for all work associated with the removal of ceiling tiles and grid as needed in areas that require access to complete this scope of work when ceilings are not scheduled to be removed per the bid documents. All costs associated to repair/replace ceiling tiles or grid damaged by this TRADE CONTRACTOR shall be replaced at this TRADE CONTRACTOR'S expense. Ceiling shown to be removed/replaced on the bid documents is by OTHER.	

SCOPE OF WORK

For

BID PACKAGE 15

HVAC

All bids for the HVAC Bid Package 15 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

079200……..Joint Sealants

All Division 23 Specifications

Bid Group	Bid Package	Scope Item	Description	
1	HVAC	15.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Group may be updated by future adjustments that will become part of said contractors' agreement. **NOTE: This TRADE CONTRACTOR shall perform all work in accordance with the Site**	

			Logistics plan and Construction Schedule included within the project manual.	
1	HVAC	15.02	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	
1	HVAC	15.03	This TRADE CONTRACTOR shall provide all necessary lifts/scaffolds to reach all areas required by this scope of work. This TRADE CONTRACTOR shall provide all manpower, tools, equipment, accessories, and hoisting required to complete its scope of work. Including any on site storage for this TRADE CONTRACTORS materials and equipment.	
1	HVAC	15.04	This TRADE CONTRACTOR shall be responsible for the selective demo, coring, etc. of all openings required to accommodate HVAC penetrations/openings (i.e. dampers, transfer ducts, pipe penetrations, etc...) in floors and walls that are not explicitly shown on the Architectural sheets. This TRADE CONTRACTOR shall provide caulking, packing, grouting and sealing of sleeves, openings, and other items pertaining to this TRADE CONTRACTOR's work. This Trade Contractor shall protect and make safe all openings created by this trade contractor for passage of piping and other items. This TRADE CONTRACTOR shall be responsible for all work in all details on sheet G3.00.	
1	HVAC	15.05	This TRADE CONTRACTOR shall be responsible for sealants/caulk for the following: joints between sheet metal and masonry/precast, sheet metal casings, filter frames and all other locations where required to eliminate leakage and/or noise. Block off around all coils and filters to prevent air leakage with galvanized metal with required bracing for stiffeners and prevention of vibration according to the drawings, specifications and contract documents. This TRADE CONTRACTOR shall be responsible for all required firestopping.	
1	HVAC	15.06	This TRADE CONTRACTOR shall furnish and install all gas service piping including valves as required by code from meter shut off valves to all equipment requiring gas connections and shut off valves (iif applicable). This TRADE CONTRACTOR shall also be responsible for furnishing and installing any and all pressure regulators with vents to the atmosphere as required whether shown and specified on the drawings or not.	
1	HVAC	15.07	This TRADE CONTRACTOR shall be responsible for the installation of smoke detectors in duct work and any connections/interface with HVAC systems, smoke duct detectors supplied by ELECTRICAL CONTRACTOR. This TRADE CONTRACTOR shall coordinate the locations with ELECTRICAL CONTRACTOR. This TRADE CONTRACTOR shall be responsible for hardwiring fan shut down from duct smoke detectors.	
1	HVAC	15.08	This TRADE CONTRACTOR shall be responsible for furnishing and installing instrumentation and control items in duct work and piping for temperature control. This Trade Contractor shall coordinate the locations with Construction Manager.	
1	HVAC	15.09	This TRADE CONTRACTOR shall furnish and install all curbs and associated materials (ie. vibration isolators) required for all roof top equipment according to the drawings, specifications and contract documents.	
1	HVAC	15.10	This TRADE CONTRACTOR shall furnish and install any and all louvers and fire dampers including connection angles and miscellaneous attachments for the tie-ins according to the drawings, specifications and contract documents.	
1	HVAC	15.11	This TRADE CONTRACTOR shall furnish and install all ventilation, heating, and cooling equipment and assemblies including but not limited to all Return fans, Wall Mounted Radiators, Exhaust Fans, VAV boxes, Energy Recovery Units, Duct Free Split systems, pumps, unit heaters, radiant ceiling panels, fan powered boxes, unit ventilator maintenance/cleaning, combination dampers, all gas piping assemblies, Glycol Fill Systems, Flue piping, Expansion tanks, Hot water pumps, Chilled Water Pumps, VFD's, intakes, Hydronic Accessories, roof guard pads, Refrigerant reclaim and replaced per spec (i.e 25% propylene glycol, etc.), pipe roller assemblies and saddles, kitchen hood/exhauster assemblies (if applicable), etc., as necessary for a complete HVAC system according to the drawings, specifications and contract documents.	
1	HVAC	15.12	This TRADE CONTRACTOR shall be responsible for protecting any and all HVAC related materials and equipment on-site and as specified: prior to installation, during installation and/or until final acceptance by Construction Manager. This TRADE CONTRACTOR shall provide temporary protection of all HVAC equipment, ductwork, and piping during construction according to the specifications. This shall include but is not limited to sealing all open ends of ductwork at all times to prevent dirt and dust from entering this ductwork. This shall apply to ductwork being stored on site prior to installation as well as the ductwork after it is installed. Open ends of fan powered boxes where the filter is shall also be protected. Failure to adequately protect ductwork will result in the trade contractor being back-charged for any duct cleaning that will be	

			required. Where equipment needs to be installed prior to the building being "watertight" this trade contractor shall provide, install, and maintain protection for this equipment (i.e. temp-ins at roof curbs).	
1	HVAC	15.13	This TRADE CONTRACTOR shall be responsible to keep the building water tight after existing equipment on the roof is removed and/or after new equipment is set until the roofing contractor is back onsite to roof/flash around equipment and voids. Any water damage below due to areas not being water type shall be this TRADE CONTRACTORS responsibility to repair.	
1	HVAC	15.14	This TRADE CONTRACTOR shall be responsible for all starters not shown as provided and installed by the electrical trade contractor. This Trade Contractor shall be responsible for providing combination starter/disconnect for all three phase equipment that does not run continuously according to the drawings, specifications and contract documents.	
1	HVAC	15.15	This TRADE CONTRACTOR to provide sufficient equipment, material, skilled manpower, supervision and/or **premium time/shift work (all without additional compensation) as may be required to complete the work of this Trade Contractor in accordance with the overall project schedule.**	
1	HVAC	15.16	This TRADE CONTRACTOR shall review and become familiar with ALL documents included in this bid group. This Trade Contractor shall furnish, install, complete and/or otherwise comply with all associated HVAC work and requirements shown on the plans and specifications.	
1	HVAC	15.17	This TRADE CONTRACTOR shall be responsible for and compliant with all specified requirements including but not limited to all: Performance Requirements, Submittals, QA, Testing, Training, QC, coordination, and Extra Materials specified and pertaining to this trade contractor's work as noted in the plans and specifications. This TRADE CONTRACTOR shall furnish all operating and maintenance manuals to CONSTRUCTION MANAGER (2) weeks prior to the scheduled substantial completion date. **NOTE: This TRADE CONTRACTOR's Guarantee/warranty period of equipment and HVAC system will not start until after substantial completion acceptance, including any and all equipment utilized before final acceptance.**	
1	HVAC	15.18	This TRADE CONTRACTOR shall be responsible for contacting jurisdictional inspection agencies (i.e. local code enforcement, testing agency's) associated with the work of this Trade Contractor to: A) Schedule any and all required inspections so as not to delay project schedule, B) Complete all work required for acceptance of this Trade Contractors work by the jurisdictional inspecting agency (at no additional cost, including incidentals) and C) Submit all inspecting agency ruling related documentation/correspondence to Construction Manager before close of business the day of occurrence. **NOTE: This TRADE CONTRACTOR shall provide required out-of-sequence and/or additional testing and balancing of HVAC systems to permit expedited completion of partitions, ceilings and other work, including furnishing and installing additional valves as required to complete the balancing and testing of work according to the drawings, specifications and contract documents. This TRADE CONTRACTOR will be responsible for furnishing, installing and maintaining MERV13 filtration on the return air inlet of the fan powered boxes and locking the VAV dampers closed in these units for the purposes of temporary heat. Filters shall be changed regularly as required by this TRADE CONTRACTOR and a new set of filters shall be installed at substantial completion not included in what is required to be provided as attic stock.**	
1	HVAC	15.19	This TRADE CONTRACTOR shall be responsible to provide its own project layout according to the drawings, considering the benchmark locations and elevations that will be given by the Construction Manager.	
1	HVAC	15.20	This TRADE CONTRACTOR shall perform daily cleanup operations and shall comply with all Pepper and OSHA safety requirements especially including but not limited to crane safety, PPE, and fall protection.	
1	HVAC	15.21	This TRADE CONTRACTOR shall be responsible for all work associated with cutting/coring all openings in new or existing walls and floors.	
1	HVAC	15.23	This TRADE CONTRACTOR shall be responsible for all work associated with the removal of ceiling tiles and grid as needed in areas that require access to complete this scope of work when ceilings are not scheduled to be removed per the bid documents. All costs associated to repair/replace ceiling tiles or grid damaged by this	

			TRADE CONTRACTOR shall be replaced at this TRADE CONTRACTOR'S expense. Ceiling shown to be removed/replaced on the bid documents is by OTHER.	
1	HVAC	15.24	All Conduit for temperature controls or BAS shown throughout the bid documents is by the ELECTRICAL Contractor. Any conduit required, but not shown on the bid documents is by this TRADE CONTRACTOR.	

SCOPE OF WORK

For

BID PACKAGE 16

Electrical and Low Voltage

All bids for the Electrical and Low Voltage and Low Voltage Bid Package 16 must be inclusive of, but not necessarily limited to, all requirements outlined in the All Scope of Work as well as the trade specific requirements outlined below:

Specifications

The following listed Specification Sections as well as any other related Documents or Specification Sections are included:

079200……..Joint Sealants

All Division 26 Specifications
All Division 27 Specifications
All Division 28 Specifications

Bid Group	Bid Package	Scope Item	Description	
1	Electrical	16.01	This TRADE CONTRACTOR shall perform under guidelines of phasing and scheduling. The schedule contained in this Bid Group may be updated by future adjustments that will become part of said contractors' agreement. **NOTE: This TRADE CONTRACTOR shall perform all work in accordance with the Site Logistics plan and Construction Schedule included within the project manual.**	
1	Electrical	16.02	All mobilizations and demobilizations related costs of this TRADE CONTRACTOR are to be included without consideration of additional compensation.	
1	Electrical	16.03	This TRADE CONTRACTOR shall provide all necessary lifts/scaffolds to reach all areas required by this scope of work. This TRADE CONTRACTOR shall provide all manpower, tools, equipment, accessories, and hoisting required to complete its scope of work. Including any on site storage for this TRADE CONTRACTORS materials and equipment.	
1	Electrical	16.04	This TRADE CONTRACTOR shall be responsible for all required firestopping.	
1	Electrical	16.05	This TRADE CONTRACTOR to provide sufficient equipment, material, skilled manpower, supervision and/or **premium time/shift work (all without additional compensation) as may be required to complete the work of this Trade Contractor in accordance with the overall project schedule.**	
1	Electrical	16.06	This TRADE CONTRACTOR shall review and become familiar with ALL documents included in this bid group. This Trade Contractor shall furnish, install, complete and/or otherwise comply with all associated Electrical work and requirements shown on the plans and specifications.	
1	Electrical	16.07	This TRADE CONTRACTOR shall be responsible to provide its own project layout according to the drawings.	
1	Electrical	16.08	This TRADE CONTRACTOR shall perform daily cleanup operations and shall comply with all Pepper and OSHA safety requirements especially including but not limited to crane safety, PPE, and fall protection.	
1	Electrical	16.09	This TRADE CONTRACTOR shall be responsible for furnishing and installing all materials, skilled and/or licensed labor, coordination, equipment, tools, etc. to complete all aspects of this trade contractor's work for the complete electrical package including but not limited to power, manufactured wiring assemblies, grounding and bonding, raceways and boxes, identification, occupancy sensors, utility services, switchboards, panelboards, wiring devices, fuses, enclosed switches, enclosed controllers, generators, temporary power, surge protective devices, interior lighting, exterior lighting, site lighting, emergency lighting, exit lighting, temporary lighting, transformer(s), disconnects, miscellaneous equipment/motor wiring, fire alarm systems, pull stations, audio/visual signals, joint sealants, fire resistive joint systems, and other specified requirements for a complete, conforming and operable system as shown/stated in the plans and specifications and delivered per the project schedule	
1	Electrical	18.10	This TRADE CONTRACTOR shall be responsible for furnishing, layout, and installation of all electrical components including but not limited to: conduit, boxes, wiring, light fixtures, lamps, exit signs, panels, transformer(s), switchgear, transfer switches, dimming equipment, outlets, switches, plates, VFD's (install), etc., and any other electrical/lighting components as required within the specifications and as indicated on drawings. This TRADE CONTRACTOR shall be responsible for all conduit rough in for access control, security, voice/data, temp. controls/BAS and fire alarm low voltage equipment and devices including conduit, pull string and junction boxes as required within the specifications and as indicated on drawings and specifications. All fire alarm conduit shall be red. Any conduit required for Temp. controls/BAS, but not shown on the bid documents in by the HVAC CONTRACTOR.	
1	Electrical	16.11	This TRADE CONTRACTOR shall be responsible for providing all items for support of contractor's work, including all clip hangers, angles, and miscellaneous metal of any nature as required within the specifications and indicated on drawings. This TRADE CONTRACTOR shall be responsible for all work associated with the furnish and install of all required pipe roller supports as required on	

			the roof for all electrical work.	
1	Electrical	16.12	This TRADE CONTRACTOR shall be responsible for all electrical requirements for electric door strikes, magnetic hold-opens, ADA push buttons, locks and other hardware as indicated on the architectural door schedule whether shown on the Electrical plans or not. Hardware and power supplies is by OTHER.	
1	Electrical	16.13	This TRADE CONTRACTOR shall be responsible for coordination with other trade contractors to obtain wiring diagrams and power requirements for equipment furnished by OTHER, prior to wiring same in the field.	
1	Electrical	16.14	This TRADE CONTRACTOR shall be responsible for all directory label charts, along with identification and tagging requirements of work as required within the specifications and as indicated on the drawings, per Construction Manager's direction (verify numbering and tagging sequence with Construction Manager). This TRADE CONTRACTOR shall provide a directory in every panel. **NOTE: This TRADE CONTRACTOR shall verify the room numbers shown on the bid documents are FINAL ROOM NUMBERS before finalizing panel schedules. All final panel schedules shall be based on these final room numbers and not necessarily the room numbers on the A sheets.**	
1	Electrical	16.15	This TRADE CONTRACTOR shall be responsible for costs associated with Fire Department's/B&F Technical's review of fire alarm drawings.	
1	Electrical	16.16	This TRADE CONTRACTOR shall be responsible for all work associated with the removal of ceiling tiles and grid as needed in areas that require access to complete this scope of work when ceilings are not scheduled to be removed per the bid documents. All costs associated to repair/replace ceiling tiles or grid damaged by this TRADE CONTRACTOR shall be replaced at this TRADE CONTRACTOR'S expense. Ceiling sshown to be removed/replaced on the bid documents is by OTHER.	
1	Electrical	16.17	Any required shut downs **MUST** be performed on second shift or weekends as previously coordinated with each school and approved in advance.	
1	Electrical	16.18	This TRADE CONTRACTOR shall be responsible for all work associated with hooking up power/electrical to Pepper's construction trailer shown on the site logistics plan.	
1	Electrical	16.19	This TRADE CONTRACTOR shall be responsible for all work associated with providing temp power and lighting	

End of Section 003200

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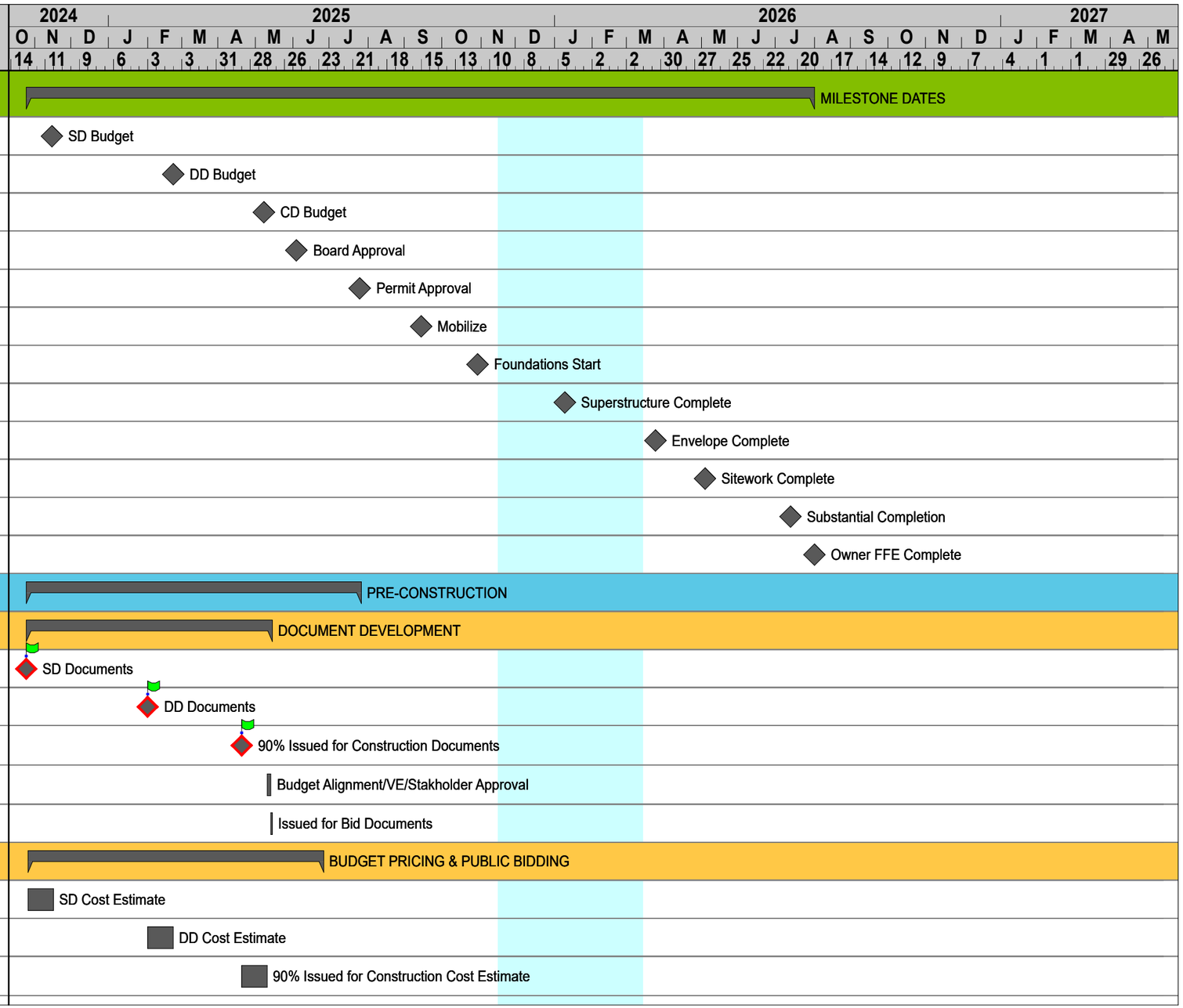
Line	Task Number	Activity Name	Duration	Start	Finish
1	**MIL10**	**MILESTONE DATES**	**461d**	**10/25/24**	**08/03/26**
2	MIL20	SD Budget		11/15/24	11/15/24
3	MIL30	DD Budget		02/24/25	02/24/25
4	MIL40	CD Budget		05/08/25	05/08/25
5	MIL50	Board Approval		06/04/25	06/04/25
6	MIL60	Permit Approval		07/25/25	07/25/25
7	MIL70	Mobilize		09/15/25	09/15/25
8	MIL80	Foundations Start		10/30/25	10/30/25
9	MIL90	Superstructure Complete		01/09/26	01/09/26
10	MIL100	Envelope Complete		03/25/26	03/25/26
11	MIL110	Sitework Complete		05/05/26	05/05/26
12	MIL120	Substantial Completion		07/14/26	07/14/26
13	MIL130	Owner FFE Complete		08/03/26	08/03/26
14	**PRE500**	**PRE-CONSTRUCTION**	**196d**	**10/25/24**	**07/25/25**
15	**PRE510**	**DOCUMENT DEVELOPMENT**	**144d**	**10/25/24**	**05/14/25**
16	PRE520	SD Documents		10/25/24 *	10/25/24
17	PRE530	DD Documents		02/03/25 *	02/03/25
18	PRE540	90% Issued for Construction Documents		04/21/25 *	04/21/25
19	PRE550	Budget Alignment/VE/Stakholder Approval	2d	05/12/25	05/13/25
20	PRE560	Issued for Bid Documents	1d	05/14/25	05/14/25
21	**PRE570**	**BUDGET PRICING & PUBLIC BIDDING**	**173d**	**10/28/24**	**06/26/25**
22	PRE580	SD Cost Estimate	15d	10/28/24	11/15/24
23	PRE590	DD Cost Estimate	15d	02/03/25	02/21/25
24	PRE600	90% Issued for Construction Cost Estimate	12d	04/21/25	05/12/25



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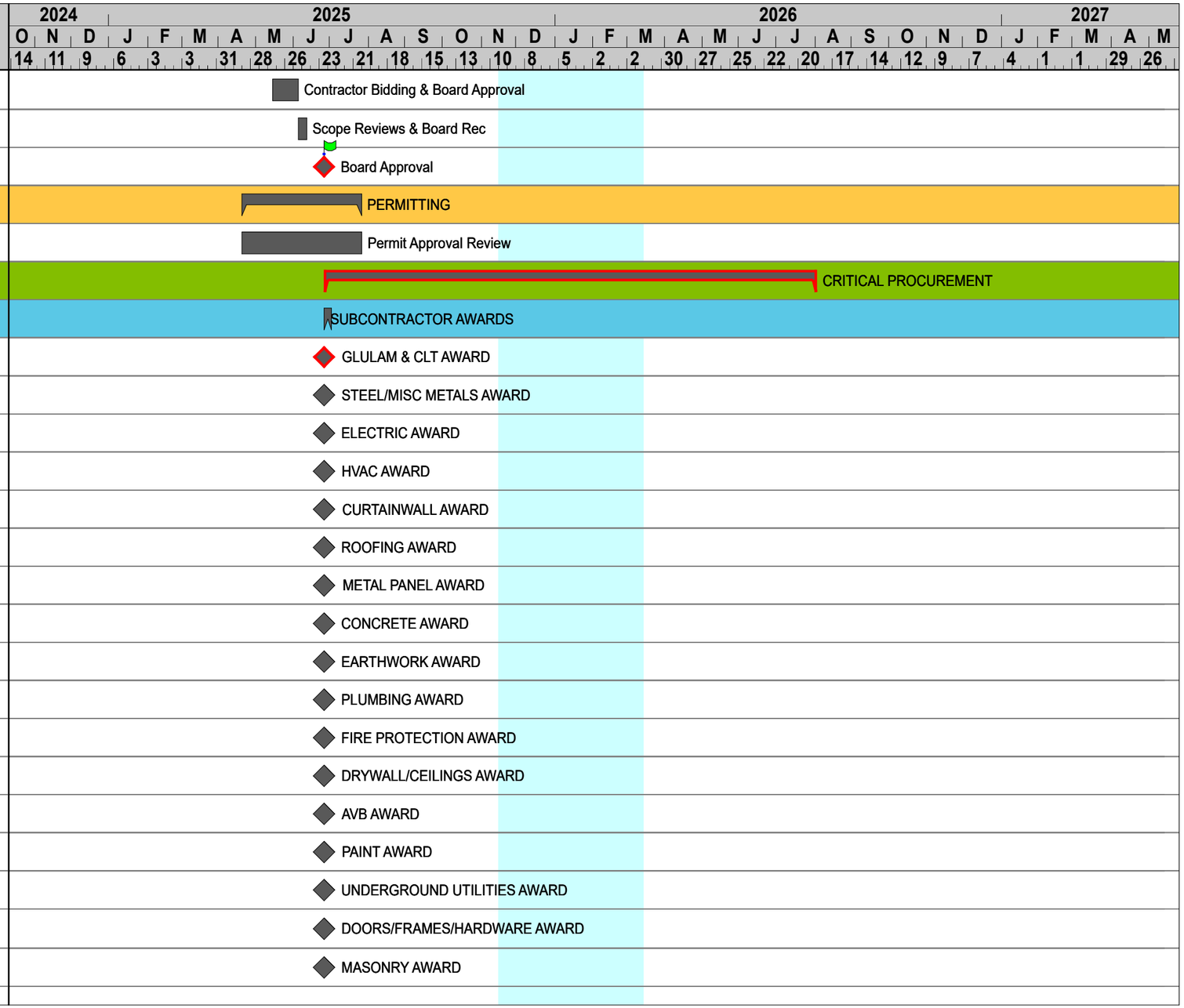
25	PRE610	Contractor Bidding & Board Approval	15d	05/15/25	06/04/25
26	PRE620	Scope Reviews & Board Rec	5d	06/05/25	06/11/25
27	PRE630	Board Approval		06/26/25 *	06/26/25
28	PRE640	PERMITTING	70d	04/21/25	07/25/25
29	PRE650	Permit Approval Review	70d	04/21/25	07/25/25
30	PRO1000	CRITICAL PROCUREMENT	288d	06/26/25	08/03/26
31	PRO1010	SUBCONTRACTOR AWARDS		06/26/25	06/26/25
32	PRO1020	GLULAM & CLT AWARD		06/26/25	06/26/25
33	PRO1030	STEEL/MISC METALS AWARD		06/26/25	06/26/25
34	PRO1040	ELECTRIC AWARD		06/26/25	06/26/25
35	PRO1050	HVAC AWARD		06/26/25	06/26/25
36	PRO1060	CURTAINWALL AWARD		06/26/25	06/26/25
37	PRO1070	ROOFING AWARD		06/26/25	06/26/25
38	PRO1080	METAL PANEL AWARD		06/26/25	06/26/25
39	PRO1090	CONCRETE AWARD		06/26/25	06/26/25
40	PRO1100	EARTHWORK AWARD		06/26/25	06/26/25
41	PRO1110	PLUMBING AWARD		06/26/25	06/26/25
42	PRO1120	FIRE PROTECTION AWARD		06/26/25	06/26/25
43	PRO1130	DRYWALL/CEILINGS AWARD		06/26/25	06/26/25
44	PRO1140	AVB AWARD		06/26/25	06/26/25
45	PRO1150	PAINT AWARD		06/26/25	06/26/25
46	PRO1160	UNDERGROUND UTILITIES AWARD		06/26/25	06/26/25
47	PRO1170	DOORS/FRAMES/HARDWARE AWARD		06/26/25	06/26/25
48	PRO1180	MASONRY AWARD		06/26/25	06/26/25



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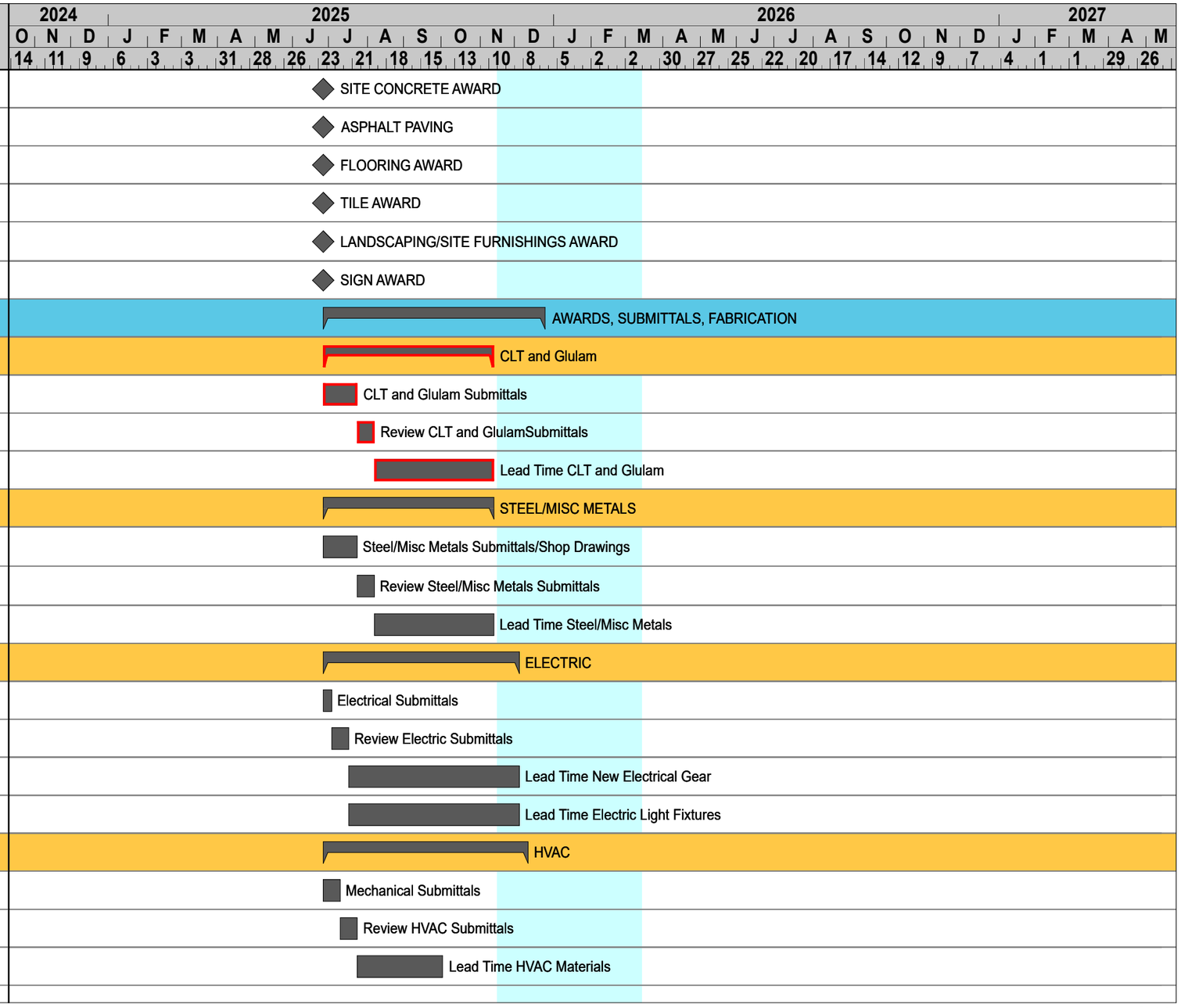
Line	Task Number	Activity Name	Duration	Start	Finish
49	PRO1190	SITE CONCRETE AWARD		06/26/25	06/26/25
50	PRO1200	ASPHALT PAVING		06/26/25	06/26/25
51	PRO1210	FLOORING AWARD		06/26/25	06/26/25
52	PRO1220	TILE AWARD		06/26/25	06/26/25
53	PRO1230	LANDSCAPING/SITE FURNISHINGS AWARD		06/26/25	06/26/25
54	PRO1240	SIGN AWARD		06/26/25	06/26/25
55	**PRO1250**	**AWARDS, SUBMITTALS, FABRICATION**	**130d**	**06/26/25**	**12/24/25**
56	**PRO1260**	**CLT and Glulam**	**100d**	**06/26/25**	**11/12/25**
57	PRO1270	CLT and Glulam Submittals	20d	06/26/25	07/23/25
58	PRO1280	Review CLT and GlulamSubmittals	10d	07/24/25	08/06/25
59	PRO1290	Lead Time CLT and Glulam	70d	08/07/25	11/12/25
60	**PRO1300**	**STEEL/MISC METALS**	**100d**	**06/26/25**	**11/12/25**
61	PRO1310	Steel/Misc Metals Submittals/Shop Drawings	20d	06/26/25	07/23/25
62	PRO1320	Review Steel/Misc Metals Submittals	10d	07/24/25	08/06/25
63	PRO1330	Lead Time Steel/Misc Metals	70d	08/07/25	11/12/25
64	**PRO1340**	**ELECTRIC**	**115d**	**06/26/25**	**12/03/25**
65	PRO1350	Electrical Submittals	5d	06/26/25	07/02/25
66	PRO1360	Review Electric Submittals	10d	07/03/25	07/16/25
67	PRO1370	Lead Time New Electrical Gear	100d	07/17/25	12/03/25
68	PRO1380	Lead Time Electric Light Fixtures	100d	07/17/25	12/03/25
69	**PRO1390**	**HVAC**	**120d**	**06/26/25**	**12/10/25**
70	PRO1400	Mechanical Submittals	10d	06/26/25	07/09/25
71	PRO1410	Review HVAC Submittals	10d	07/10/25	07/23/25
72	PRO1420	Lead Time HVAC Materials	50d	07/24/25	10/01/25



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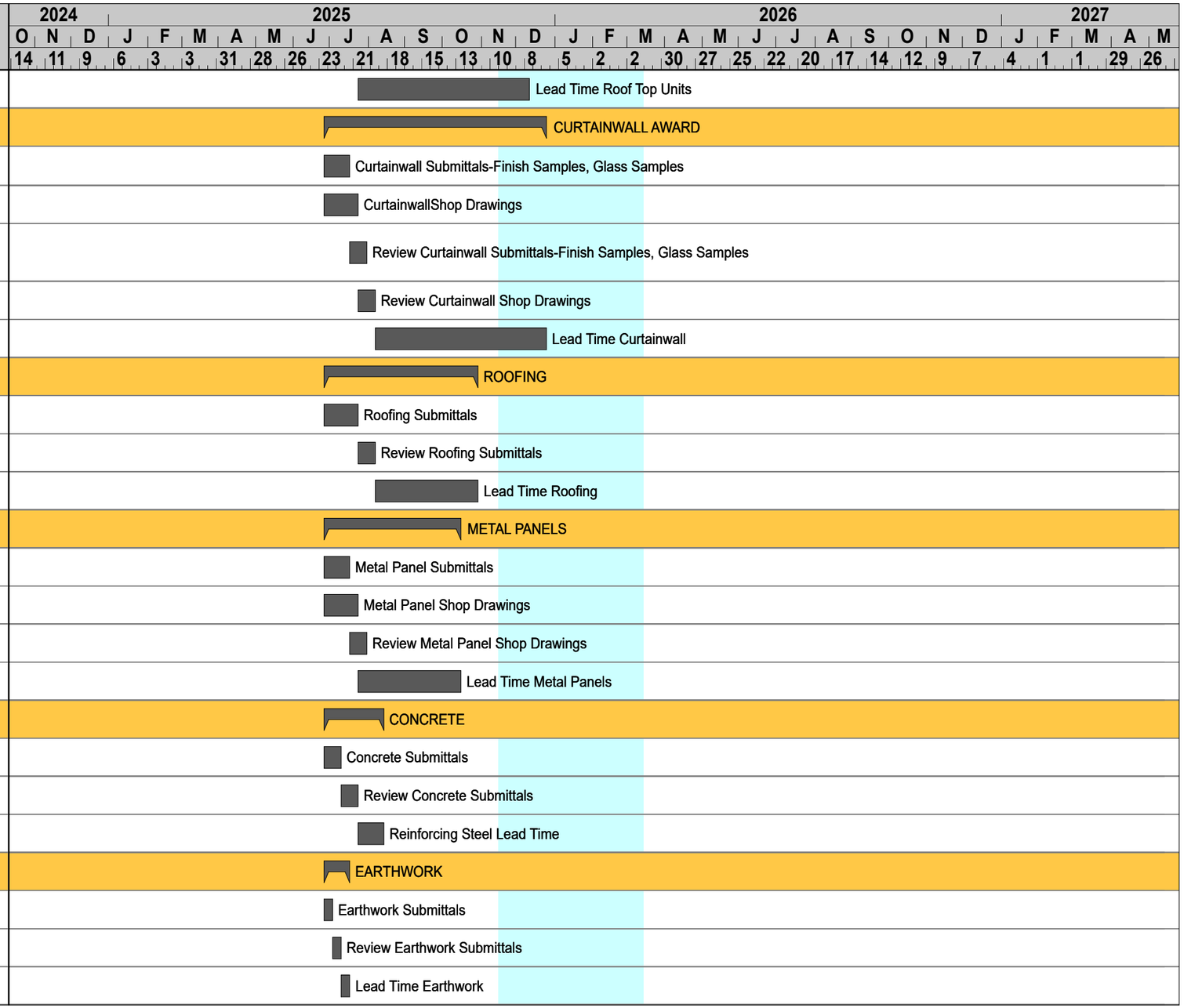
Line	Task Number	Activity Name	Duration	Start	Finish
73	PRO1430	Lead Time Roof Top Units	100d	07/24/25	12/10/25
74	**PRO1440**	**CURTAINWALL AWARD**	**130d**	**06/26/25**	**12/24/25**
75	PRO1450	Curtainwall Submittals-Finish Samples, Glass Samples	15d	06/26/25	07/16/25
76	PRO1460	CurtainwallShop Drawings	20d	06/26/25	07/23/25
77	PRO1470	Review Curtainwall Submittals-Finish Samples, Glass Samples	10d	07/17/25	07/30/25
78	PRO1480	Review Curtainwall Shop Drawings	10d	07/24/25	08/06/25
79	PRO1490	Lead Time Curtainwall	100d	08/07/25	12/24/25
80	**PRO1500**	**ROOFING**	**90d**	**06/26/25**	**10/29/25**
81	PRO1510	Roofing Submittals	20d	06/26/25	07/23/25
82	PRO1520	Review Roofing Submittals	10d	07/24/25	08/06/25
83	PRO1530	Lead Time Roofing	60d	08/07/25	10/29/25
84	**PRO1540**	**METAL PANELS**	**80d**	**06/26/25**	**10/15/25**
85	PRO1550	Metal Panel Submittals	15d	06/26/25	07/16/25
86	PRO1560	Metal Panel Shop Drawings	20d	06/26/25	07/23/25
87	PRO1570	Review Metal Panel Shop Drawings	10d	07/17/25	07/30/25
88	PRO1580	Lead Time Metal Panels	60d	07/24/25	10/15/25
89	**PRO1590**	**CONCRETE**	**35d**	**06/26/25**	**08/13/25**
90	PRO1600	Concrete Submittals	10d	06/26/25	07/09/25
91	PRO1610	Review Concrete Submittals	10d	07/10/25	07/23/25
92	PRO1620	Reinforcing Steel Lead Time	15d	07/24/25	08/13/25
93	**PRO1630**	**EARTHWORK**	**15d**	**06/26/25**	**07/16/25**
94	PRO1640	Earthwork Submittals	5d	06/26/25	07/02/25
95	PRO1650	Review Earthwork Submittals	5d	07/03/25	07/09/25
96	PRO1660	Lead Time Earthwork	5d	07/10/25	07/16/25



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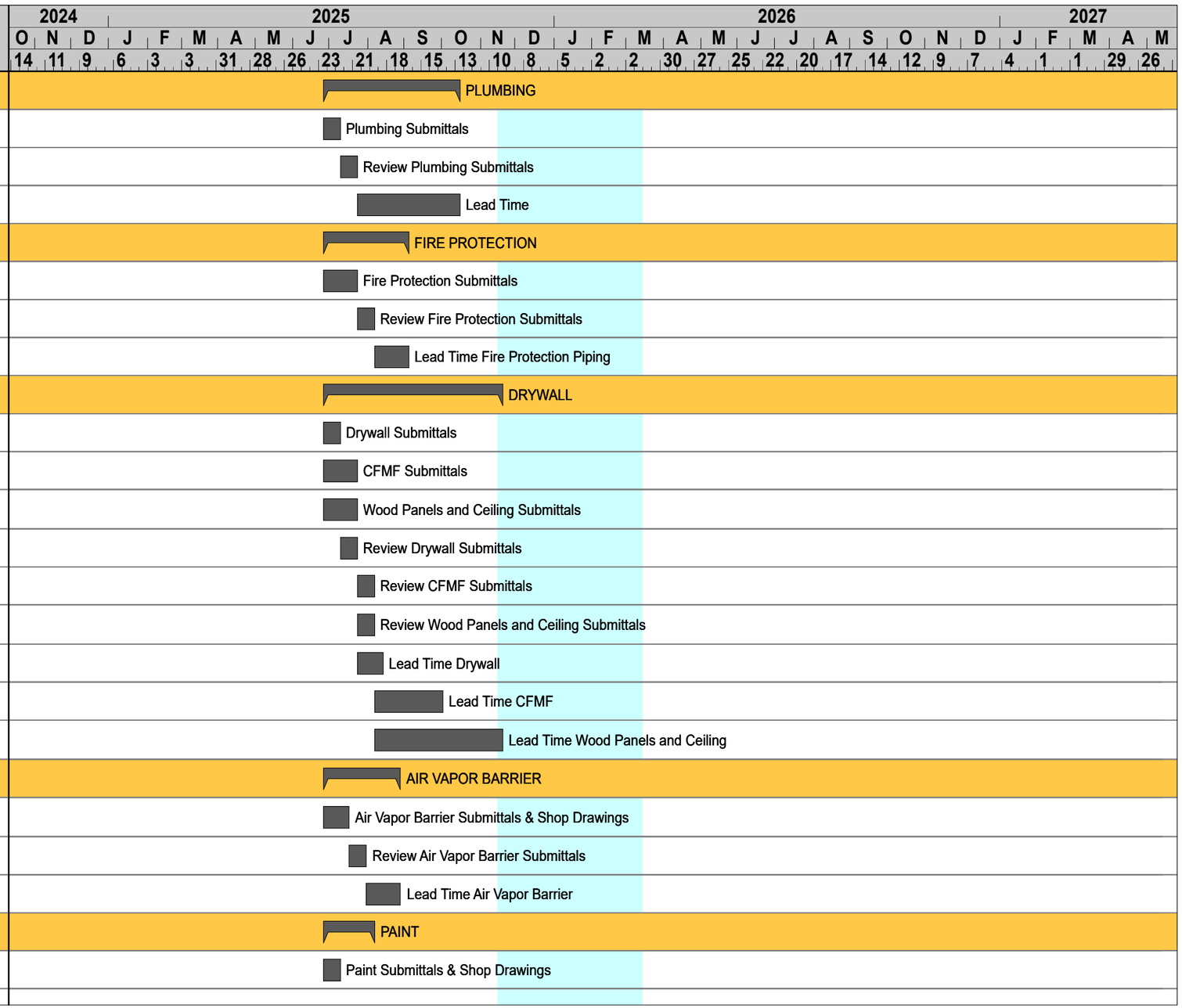
97	PRO1670	PLUMBING	80d	06/26/25	10/15/25
98	PRO1680	Plumbing Submittals	10d	06/26/25	07/09/25
99	PRO1690	Review Plumbing Submittals	10d	07/10/25	07/23/25
100	PRO1700	Lead Time	60d	07/24/25	10/15/25
101	PRO1710	FIRE PROTECTION	50d	06/26/25	09/03/25
102	PRO1720	Fire Protection Submittals	20d	06/26/25	07/23/25
103	PRO1730	Review Fire Protection Submittals	10d	07/24/25	08/06/25
104	PRO1740	Lead Time Fire Protection Piping	20d	08/07/25	09/03/25
105	PRO1750	DRYWALL	105d	06/26/25	11/19/25
106	PRO1760	Drywall Submittals	10d	06/26/25	07/09/25
107	PRO1770	CFMF Submittals	20d	06/26/25	07/23/25
108	PRO1780	Wood Panels and Ceiling Submittals	20d	06/26/25	07/23/25
109	PRO1790	Review Drywall Submittals	10d	07/10/25	07/23/25
110	PRO1800	Review CFMF Submittals	10d	07/24/25	08/06/25
111	PRO1810	Review Wood Panels and Ceiling Submittals	10d	07/24/25	08/06/25
112	PRO1820	Lead Time Drywall	15d	07/24/25	08/13/25
113	PRO1830	Lead Time CFMF	40d	08/07/25	10/01/25
114	PRO1840	Lead Time Wood Panels and Ceiling	75d	08/07/25	11/19/25
115	PRO1850	AIR VAPOR BARRIER	45d	06/26/25	08/27/25
116	PRO1860	Air Vapor Barrier Submittals & Shop Drawings	15d	06/26/25	07/16/25
117	PRO1870	Review Air Vapor Barrier Submittals	10d	07/17/25	07/30/25
118	PRO1880	Lead Time Air Vapor Barrier	20d	07/31/25	08/27/25
119	PRO1890	PAINT	30d	06/26/25	08/06/25
120	PRO1900	Paint Submittals & Shop Drawings	10d	06/26/25	07/09/25



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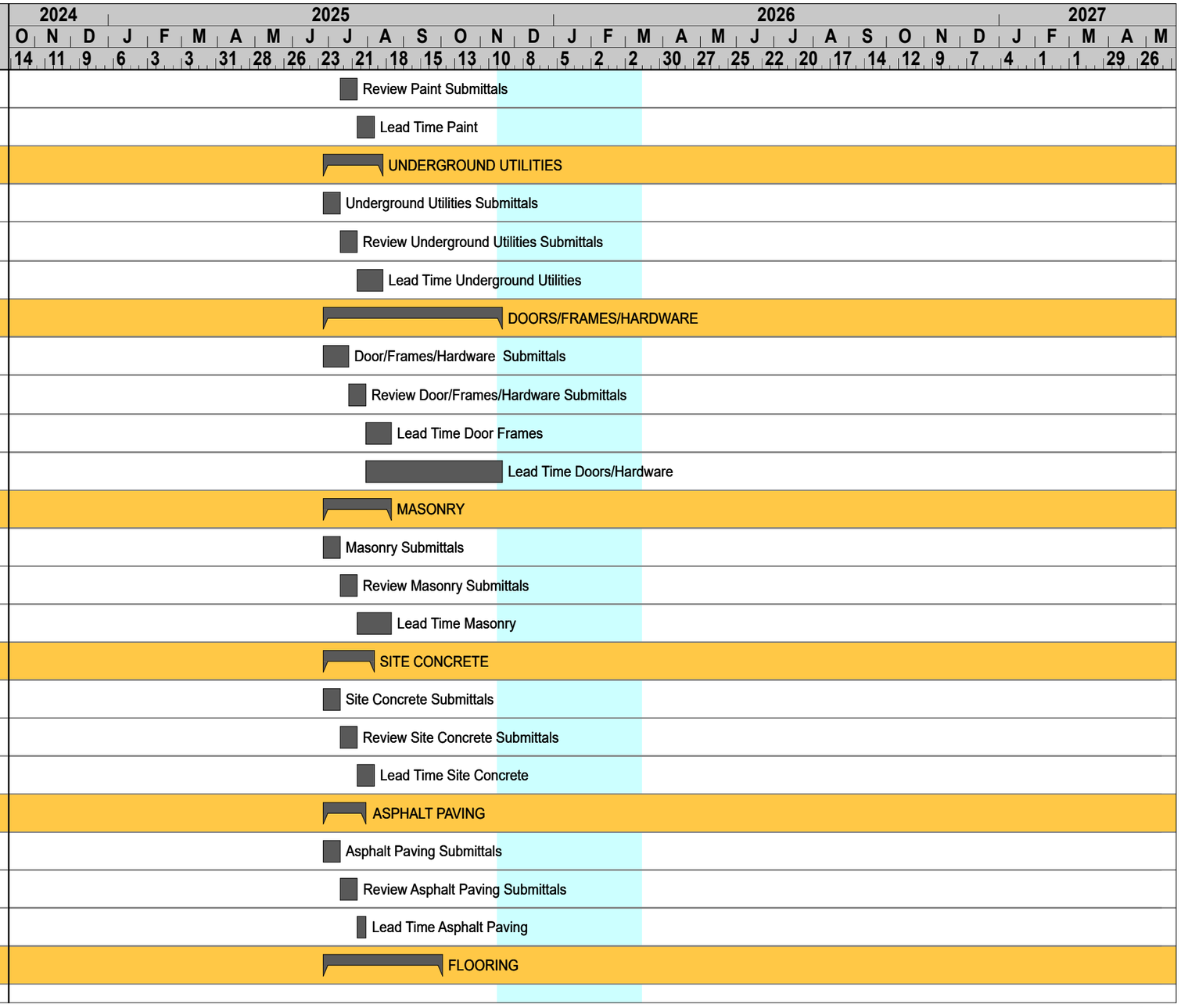
121	PRO1910	Review Paint Submittals	10d	07/10/25	07/23/25
122	PRO1920	Lead Time Paint	10d	07/24/25	08/06/25
123	**PRO1930**	**UNDERGROUND UTILITIES**	**35d**	**06/26/25**	**08/13/25**
124	PRO1940	Underground Utilities Submittals	10d	06/26/25	07/09/25
125	PRO1950	Review Underground Utilities Submittals	10d	07/10/25	07/23/25
126	PRO1960	Lead Time Underground Utilities	15d	07/24/25	08/13/25
127	**PRO1970**	**DOORS/FRAMES/HARDWARE**	**105d**	**06/26/25**	**11/19/25**
128	PRO1980	Door/Frames/Hardware Submittals	15d	06/26/25	07/16/25
129	PRO1990	Review Door/Frames/Hardware Submittals	10d	07/17/25	07/30/25
130	PRO2000	Lead Time Door Frames	15d	07/31/25	08/20/25
131	PRO2010	Lead Time Doors/Hardware	80d	07/31/25	11/19/25
132	**PRO2020**	**MASONRY**	**40d**	**06/26/25**	**08/20/25**
133	PRO2030	Masonry Submittals	10d	06/26/25	07/09/25
134	PRO2040	Review Masonry Submittals	10d	07/10/25	07/23/25
135	PRO2050	Lead Time Masonry	20d	07/24/25	08/20/25
136	**PRO2060**	**SITE CONCRETE**	**30d**	**06/26/25**	**08/06/25**
137	PRO2070	Site Concrete Submittals	10d	06/26/25	07/09/25
138	PRO2080	Review Site Concrete Submittals	10d	07/10/25	07/23/25
139	PRO2090	Lead Time Site Concrete	10d	07/24/25	08/06/25
140	**PRO2100**	**ASPHALT PAVING**	**25d**	**06/26/25**	**07/30/25**
141	PRO2110	Asphalt Paving Submittals	10d	06/26/25	07/09/25
142	PRO2120	Review Asphalt Paving Submittals	10d	07/10/25	07/23/25
143	PRO2130	Lead Time Asphalt Paving	5d	07/24/25	07/30/25
144	**PRO2140**	**FLOORING**	**70d**	**06/26/25**	**10/01/25**



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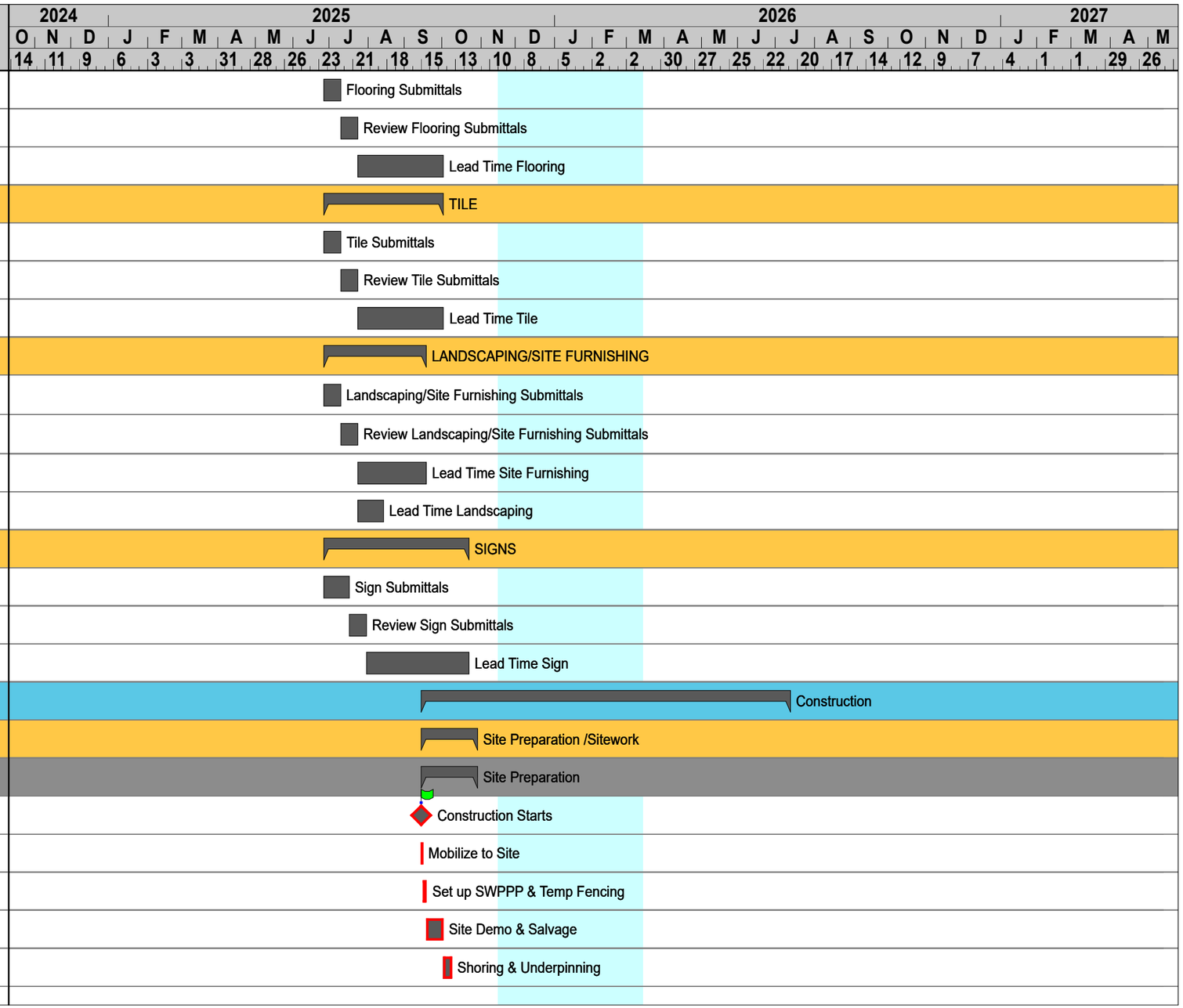
145	PRO2150	Flooring Submittals	10d	06/26/25	07/09/25
146	PRO2160	Review Flooring Submittals	10d	07/10/25	07/23/25
147	PRO2170	Lead Time Flooring	50d	07/24/25	10/01/25
148	**PRO2180**	**TILE**	**70d**	**06/26/25**	**10/01/25**
149	PRO2190	Tile Submittals	10d	06/26/25	07/09/25
150	PRO2200	Review Tile Submittals	10d	07/10/25	07/23/25
151	PRO2210	Lead Time Tile	50d	07/24/25	10/01/25
152	**PRO2220**	**LANDSCAPING/SITE FURNISHING**	**60d**	**06/26/25**	**09/17/25**
153	PRO2230	Landscaping/Site Furnishing Submittals	10d	06/26/25	07/09/25
154	PRO2240	Review Landscaping/Site Furnishing Submittals	10d	07/10/25	07/23/25
155	PRO2250	Lead Time Site Furnishing	40d	07/24/25	09/17/25
156	PRO2260	Lead Time Landscaping	15d	07/24/25	08/13/25
157	**PRO2270**	**SIGNS**	**85d**	**06/26/25**	**10/22/25**
158	PRO2280	Sign Submittals	15d	06/26/25	07/16/25
159	PRO2290	Review Sign Submittals	10d	07/17/25	07/30/25
160	PRO2300	Lead Time Sign	60d	07/31/25	10/22/25
161	**CON2000**	**Construction**	**216d**	**09/15/25**	**07/14/26**
162	**CON2010**	**Site Preparation /Sitework**	**33d**	**09/15/25**	**10/29/25**
163	**CON2020**	**Site Preparation**	**33d**	**09/15/25**	**10/29/25**
164	CON2030	Construction Starts		09/15/25 *	09/15/25
165	CON2040	Mobilize to Site	1d	09/15/25	09/15/25
166	CON2050	Set up SWPPP & Temp Fencing	2d	09/16/25	09/17/25
167	CON2060	Site Demo & Salvage	10d	09/18/25	10/01/25
168	CON2960	Shoring & Underpinning	5d	10/02/25	10/08/25



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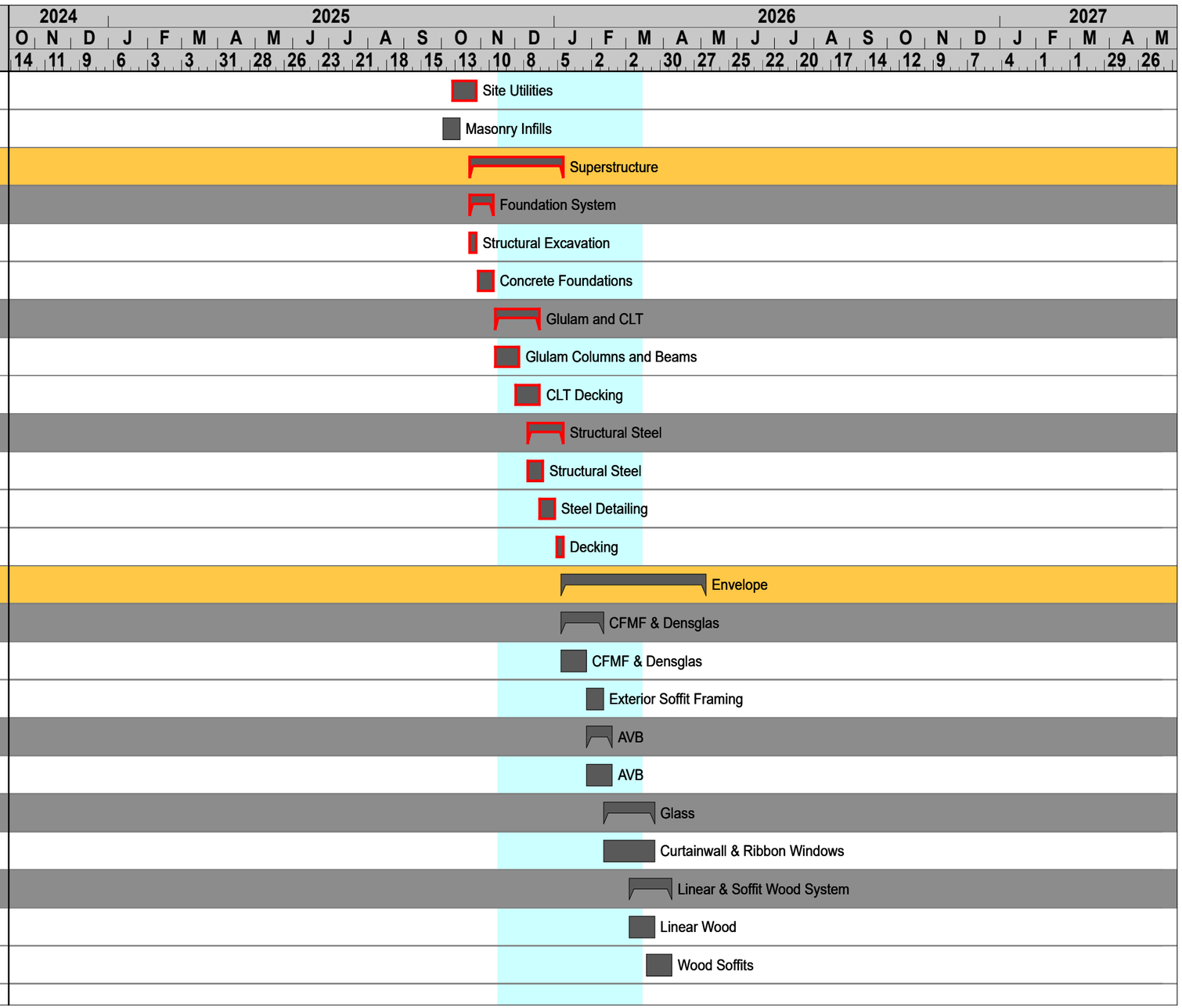
169	CON2950	Site Utilities	15d	10/09/25	10/29/25
170	CON2070	Masonry Infills	10d	10/02/25	10/15/25
171	**CON2080**	**Superstructure**	**56d**	**10/23/25**	**01/08/26**
172	**CON2090**	**Foundation System**	**15d**	**10/23/25**	**11/12/25**
173	CON2100	Structural Excavation	5d	10/23/25	10/29/25
174	CON2110	Concrete Foundations	10d	10/30/25	11/12/25
175	**CON2120**	**Glulam and CLT**	**27d**	**11/13/25**	**12/19/25**
176	CON2130	Glulam Columns and Beams	15d	11/13/25	12/03/25
177	CON2140	CLT Decking	15d	12/01/25	12/19/25
178	**CON2150**	**Structural Steel**	**22d**	**12/10/25**	**01/08/26**
179	CON2160	Structural Steel	10d	12/10/25	12/23/25
180	CON2170	Steel Detailing	10d	12/19/25	01/01/26
181	CON2180	Decking	5d	01/02/26	01/08/26
182	**CON2190**	**Envelope**	**85d**	**01/07/26**	**05/05/26**
183	**CON2200**	**CFMF & Densglas**	**25d**	**01/07/26**	**02/10/26**
184	CON2210	CFMF & Densglas	15d	01/07/26	01/27/26
185	CON2220	Exterior Soffit Framing	10d	01/28/26	02/10/26
186	**CON2230**	**AVB**	**15d**	**01/28/26**	**02/17/26**
187	CON2240	AVB	15d	01/28/26	02/17/26
188	**CON2250**	**Glass**	**30d**	**02/11/26**	**03/24/26**
189	CON2260	Curtainwall & Ribbon Windows	30d	02/11/26	03/24/26
190	**CON2270**	**Linear & Soffit Wood System**	**25d**	**03/04/26**	**04/07/26**
191	CON2280	Linear Wood	15d	03/04/26	03/24/26
192	CON2290	Wood Soffits	15d	03/18/26	04/07/26



Revision Number: A
Revision Comments: Comment - Chart Properties
Revision Date: 4/27/2006

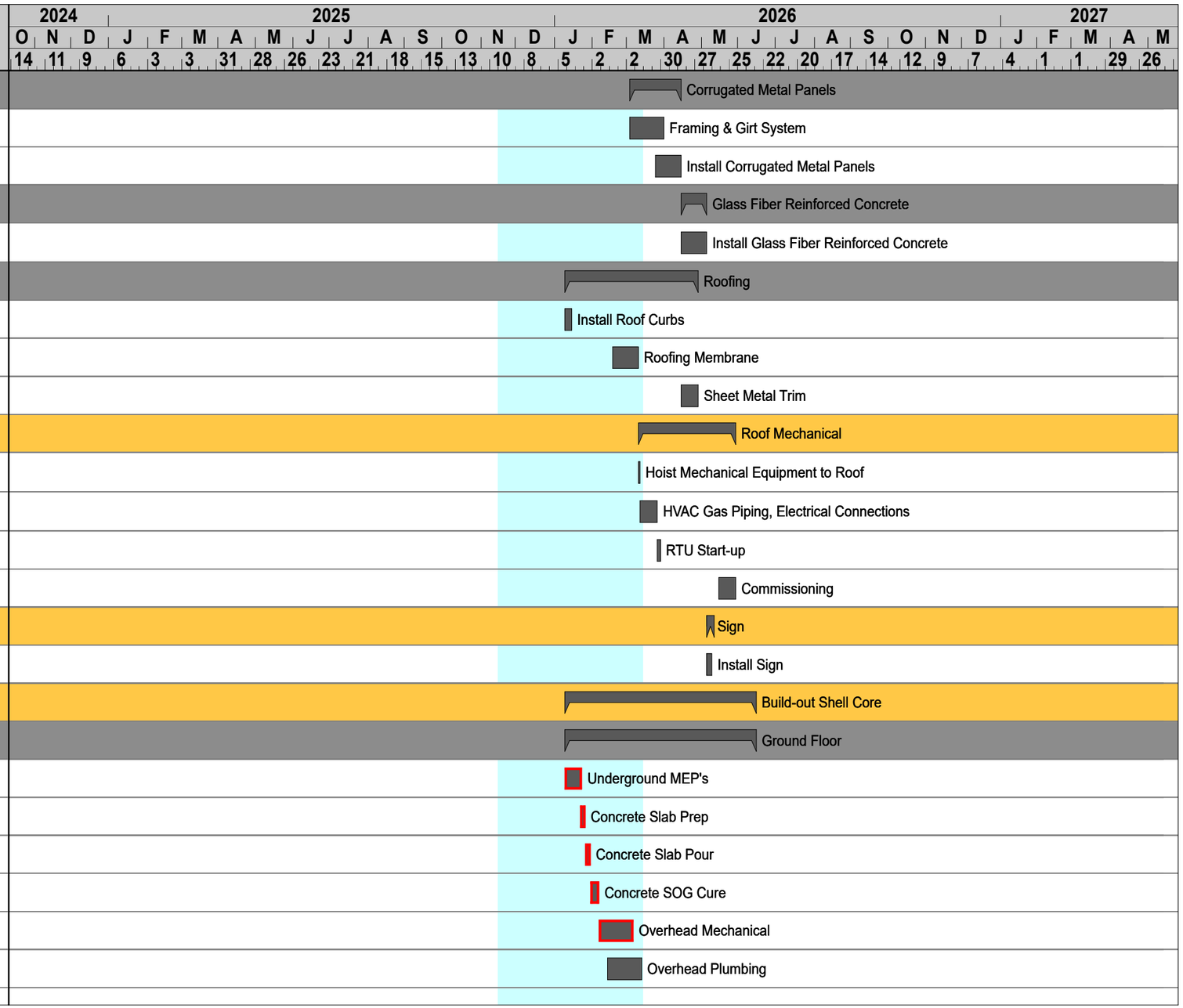
Pepper Construction

McHenry County College Event Space Addition

Standard View

Print Date: 4/22/2025
Data Date: 10/1/2017

Line	Task Number	Activity Name	Duration	Start	Finish
193	CON2300	**Corrugated Metal Panels**	30d	03/04/26	04/14/26
194	CON2310	Framing & Girt System	20d	03/04/26	03/31/26
195	CON2320	Install Corrugated Metal Panels	15d	03/25/26	04/14/26
196	CON2330	**Glass Fiber Reinforced Concrete**	15d	04/15/26	05/05/26
197	CON2340	Install Glass Fiber Reinforced Concrete	15d	04/15/26	05/05/26
198	CON2350	**Roofing**	78d	01/09/26	04/28/26
199	CON2360	Install Roof Curbs	4d	01/09/26	01/14/26
200	CON2370	Roofing Membrane	15d	02/18/26	03/10/26
201	CON2980	Sheet Metal Trim	10d	04/15/26	04/28/26
202	CON2380	**Roof Mechanical**	57d	03/11/26	05/28/26
203	CON2390	Hoist Mechanical Equipment to Roof	1d	03/11/26	03/11/26
204	CON2400	HVAC Gas Piping, Electrical Connections	10d	03/12/26	03/25/26
205	CON2410	RTU Start-up	2d	03/26/26	03/27/26
206	CON2420	Commissioning	10d	05/15/26	05/28/26
207	CON2430	**Sign**	3d	05/06/26	05/08/26
208	CON2440	Install Sign	3d	05/06/26	05/08/26
209	CON2450	**Build-out Shell Core**	112d	01/09/26	06/15/26
210	CON2460	**Ground Floor**	112d	01/09/26	06/15/26
211	CON2470	Underground MEP's	10d	01/09/26	01/22/26
212	CON2480	Concrete Slab Prep	3d	01/22/26	01/26/26
213	CON2490	Concrete Slab Pour	3d	01/27/26	01/29/26
214	CON2500	Concrete SOG Cure	5d	01/30/26	02/05/26
215	CON2510	Overhead Mechanical	20d	02/06/26	03/05/26
216	CON2520	Overhead Plumbing	20d	02/13/26	03/12/26



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Pepper Construction

McHenry County College Event Space Addition

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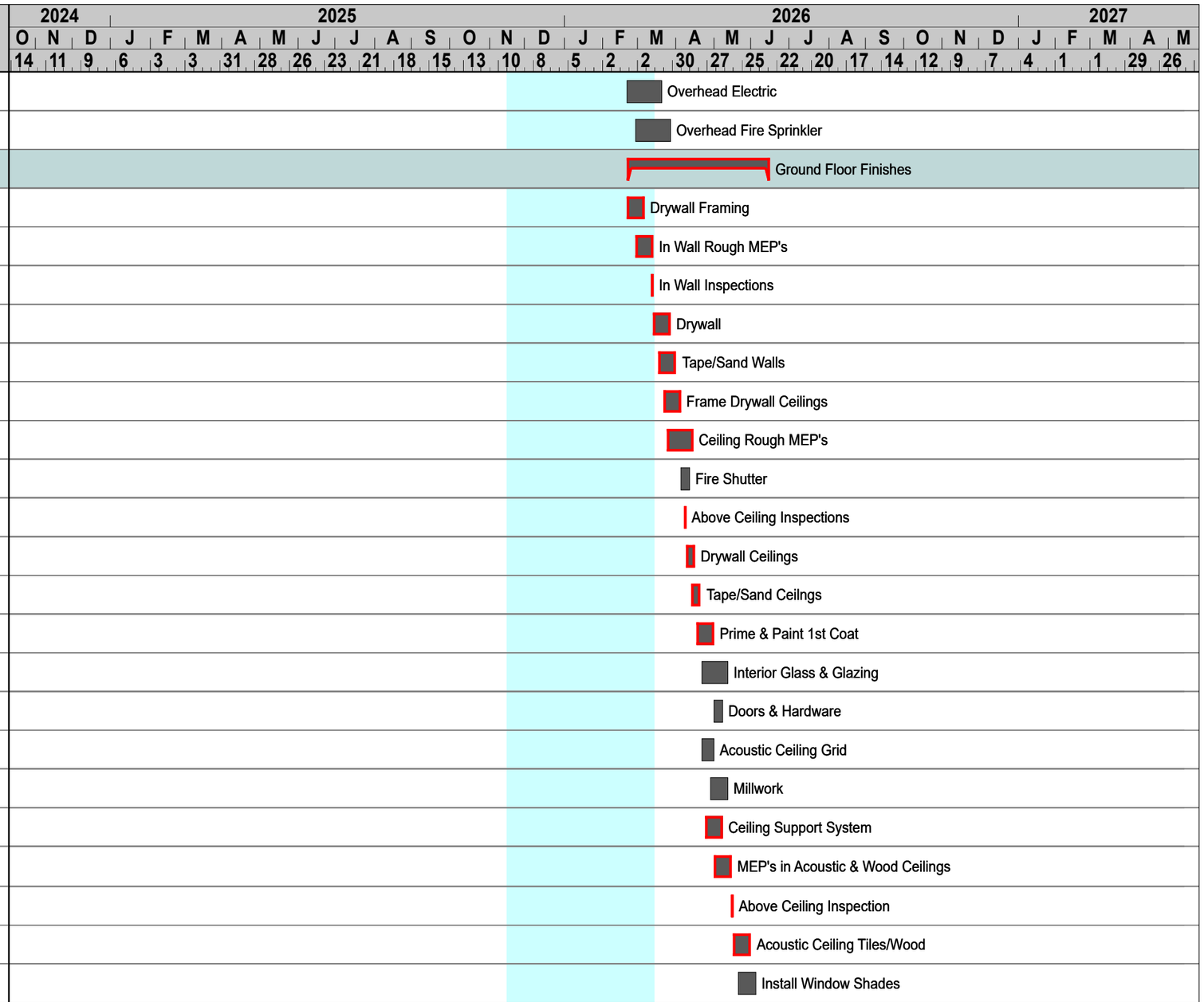
Line	Task Number	Activity Name	Duration	Start	Finish
217	CON2530	Overhead Electric	20d	02/20/26	03/19/26
218	CON2540	Overhead Fire Sprinkler	20d	02/27/26	03/26/26
219	**CON2550**	**Ground Floor Finishes**	**82d**	**02/20/26**	**06/15/26**
220	CON2560	Drywall Framing	10d	02/20/26	03/05/26
221	CON2570	In Wall Rough MEP's	10d	02/27/26	03/12/26
222	CON2580	In Wall Inspections	1d	03/12/26	03/12/26
223	CON2590	Drywall	10d	03/13/26	03/26/26
224	CON2600	Tape/Sand Walls	10d	03/18/26	03/31/26
225	CON2610	Frame Drywall Ceilings	10d	03/23/26	04/03/26
226	CON2620	Ceiling Rough MEP's	15d	03/25/26	04/14/26
227	CON2630	Fire Shutter	5d	04/06/26	04/10/26
228	CON2640	Above Ceiling Inspections	1d	04/08/26	04/08/26
229	CON2650	Drywall Ceilings	5d	04/09/26	04/15/26
230	CON2660	Tape/Sand Ceilngs	5d	04/14/26	04/20/26
231	CON2670	Prime & Paint 1st Coat	10d	04/17/26	04/30/26
232	CON2970	Interior Glass & Glazing	15d	04/22/26	05/12/26
233	CON2680	Doors & Hardware	5d	05/01/26	05/07/26
234	CON2690	Acoustic Ceiling Grid	7d	04/22/26	04/30/26
235	CON2700	Millwork	10d	04/29/26	05/12/26
236	CON2710	Ceiling Support System	10d	04/24/26	05/07/26
237	CON2720	MEP's in Acoustic & Wood Ceilings	10d	05/01/26	05/14/26
238	CON2730	Above Ceiling Inspection	1d	05/15/26	05/15/26
239	CON2740	Acoustic Ceiling Tiles/Wood	10d	05/18/26	05/29/26
240	CON2750	Install Window Shades	10d	05/21/26	06/03/26



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McHenry County College Event Space Addition

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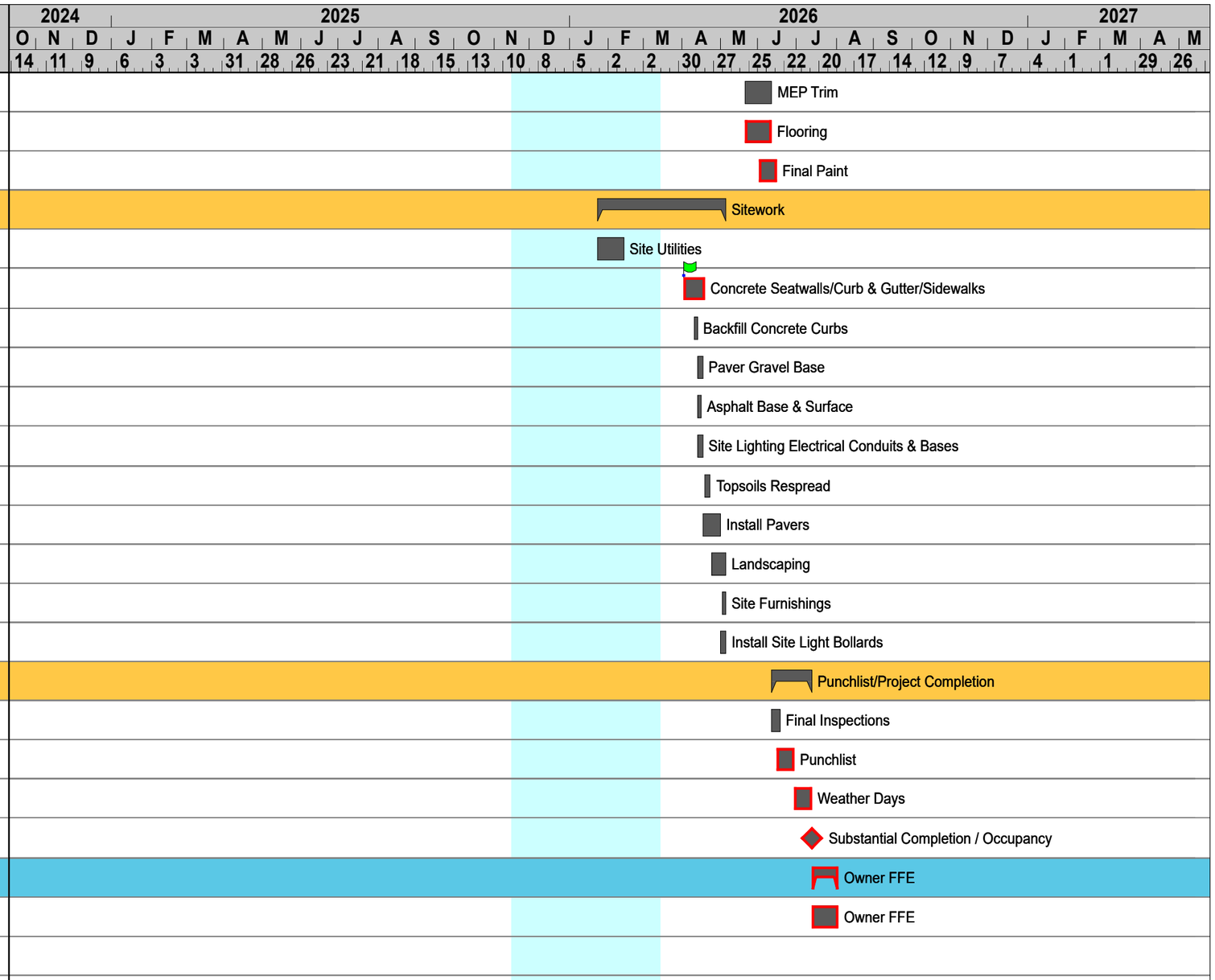
Line	Task Number	Activity Name	Duration	Start	Finish
241	CON2760	MEP Trim	15d	05/21/26	06/10/26
242	CON2770	Flooring	15d	05/21/26	06/10/26
243	CON2780	Final Paint	10d	06/02/26	06/15/26
244	**CON2790**	**Sitework**	**73d**	**01/23/26**	**05/05/26**
245	CON2800	Site Utilities	15d	01/23/26	02/12/26
246	CON2810	Concrete Seatwalls/Curb & Gutter/Sidewalks	12d	04/02/26 *	04/17/26
247	CON2820	Backfill Concrete Curbs	2d	04/10/26	04/13/26
248	CON2990	Paver Gravel Base	3d	04/14/26	04/16/26
249	CON2830	Asphalt Base & Surface	2d	04/14/26	04/15/26
250	CON2840	Site Lighting Electrical Conduits & Bases	3d	04/14/26	04/16/26
251	CON2860	Topsoils Respread	3d	04/20/26	04/22/26
252	CON2870	Install Pavers	10d	04/17/26	04/30/26
253	CON2880	Landscaping	8d	04/24/26	05/05/26
254	CON2850	Site Furnishings	2d	05/04/26	05/05/26
255	CON2890	Install Site Light Bollards	3d	05/01/26	05/05/26
256	**CON2900**	**Punchlist/Project Completion**	**23d**	**06/11/26**	**07/14/26**
257	CON2910	Final Inspections	5d	06/11/26	06/17/26
258	CON2920	Punchlist	10d	06/16/26	06/29/26
259	CON2930	Weather Days	10d	06/30/26	07/13/26
260	CON2940	Substantial Completion / Occupancy		07/14/26	07/14/26
261	**OWN3000**	**Owner FFE**	**15d**	**07/14/26**	**08/03/26**
262	OWN3010	Owner FFE	15d	07/14/26	08/03/26



Milestone Appearances
◇ Diamond

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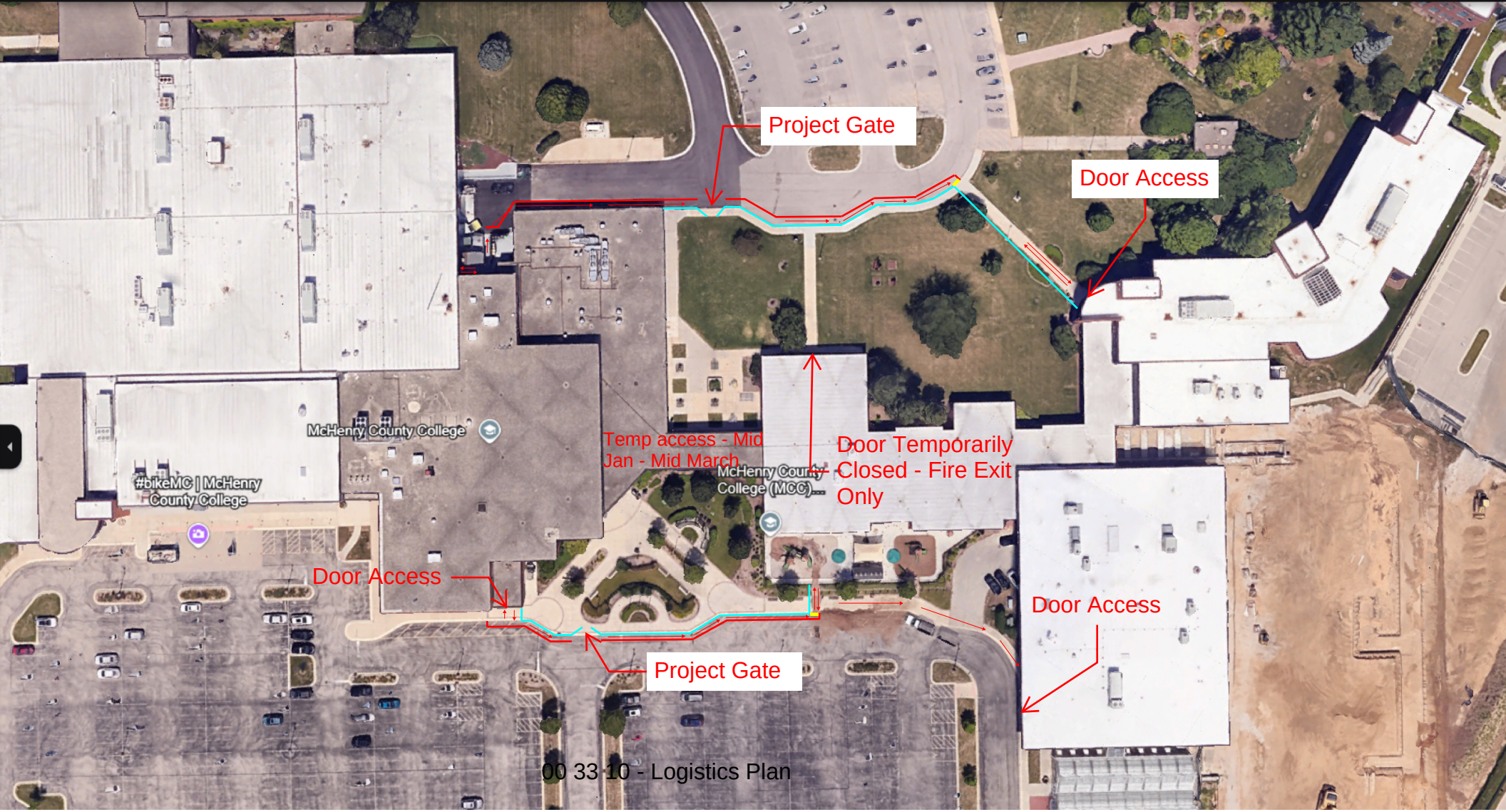

00 33 10 - Logistics Plan

SECTION 00 40 00
BIDDER'S QUALIFICATION

Bidders that plan to submit bids must register with the McHenry County College on their vendor portal at:

_____

Bidders who are not already registered/prequalified with Pepper Construction must submit an A305 Contractors Qualification Form along with their sealed bid for review by the College. A blank A305 Contractors Qualification Form has been included in this section for the bidders use. Contractors have the right to bid the work but awards may not be made if it is determined that the bidder is not qualified.

Prior to issuance of the Prime Trade Subcontract Agreement, awarded subcontractors must register with Pepper Construction. It may be in the best interest of a bidder to register prior to submitting a bid but is not a prerequisite for bidding. Financial and safety information must be completed online. Instructions to the website are below and further details regarding required information will be found once online.

Please visit www.pepperconstruction.com/prequalification

Bidders Not Previously registered: Enter your tax ID. Then a password can be created. Bidders must upload a W9 to become a business partner with Pepper.

Previously Qualified Bidders: Email: prequal@pepperconstruction.com for password reset. Include TAX ID and company name in the email.

Qualifications are good for one year.

All information is confidential. It is the responsibility of the Prime Trade Contractor to obtain registration status in a timely manner.

END OF SECTION 00 40 00

SECTION 00 41 00
ANTI-COLLUSION AFFIDAVIT AND CONSULTANT'S CERTIFICATION

1.1 ANTI-COLLLUSION AFFIDAVIT AND CONSULTANT'S CERTIFICATION

_____, being first duly sworn, deposes and says that he is _____(Partner, Officer, Owner, Etc.) Of _____ (Contractor).

The party making the foregoing proposal or bid, that such bid is genuine and not collusive, or sham; that said bidder has not colluded, conspired, connived or agreed, directly or indirectly, with any bidder or person, to putting a sham bid or to refrain from bidding, and has not in any manner, directly or indirectly, sought by agreement or collusion, or communication or conference with any person; to fix the bid price element of said bid, or of that of any other bidder, or to secure any advantage against any other bidder or any person interested in the proposed contract.

The undersigned certifies that he is not barred from bidding on this contract as a result of a conviction for the violation of State laws prohibiting bid-rigging or bid-rotating.

_____
(Name of Bidder if the Bidder is an Individual)
(Name of Partner if the Bidder is a Partnership)
(Name of Officer if the Bidder is a Corporation)

The above statements must be subscribed and sworn to before notary public.

Subscribed and Sworn to this _____ day of _____, 2025.

_____
Notary Public

Failure to complete and return this form may be considered sufficient reason for rejection of the bid.

END OF SECTION 00 41 00

SECTION 00 42 00
DISQUALIFICATION OF CERTAIN BIDDERS

1.1 PERSONS AND ENTITIES SUBJECT TO DISQUALIFICATION

No person or business entity shall be awarded a contract of subcontract, for a stated period of time from the date of conviction or entry of a plea or admission of guilt, if the person or business entity,

A. Has been convicted of an act committed, within the State of Illinois or any state within the United Staes, of bribery or attempting to bribe an officer or employee in the State of Illinois, or any State in the United States in that officer's or employee's official capacity;

B. Has been convicted of an act committed, within the State of Illinois or any state within the United States, of bid rigging or attempting to rig bids as defined in the Sherman Anti-Trust Act and Clayton Act 15U.S.C.;

C. Has been convicted of bid rigging or attempting to rig bids under the laws of the State of Illinois or any state in the United States;

D. Has been convicted of bid rotating or attempting to rotate bids under the laws of the State of Illinois, or any state in the United States;

E. Has been convicted of an act committed, within the State of Illinois or any State in the United States, of price-fixing or attempting to fix prices as defined by the Sherman Anti-Trust Act and Clayton Act 15 U.S.C. Sec. 1 et seq.;

F. Has been convicted of price-fixing or attempting to fix prices under the laws of the State of Illinois, or any state in the United States;

G. Has been convicted of defrauding or attempting to defraud any unit of state or local government or school district within the State of Illinois or in any state in the United States;

H. Has made an admission of guilt of such conduct as set forth in subsection (A) through (F) above which admission is a matter of record, whether or not such person or business entity was subject to prosecution for the offense or offenses admitted to;

I. Has entered a plea of nolo contendere to charges of bribery, price fixing, bid rigging, bid rotating, or fraud; as set forth in subparagraphs (A) through (F) above.

Business entity, as used herein, means a corporation, partnership, limited liability company trust, association, unincorporated business or individually owned business.

By signing this document, the bidder hereby certifies that they are not barred from bidding on this contract as a result of a violation of either Section 33E-3 or 33E-4 of the Illinois Criminal Code of 1961, as amended.

_____

(Name of Bidder if the Bidder is an Individual)
(Name of Partner if the Bidder is a Partnership)
(Name of Officer if the Bidder is a Corporation)

The above statements must be subscribed and sworn to before notary public.

Subscribed and Sworn to this _____ day of _____, 2025.

_____

Notary Public

Failure to complete and return this form may be considered sufficient reason for rejection of the bid.

END OF SECTION 00 42 00

SECTION 00 43 00
CONFLICT OF INTEREST

1.1 CONFLICT OF INTEREST

_____, hereby certifies that it has conducted an investigation into whether an actual or potential conflict of interest exists between the bidder, its owners and employees and any official or employee of the College identified herein.

Bidder further certifies that it has disclosed any such actual or potential conflict of interest and acknowledges if bidder has not disclosed any actual or potential conflict of interest, the College may disqualify the bid or may void any award and acceptance that the college has made.

_____
(Name of Bidder if the Bidder is an Individual)
(Name of Partner if the Bidder is a Partnership)
(Name of Officer if the Bidder is a Corporation)

The above statements must be subscribed and sworn to before notary public.

Subscribed and Sworn to this _____ day of _____, 2025.

_____
Notary Public

Failure to complete and return this form may be considered sufficient reason for rejection of the bid.

END OF SECTION 00 43 00

SECTION 00 44 00
PARTICIPATION AFFIDAVIT

1.1 PARTICIPATION AFFIDAVIT

_____, being first duly sworn, deposes and says, under penalties as provided in Section-109 of the Illinois Code of Civil Procedures, 753 ILCS 5/1-109, that he is (Partner, Officer, Owner, Etc.), of

_____ (Trade Contractor).

The individual or entity making the foregoing proposal or bid certifies that the Trade Contractor or Tier Subcontractor, respectively, is not barred from being awarded a contract or subcontract pursuant to 30 ILCS 500/50-10. Additionally, the Trade Contractor or Tier Subcontractor, respectively, certifies he/she is not suspended from doing business with any State, Federal or Local Agency.

_____
(Name of Bidder if the Bidder is an Individual)
(Name of Partner if the Bidder is a Partnership)
(Name of Officer if the Bidder is a Corporation)

The above statements must be subscribed and sworn to before notary public.

Subscribed and Sworn to this _____ day of _____, 2025.

_____
Notary Public

Failure to complete and return this form may be considered sufficient reason for rejection of the bid.

END OF SECTION 00 44 00

SECTION 00 45 00
BID BOND FORM

1.1 BID BOND FORM

KNOW ALL MEN BY THESE PRESENTS, THAT WE _____ as Principal, hereinafter called the Principal, and _____ a corporation duly organized under the laws of the State of Illinois as Surety, are held and firmly bound unto _____ as Obligee, hereinafter called Obligee, in the sum of _____ Dollars ($_____), for the payment of which sum well and truly to be made, the said Principal and the said Surety, bind ourselves, our heirs, executors, administrators, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has submitted a bid for:

_____

NOW, THEREFORE, if the Obligee shall accept the bid of the Principal and the Principal shall enter into a Contract with the Obligee in accordance with the terms of such bid, and give such bond or bonds as may be specified in the bidding or Contract Documents with good and sufficient surety for the faithful performance of such Contract and for the prompt payment of labor and material furnished in the prosecution thereof; or in the event of the failure of the Principal to enter such Contract and give such bond or bonds, if the Principal shall pay to the Obligee the difference not to exceed the penalty hereof between the amount specified in said bid and such larger amount for which the Obligee may in good faith contract with another party to perform the Work covered by said bid, then this obligation shall be null and void, otherwise to remain in full force and effect.

Signed and sealed this _____ day of _____ 2025.

_____
(Principal) (Seal)

_____ _____
(Witness) (Title)

_____
(Surety) (Seal)

_____ _____
(Witness) (Title)

PLEASE NOTE: Bid Bond must be from companies having a rating of at least A-minus and of a class size of at least X, as determined by A.M. Best Ratings.

END OF SECTION 00 45 00

SECTION 00 50 00
CONTRACTOR REFERENCES

1.1 CONTRACTOR REFERENCES INFORMATION

A. To receive full consideration, bids must contain a list of projects of similar size, and scope of work.

B. Each project listed must include the following minimum information:

1. Project Name and Address.
2. Owner's Name and Address.
3. Brief Description of the Scope of Work.
4. Dollar Value of the Contract for Construction.
5. Month and Year that the Contract for Construction was let.
6. Project Reference contact name, company, phone number, and relationship to project.

C. Attach list of Contractor References to this page.

D. Name of Bidder:_____

E. Date:_____

END OF SECTION 00 50 00

TRADE PARTNER SAFETY HANDBOOK

Contents

1. **INTRODUCTION** - This handbook has been provided to familiarize all Trade Partners ("TRADE PARTNERS" or "Subcontractor") and their Supervisors with the Pepper Construction Company ("PEPPER") safety rules, procedures, and guidelines for preventing jobsite accidents and injuries. It is the responsibility of the TRADE PARTNER to provide their Project Managers and Site Supervisors with a copy of this document. This document does not replace, modify, or supersede the rights and obligations of the parties as set forth in the PEPPER subcontract ("Subcontract"). The TRADE PARTNER is ultimately responsible for the safety of its personnel and third parties that come in contact with the TRADE PARTNER's operations. This handbook is not intended to replace the TRADE PARTNER's policies or to make PEPPER responsible for the Subcontractor's operations.

   Some items may exceed OSHA minimum requirements. If OWNER safety requirements apply, the stricter requirement will be followed.

2. **STATUTORY REQUIREMENTS** - Each TRADE PARTNER is expected to be aware of and comply with Federal, State, and Local safety regulations. In addition, each TRADE PARTNER has agreed to hold the Owner and PEPPER harmless for all claims, damages (including legal fees), and/or penalties incurred because of TRADE PARTNER's failure to comply with such regulations.
3. **INSURANCE REQUIREMENTS** - TRADE PARTNERS may not start their work until a valid and acceptable certificate of insurance is on file with PEPPER. This includes a copy being provided to the PEPPER Site Superintendent.
4. **SAFETY PRE-QUALIFICATION** – Each TRADE PARTNER that will have direct employees on the jobsite must be Safety Prequalified by PEPPER. The Safety Prequalification Information online application must be completed and submitted to PEPPER prior to contract award.
5. **SAFETY PLANNING & PROGRAMS**

   5.1. The TRADE PARTNER must submit a Project Specific Safety Plan. Templates may be provided by PEPPER upon request. The completed safety plan must be submitted to PEPPER for review prior to the Safety Preinstallation Meeting and the start of work. The plan shall be updated as site conditions warrant and reflect changes in safety procedures that are necessary to maintain a safe jobsite.

   5.2. Safety Preinstallation Meeting – all TRADE PARTNERS are required to attend a Safety Preinstallation Meeting that must take place before any work starts. The PEPPER Superintendent will schedule the meeting. Required attendees include the TRADE PARTNER full time Site Superintendent/Foreman and the PEPPER Superintendent. The TRADE PARTNER COMPETENT PERSON must be fully aware of this plan and the procedures necessary to eliminate any hazards.

   5.3. The TRADE PARTNER is required to review the Project Specific Safety Plan with their tradespeople prior to beginning work.

6. **COMPETENT PERSON REQUIREMENT** - The TRADE PARTNER must designate a Competent Person. It is the competent person's responsibility to initiate and maintain an effective safety process at the

jobsite. Each competent person shall have completed the 30-hour OSHA Construction Safety and Health Training course.

7. **TRAINING** - Weekly toolbox talks and daily Task Hazard Analysis (Job Safety Analysis) meetings are required of all TRADE PARTNERS. Documentation of these meetings must be submitted to the PEPPER site Superintendent at least weekly. Project meetings will include Safety as an agenda item and all TRADE PARTNER supervisors are required to attend.
8. **SAFETY ORIENTATION** - TRADE PARTNERS are required to send trades people who are new to the project to the PEPPER orientation before they begin work at the site. PEPPER will conduct the orientation meetings.
9. **INSPECTIONS** - TRADE PARTNERS are required to inspect daily the areas in which their employees are working and immediately report any unsatisfactory or unsafe conditions to the PEPPER site Superintendent**.**
10. **CONTRACTOR VIOLATIONS** - If unsafe conditions, practices, or procedures are observed, the TRADE PARTNER supervisor will be requested to correct the situation. Failure to adequately correct the condition or refusal to comply or enforce the requirements referenced in this handbook may result in:
    - 10.1. Removal of involved employees from the jobsite;
    - 10.2. Removal of all TRADE PARTNER employees from the jobsite;
    - 10.3. Denial of future bid opportunities with PEPPER.
11. **EMPLOYEE VIOLATIONS** - This procedure is established to provide for the discipline of employees who violate safety rules. Safety rules are written and enforced to provide for a safe and healthful place of employment.
    - 11.1. All TRADE PARTNER Superintendent's and Foremen are responsible for the enforcement of the safety and health program on PEPPER projects. In order to accomplish this, they must ensure that each employee is properly instructed in the use of safety equipment and safe work practices. PEPPER will monitor the safety performance of TRADE PARTNERS working on the jobsite.
    - 11.2. If violations of the statutory PEPPER requirements and/or the Project Specific Safety Plan are observed, the responsible TRADE PARTNER must initiate the disciplinary policy with their employee. The response to a safety violation should be carefully evaluated based on the nature of the safety violation. It is imperative that the TRADE PARTNER Superintendent or Foreman warn employees when they violate a safety rule and remove any employee who refuses to comply with the safety rules from the PEPPER project.
    - 11.3. When an employee is observed violating a safety rule, the tradesperson’s employer, and/or PEPPER shall implement the following steps:

11.3.1. First offense – written or verbal warning to employee (all written warnings shall be documented using the TRADE PARTNERS Employee Safety Violation Notice or letterhead);

11.3.2. Second offense – written warning to employee with a phone call and/or letter to TRADE PARTNER office within 24 hours of violation. Employees shall be prohibited from working on PEPPER projects for 2 working days.

11.3.3. Third offense – within any twelve-month period is grounds for immediate removal from the project and prohibition of working on PEPPER projects for one year.

11.4. Serious Intentional Violations are defined as violations that may have potentially severe consequences, or place individual(s) in imminent danger. A serious intentional violation may result in immediate dismissal from the project and termination of the employees' ability to work on other PEPPER projects. Examples of serious intentional violations include but are not limited to:

11.4.1. Smoking in non-designated areas;

11.4.2. Possession of alcohol, firearms, and/or illegal drugs;

11.4.3. Fighting or belligerent behavior;

11.4.4. Tampering with emergency equipment;

11.4.5. Working without a valid shutdown notification, hot work permit, or application of a Lockout/Tagout;

11.4.6. Working without proper fall protection, placing a person in imminent danger;

11.4.7. Entering excavations/trenches without appropriate sloping, shoring, or other protective measures, placing a person in imminent danger;

11.4.8. Entering areas designated and marked as "Do Not Enter", placing a person in imminent danger;

11.4.9. Operating equipment without valid licensing or training certification;

11.4.10. Not reporting work related injuries and/or damage to PEPPER equipment or property;

11.4.11. Failure to report and/or correct recognized safety hazards;

11.4.12. Repeated or multiple safety violations of the same nature;

11.4.13. Other acts, which indicate a TRADE PARTNER employee's, disregard toward his/her safety, the safety of others, or neglect of proper care of PEPPER property/equipment.

11.4.14. Falsify what transpired when reporting workplace injuries or death.

11.5. TRADE PARTNER Superintendent or Foreman shall review with the employee the details of the safety violation including corrective actions and consequences.

11.6. Copies of the Safety Violation shall be forwarded to the PEPPER Superintendent and Safety Director.

12. ACCIDENT REPORTING – Immediately upon being made aware, each TRADE PARTNER will verbally report to the PEPPER site Superintendent, any accident or injury involving TRADE PARTNER employees or the employees of their second-tier TRADE PARTNER(s), damage to property, public or private, general liability or injury to non-employees. Additionally, a copy of each accident report and investigation is to be provided to the PEPPER site Superintendent within 24 hours.

13. MEDICAL FACILITIES - First Aid supplies are available in the PEPPER site Superintendent's trailer or job office. Emergency telephone numbers are also posted at this location. The emergency numbers will include a nearby medical facility.

13.1. By law, every TRADE PARTNER must provide a First Aid Kit in their job site office or gang box, provide at least one trained responder certified in First Aid/CPR, and administer care to injured workers.

13.2. TRADE PARTNERS shall provide transportation from the job site to the specified doctor's office or clinic. The employer is responsible for transporting the injured worker to the designated medical facility.

14. BLOODBORNE PATHOGENS

14.1. Exposure Determination - OSHA requires employers to perform an exposure determination in which employees may incur occupational exposure to blood or other potentially infectious materials. This exposure determination is made without regard to the use of personal protective equipment. (Employees are considered exposed even if they wear personal protective equipment). This exposure determination is required to list all job classifications in which the employees may be expected to incur such occupational exposure, regardless of frequency. The employer is also required to list job classifications in which some employees may have exposure if performing certain tasks or procedures.

14.2. Personal Protective Equipment - All personal protective equipment used at this project, for protection of bloodborne pathogens, will be provided without cost to employees by their employer. Personal Protective Equipment (PPE) will be chosen based on the reasonable likelihood of any possible exposure to blood or other infectious materials.

14.3. Hepatitis B Vaccine

14.3.1. All employees who have been identified as having possible exposure to blood or other potentially infectious materials will be offered the Hepatitis B vaccine at no cost to the employee by their employer. The vaccine will be offered within 10 days of initial assignment involving potential exposure. Employees who decline the

Hepatitis B vaccine must sign a waiver. Employees who initially decline the vaccine but who later wish to have it will be provided the vaccine at no cost.

14.3.2. Employees who perform first aid only on an emergency basis, he/she will be offered the Hepatitis B vaccine. In the event emergency first aid has been rendered, and responder has possible exposure to blood or other infectious materials, he/she will be offered the Hepatitis B vaccine at no cost to the employee by their employer. If he/she declines the Hepatitis B vaccine, he/she will sign a waiver.

15. **CONCRETE/MASONRY CORING & CUTTING** – If the TRADE PARTNER scope of work includes core drilling or sawing in concrete slabs and/or concrete/masonry walls, the TRADE PARTNER is required to use Ground Penetrating Radar or other suitable technology to define areas where it is safe to drill or cut in order to avoid damaging rebar, post-tension cables, electrical conduit or the like.

16. **CONCRETE PUMP TRUCKS** – The TRADE PARTNER responsible for that equipment on site is the "Controlling Entity" for that activity and must verify that ground conditions are stable and that outrigger bearing pressures can be safely met. The TRADE PARTNER responsible for that work must establish a safe travel path of equipment, outrigger locations and ensure that no hazards such as overhead or underground utilities or vaults or structures exist.

17. **CONFINED SPACE ENTRY** - All employees must be protected from hazards associated with confined space entry. No employee shall be permitted to enter a confined space that has not first been monitored to ensure sufficient oxygen levels exist, toxic gas levels are below OSHA Permissible Exposure Limits (PEL), and combustible gases are below the Lower Flammable Limits (LEL). All work with exposure to confined spaces must be competed in accordance with OSHA 1926 Subpart AA.

18. **CONTRABAND & FIREARMS** – The following items shall be considered contraband - stolen property, firearms, weapons, explosives, and any other hazardous substances and are strictly prohibited on any PEPPER jobsite. Persons or employees found to be using or in possession of OR concealing any of the above-unauthorized items will be permanently removed from the jobsite.

19. **UTILITY AND CRITICAL SYSTEMS SHUTDOWN**- Utility Shutdowns and Critical System Service must be scheduled 10 calendar days before commencement of the work or as specified by client/project team. This work may result in a curtailment of owner's services and operations must be accomplished at the owners required schedule. The PEPPER Superintendent in conjunction with the owner Project Manager/Facilities representative shall coordinate all shutdown requests.

    All utility or system connections, shut-off, or interruptions must be scheduled with PEPPER before commencement of the work.

    19.1. Valves and other shutdowns shall be located before work begins.

    19.2. Contingency plans shall be developed in the event of critical system interruption.

19.3. All Critical Systems shall be identified before the start of demolition. Lines shall be painted or flagged to indicate their presence.

20. CRANES

20.1. All operators of mobile, boom truck, lattice boom, telescopic boom (Hydro) and tower cranes, shall maintain a valid certification card issued by the Operating Engineers Certification Program (OECP), the National Commission for the Certification of Crane Operators (NCCCO) or a company program reviewed by an outside auditor. The certification must be specific to the type of crane being operated. Certifications must be current and in good standing. Certifications must be available for verification by PEPPER at any time while the operator is on site.

20.2. The TRADE PARTNER responsible for crane work on site must verify that ground conditions are stable and outrigger bearing pressures imposed can be safety met. The TRADE PARTNER responsible for that work must establish and plan a travel path for the equipment, determine outrigger locations and ensure that no hazards such as overhead or underground utilities or vaults or structure exist. The TRADE PARTNER must perform these inspections and notify PEPPER prior to any lift or pick taking place.

20.3. Crane appurtenances that exceed 200' above the ground or within 20,000 feet of an airport shall be marked and lighted, unless an exemption is received from the FAA. Contractors erecting the crane must review and complete FAA Form 7460 as required. See Notice of Proposed Construction or Alteration (faa.gov)

20.4. Annual inspection is required, and a copy provided to PEPPER upon request.

20.5. Tower Cranes must be inspected by a Third-Party Qualified Person after erecting, climbing, jumping, de-jumping and/or dismantling activities. Additionally, a Registered Professional Engineer must verify that the host structure is strong enough to withstand forces imposed on it by braces, anchorages, and supporting floors. A written copy of this inspection must be provided to PEPPER upon request.

20.6. All signal persons and riggers must have certified training. Certifications must be current and in good standing. Certifications must be available for verification by PEPPER at any time while the operator is on site.

20.7. Tag lines or guide ropes shall be used to control all loads.

20.8. Equipment operators and truck drivers must not operate closer than recommended minimum clearance distances from overhead or underground electrical wires. If work is required near these utilities, the TRADE PARTNER must consult with the PEPPER site Superintendent about alternative action plans.

21. NON-CRANE HOISTING– When using equipment such as but not limited to pulley, winches, come-a-longs, forklifts and gantry systems, the hoisting system must be designed and engineered to be used in such a manner. The hoisting system includes all hoisting equipment and components, anchor points,

attachment points and rigging. Documentation, including the weight of objects being hoisted and capacity of each hoisting component and hoisting system as a whole, must be provided to PEPPER prior to hoisting.

22. **DRONE USAGE -** If the usage of an aerial drone is required by any TRADE PARTNER/vendor on any PEPPER project sites, the TRADE PARTNERS/vendors must contact the PEPPER Safety Director for consultation with the PCG Legal Department prior to use and to ensure that the TRADE PARTNER/~~Trade Partner~~ meets requirements as outlined in FAA's Small UAS (Unmanned Aircraft Systems) Rule (Part 107).

23. **DEMOLITION** - Demolition of existing electrical, plumbing, and/or mechanical must not commence without the following steps.

    23.1. The utility must be identified and marked by the trade responsible for that utility.

    23.2. Markings will be placed at 4ft (max) intervals and be color-coded that signify the following:

        23.2.1. Green – Safe to Cut and Remove

        23.2.2. Red or not color coded Do Not Cut or Remove – Stop Work and contact PEPPER supervision.

    23.3. Surveying tape for color coding/flagging of the 'to be removed' materials and mechanicals shall be used.

24. **DRUG & ALCOHOL POLICY**

    24.1. All illegal and unauthorized substances, drugs, look-alike drugs, synthetic drugs, alcoholic beverages, and drug paraphernalia are strictly prohibited on PEPPER jobsites.

    24.2. Persons or TRADE PARTNER employees found to be using or in possession of, or concealing of any of the above items, will not be allowed on the PEPPER jobsite.

    24.3. Any employee of the TRADE PARTNER, suspected to be under the influence of drugs or alcohol, will be referred to their supervisor to determine their compliance to this Drug & Alcohol Policy and further disposition of the employee.

    24.4. All employees, their vehicles, and personal property are subject to search and inspection, before entering or departing a PEPPER job site.

    24.5. PEPPER has adopted a "Zero Tolerance" policy regarding drug or alcohol usage. Drug or alcohol use during the work shift is prohibited (This includes breaks and lunch).

25. **ELECTRICAL**

    25.1. TRADE PARTNERS are responsible for maintenance of their extension cords, electrical tools, and equipment. Defective extension cords & equipment shall be removed from service immediately. OSHA requires daily inspection of extension cords, tool cords, and equipment cords.

    25.2. TRADE PARTNERS must always use GFCI's, even if using permanent building power.

25.3. Temporary Power Installation - Temporary electrical power, such as receptacle and lighting wire, may not be installed on PEPPER sites as open conductors. Open conductors are copper conductors covered with one layer of insulating material. Temporary wiring connections must be contained within a junction box with a cover and properly secured to prevent movement. Temporary electrical service conductors, unless installed in metallic raceways, must utilize flexible cords and cables which carry the trade name "HARD SERVICE" or "JUNIOR HARD SERVICE", as defined in the 2002 edition of the NEC/Article 400/Table 400.4 Non-Metallic Sheathed cable (Romex) is not permitted. .

25.4. Electrical extension cord use:

25.4.1. All cords shall be designed for hard or extra hard usage. (Not less than 12-gauge conductors)

25.4.2. Contractors shall identify all extension cords with a tag or be imprinted identifying the contractor company name.

25.4.3. All extension cords and portable equipment shall be inspected prior to each use.

25.4.4. Any damaged or defective cord or tool shall not be used. Any worn, frayed or damaged extension cords shall be removed from service. Damaged extension cords may not be repaired and put back into use.

25.4.5. Extension cords shall be placed so they do not cause slip, trip or fall hazards. Where cord sets have the potential to be damaged or where sets pose an unsafe condition, cords shall be suspended at a minimum of 8' above the work area or otherwise protected from damage. Means used to protect cords from damage shall not create a slip, trip, or fall hazard to workers as well as the public. Circumstances in which carts, aerial/scissor lifts, workers, or the public must traverse over cord sets the protection must protect the cord from damage as well as prevent a slip/trip fall hazard.

25.4.6. End of Day Roll-Up: Each contractor and/or TRADE PARTNER is responsible for disconnecting all extension cords from electrical sources at the end of the day or working shift with exception of cords used for running essential equipment such as pumps and battery chargers. All extension cords shall be "rolled up" and stored at appropriate storage areas such as (gang boxes, material storage areas etc.).

25.5. Energized parts must be guarded per OSHA 1926 Subpart K.

25.5.1. The permanent or an acceptable temporary cover must be provided. Non-conductive material is acceptable for temporary covers. However, cardboard is an unacceptable temporary cover.

25.5.2. All temporary covers must have a positive fastening device to secure it to the panel. Magnetic temporary covers may only be used during the work shift for guarding if the personnel responsible for the open panels are required to leave the

immediate area. Magnetic covers may not be used overnight or if tradesmen will not be present for the next shift.

25.5.3. It is acceptable to leave a panel open if the area that contains the panel is secured or isolated per the requirements of OSHA 1926.403 (i)(2).

25.5.4. All energized devices, such as light switches and electrical outlets, shall have non-conductive and positively secured covers in place. If devices are not energized, covers are not required per PEPPER or OSHA requirements. The use of electrical tape as a substitute for covers is not permitted. If covers must be removed for the purpose(s) of drywall finishing, painting, wall covering installation or other types of work, all energized devices shall be de-energized and locked out/tagged out by a qualified person prior to cover removal.

25.6. Any employee who may be working on or near (within 10') live electrical parts shall be qualified as explained in OSHA 1910 Subpart S. Live parts to which an employee might be exposed shall be put into an electrically safe work condition before an employee works on or near them, unless the employer can demonstrate that de-energizing introduces additional or increased hazards or is infeasible due to equipment design or operational limitations.

25.6.1. Examples of increased or additional hazards include, but are not limited to, interruption of life support equipment, deactivation of emergency alarm systems, and shutdown of hazardous location ventilation equipment or removal of illumination for an area.

25.6.2. Examples of work that may be performed on or near exposed energized electrical conductors or circuit parts because of infeasibility due to equipment design or operational limitations include performing testing or trouble shooting of electrical circuits that can only be performed with the circuit energized and work on circuits that form an integral part of a continuous process that would otherwise need to be completely shut down in order to permit work on one circuit or piece of equipment.

25.7. If the live parts cannot be placed in an electrically safe work condition, other safety related work practices shall be used to protect employees who might be exposed to the electrical hazards involved. Such work practices shall protect each employee from arc flash and from contact with live parts directly with any part of the body or indirectly through some other conductive object.

25.8. It is the goal of PEPPER to achieve 100% lockout/tagout when working on all systems that have the potential to become energized. If it is determined that lockout/tagout can't be achieved, the TRADE PARTNER must implement an energized work safety policy. If this policy must be implemented, immediate notification of the PEPPER Superintendent shall occur prior to initiating the work.

25.9. Lockout/Tagout Procedures shall be followed when work is to be performed on de-energized equipment. TRADE PARTNERS are required to develop and implement a written energy control or lockout/tagout program and maintain onsite and make available upon request.

26. EXCAVATIONS

26.1. At any time, a TRADE PARTNER-controlled employee is involved in the creation of, or working in, any trench or excavation, that TRADE PARTNER must provide an on-site COMPETENT PERSON who has certification of excavation task specific training. This documentation must be provided to the PEPPER site Superintendent upon request.

26.2. TRADE PARTNER Tradesmen Task Hazard Analysis - TRADE PARTNERS shall perform a Task Hazard Analysis for each trenching and excavating activity. If more than one activity occurs in a shift, additional THA's shall be performed. Agenda shall include:

26.2.1. Work scope.

26.2.2. Known overhead and underground utility locations and applicable private and public locate markings,

26.2.3. Requirement that limits machine excavating, digging or auguring up to a 3-ft. limit on either side of the utility markings.

26.2.4. Requirement that all located utility crossing points are exposed by day lighting procedures with vacuum truck or hand excavate. Must have EYES ON buried utilities before continuing to machine dig.

26.3. TRADE PARTNERS are required to install and maintain barricades around excavations/trenches to protect pedestrian and vehicular traffic from entering.

26.4. Equipment operators and truck drivers must not operate closer than recommended minimum clearance distances from overhead or underground electrical wires. If work is required near these utilities, the TRADE PARTNER must consult with the PEPPER site Superintendent about alternative action plans.

26.5. The excavation must be sloped or benched per OSHA standards, shored and /or safeguarded through the use of a trench box or other engineered earth retention device(s) when excavation reaches five (5) feet or greater in depth. Protection against cave-in at a depth of less than five (5) feet may be required if the COMPETENT PERSON determines that soil or other conditions warrant such protection.

26.6. The TRADE PARTNER performing excavation work shall complete a daily excavation permit and meet with the PEPPER Superintendent before work starts at the beginning of each shift.

27. EXCAVATION and UTILITY PLAN- Our goal is to eliminate underground utility damage incidents on our projects. We have developed a procedure to identify possible conflicts to avoid underground utility damage. The following is a summary of the steps to be taken:

27.1. Internal PEPPER Project Team Meeting - This meeting includes the project team, safety and technical services. The purpose is to understand the extent of underground utility work and excavations on the project. The team will determine how each step will be implemented and responsibilities will be assigned. Meeting notes shall be documented.

27.2. Obtain Public and Private Locating Services - Public and private utility locating services shall locate underground utilities. Dig # must be obtained by excavating contractors. Keep paint markings fresh if they disappear. Work may not start until the dig numbers have been submitted to the PEPPER site Superintendent. Enhancement: Have ICS surveyor transfer locates to a drawing and provide to ICS modeling lead.

27.3. Excavation Kick-off Meeting - Full team meeting including all underground contractors, excavation contractor, municipal utility representatives, owner representative (if applicable) and PEPPER team. The pothole plan will be created at this time. The description of work, permit requirements and location of known utilities shall be discussed, and notes shall be documented.

27.4. Perform Potholing - Pothole based on the pothole plan created during the kick-off meeting. When potholing, the entire width of the utility shall be exposed and documented. Sight tubes shall be installed. Anywhere new and existing utilities cross must be verified. Potholing may only be completed by hydro excavating or hand digging.

27.5. Document Location of Existing Utilities - Once utilities are visually identified, their locations must be documented on a drawing or other document. This document shall be posted in the jobsite trailer and/or provided to operators. Enhancement - Create a 3D model of existing utilities and overlay the model with project building models for coordination and constructability review.

27.6. Hand or Hydro Excavate within 3' and above Existing Utilities - No machine digging shall be performed within 3' of either side of a utility OR above the utility until potholing is complete. The PEPPER superintendent, or his/her assigned competent observer, shall observe the potholing process. No other duties will be assigned to this observer during the hand digging process. Machine digging above any utility is forbidden.

27.7. Document Newly Installed Utilities - As new utilities are installed, their location must be documented and the utility drawing updated. Site tubes should be installed when possible upon backfilling. Enhancement - if a 3D model was created, update the model periodically with the new utilities location.

27.8. Provide Accurate As-Builts - After all utilities are installed, an accurate as-built will be provided to PEPPER. The TRADE PARTNER will capture and provide this information. As utilities are installed, their locations shall be documented on the same document as in article 28.5 above.

28. FALL PROTECTION

28.1. A fall protection program is designed to provide the required methods to prevent employees from exposure to or suffering an injury due to a fall from an elevation. Due to the extreme severity of fall related injuries, TRADE PARTNERS must exercise every precaution. The use of fall protection systems and equipment is required on all PEPPER jobsites. Any employee found to be in violation of PEPPER Fall Protection requirements is subject to immediate removal from the jobsite. A "Fall Protection System" is defined as some engineered, physical means or methods that are designed to eliminate a fall exposure to employees. Under OSHA 1926 Subpart M, it is required to provide "Guard Rail Systems, Safety Net Systems or Personal Fall Arrest Systems." General Requirement: Fall protection is required whenever employees are exposed to falls of six (6) feet or greater, to a lower level.

28.2. OSHA 1926 Subpart M states that there may be work activities that qualify for an exception to the six (6) foot rule. However, it continues to state, "There is a presumption that it is feasible and will not create a greater danger to implement at least one of the above referenced systems." PEPPER supports this presumption of feasibility. It has been demonstrated that effective fall protection can be provided for many concrete leading-edge operations, pre-cast plank and double-T erection, and low sloped (4 in 12 or less) roofing operations. It is required that the appropriate fall protection systems be provided. This must be addressed in the Site-Specific Safety Plan that each TRADE PARTNER is contractually required to provide to PEPPER.

28.2.1. Concrete Leading-Edge Operations - Engineered fall protection systems must be used to minimize fall exposures.

28.2.2. Roofing – A Fall Protection System is required for all low sloped (4 in 12 or less) roofing operations when the fall distance exceeds six (6) feet. Safety monitors are not considered positive fall protection. In addition, any employee engaged in the installation of sheet metal materials (including but not limited to flashing, coping caps, etc.) must use a Fall Protection System.

28.2.3. Non-Roofing Work on Low Sloped Roofs - Other trade tasks unrelated to roofing work being performed on low-sloped roofs must install a Controlled Access Zone (CAZ). The CAZ must be created with flagging or barricades, and established a minimum of fifteen (15) feet from unprotected sides or edges. A flagged or barricaded path must be established and maintained from the point of access to the CAZ. Any employee outside the CAZ must utilize a Fall Protection System.

28.2.4. Steel Erection – All steel erection activities (erectors, connectors, and decker's) are contractually required by PEPPER, to include 100% fall protection when fall hazard is six (6) feet or greater.

28.2.4.1. The TRADE PARTNER (fabricator and their erector) is required to submit in writing a detailed plan of all fall protection to be used on the

project. This includes a detailed analysis of all fall hazards greater than six feet. The plan shall include a detailed description of the specific personal fall arrest systems to be used including manufacturers and/or engineered designs, limitations of use, and the minimum clearance distance required for the system to prevent the worker from striking the floor/deck below. Systems that do not prevent contact with the surface below will not be permitted.

28.2.4.2. PEPPER further requires that decking be installed every two stories or thirty - (30) feet, whichever is less, before erecting additional levels.

28.2.4.3. Any exceptions based on feasibility or constructability constraints must have the written approval of the PEPPER Safety Department, Project Manager and site Superintendent.

28.2.4.4. Working floors to be considered “controlled access” areas for ironworkers and decker's only until the floor has achieved 100% fall protection unless personal fall protection systems are utilized. All openings to be covered and/or cabled before access by other trades.

28.2.4.5. Cable must not deflect more than 2 in. when a 200-lb. force is applied. If a 2-in. deflection is exceeded additional intermediate supports must be provided. Maximum 2-in. deflection must be maintainable. Maximum distance between supports is 15 feet. Bracing/Kickers shall be provided at corner stanchions to maintain plumb when cables are pulled tight.

28.2.4.6. Roof levels must be protected with a Perimeter Guardrail System (top rail and mid- rail). PEPPER must approve variations due to job conditions of this requirement.

28.2.4.7. Overhead protection – On multi-story steel erection projects, a minimum of two decked floors one of which must be poured shall be in place between the erector's raising gang and trades below whose work is unrelated to the steel erection process.

28.2.4.8. 12 ft. Rated Lanyards: 12 ft. rated double hook or (Y) lanyards will be required when employees are tying off at their feet and/or when circumstances exist where the free fall distance prior to the lanyard engaging is beyond or exceeds six feet (6 ft.).

28.2.5. Masonry Fall Protection (Overhand Operations) - A Fall Protection System must be provided to all workers exposed to a six (6) foot or greater fall hazard. Therefore, the OSHA 1926 Subpart M fall protection exception does not apply to overhand bricklaying operations on PEPPER projects. The fall protection system used will be determined by the masonry contractor's competent person. This includes those engaged in overhand

work including the laying of brick, block, and related materials, striking, and brushing joints. In relation to operations included in OSHA 1926 Subpart L, Scaffolding, all regulations shall be followed.

28.2.6. Floor Openings & Perimeter Protection – Guardrail systems are provided at the perimeter, stairway openings, and shaft openings.

28.2.6.1. A guardrail system is defined as a toprail @ 42”, a midrail @ 21”, and includes a toeboard.

28.2.6.2. Hole covers must be installed and maintained by the contractor that created the hole. If a hole cover is removed by another trade, that contractor or trade assumes responsibility to cover and maintain that hole.

28.2.6.3. Hole covers shall be designed to withstand twice the weight of workers, equipment, and materials. Floor covers must be raised or suitably barricaded to prevent overloading from mobile equipment such as scissors and boom lifts.

28.2.6.4. Covers shall be secured against displacement horizontally and vertically.

28.2.6.5. All covers shall be marked with the words “HOLE", "FLOOR OPENING", OR "DO NOT REMOVE.”

28.2.6.6. All floor covers must be sealed to the floor with watertight sealant if the release of liquid could cause damage to the space(s) below.

28.2.6.7. If a TRADE PARTNER finds it necessary to remove a guardrail system, an authorized PEPPER representative must be notified, and the removal and replacement of the protective device is to be coordinated with them. This procedure is critical in assuring that these systems maintain their required protective designs.

28.2.6.8. Should a TRADE PARTNER damage any protective system, they must notify an authorized PEPPER supervisor immediately. Do not remove or repair these systems without notifying PEPPER. Whenever guardrail systems or covers are removed, employees must be protected with appropriate fall protection systems. Failure to replace protective systems, may subject the responsible employee to removal from the jobsite. Further, failure to replace protective system will result in PEPPER performing this work and the cost for this activity will not be negotiable, based on the Subcontract with the respective firm.

28.3. Leading Edge rated lanyards – leading edge rated lanyards (Class B) will be required when an employee's anchor point is below the employee's dorsal D-Ring, and in the case of a fall, the lanyard would contact sharp edge, such as, but not limited to, steel, metal decking and concrete.

29. FALLING OBJECTS PREVENTION– Personal fall protection has long been the #1 priority in construction for good reason, as falls from height remain the most frequent cause of construction worker fatalities. Recently, a new type of fall protection is gaining momentum, falling object protection, due to the number of injuries and fatalities resulting from dropped or falling objects. When objects (tools, material, etc.) have the potential to drop to a lower level, some type of preventative measure must be taken. Examples of preventative measures include but are not limited to:

29.1. Controlled Access Zone – a physical barrier to prevent access to area(s) below overhead work.

29.2. Tool tethers – Tethers must be specifically designed for the sole purpose of preventing tools from being dropped. Job made products are not permitted.

29.3. Spotter – a person, designated as a spotter, must be positioned to prevent unauthorized access below overhead work. This person shall have no other duty while designated as a spotter. If the spotter must leave the area, the overhead work must cease.

30. FIRE PROTECTION

30.1. Good housekeeping practices are the singularly most important element of fire protection. Combustible materials must be placed in trash receptacles and removed by the TRADE PARTNER performing the work from the project in a timely fashion.

30.2. When portable heaters are used, make certain they are placed well away from the combustible materials (both side to side and above and below.)

30.3. Temporary heaters will be checked for correct operation prior to being put into service each day.

30.4. Fire extinguisher shall be placed in conspicuous areas and be accompanied with proper signage.

30.4.1. All fire extinguishers shall be placed in boxes or on stands painted red, or hung on walls with red backboards at approximately 48" height. No fire extinguisher may be allowed to rest on bare ground.

30.4.2. One portable dry chemical fire extinguisher not rated less than 20lb ABC to be provided within five (5) feet of wherever gasoline operated equipment is being used.

30.4.3. Fire extinguishers are not to be tampered with or removed from assigned locations (except for emergency use). If discharged for any reason, the fire extinguisher must be replaced or recharged immediately.

30.5. Procedures to be followed in the event of a fire should be rehearsed regularly.

30.6. Hot Work Operations - In occupied buildings or at the discretion of the PEPPER Superintendent a Hot Work Permit is required for operations or activities involving an open

flame or work which may produce sparks or smoke including but not limited to: welding, torch cutting, soldering, grinding, chop saw use and open flames.

30.6.1. Permits are valid for only the date, shift, and location indicated.

30.6.2. It is the responsibility of the TRADE PARTNER to provide adequate fire extinguishers in the work area. One portable dry chemical fire extinguisher not rated less than 20lb ABC to be provided within twenty-five (25) feet of work.

30.6.3. A fire watch shall be maintained whenever welding, cutting, or spark producing operations take place and there is a threat of fire.

30.6.4. A properly trained fire watch shall be provided and shall have no additional duties.

30.6.5. Fire watch shall be continued for a minimum of (40) minutes after hot work has been completed. Procedures may vary by exposure.

30.6.6. The Hot Work Permit must be submitted to an authorized PEPPER-representative. The PEPPER site Superintendent may designate an authorized person for this purpose. All guidelines contained within that Hot Work Permit must be followed.

30.6.7. Asphalt/Pitch kettles are covered by the Hot Work Permit Program. Tar Pots are always required to be attended . Under no circumstances shall “tar pots” be located closer than 35 feet to any combustible storage area.

30.7. Flammable Storage/Use

30.7.1. Gasoline and other flammables must be kept in an approved metal safety can (approved by a nationally recognized testing laboratory) for the handling and use of flammable liquids. Further, a safety can, by definition, is a container with a capacity of 5 gallons or less and equipped with a spring-closing lid and spout cover, a means to relieve internal pressure, and flash-arresting screen. The limits of quantities stored must meet local, state, and/or federal regulations. Plastic gas cans are prohibited. Flammables must be stored in properly labeled containers (HAZCOM requirement). It is the responsibility of the TRADE PARTNER to provide adequate fire extinguishers. Smoking is strictly forbidden in areas where flammables are stored or used. “NO SMOKING” signs must be posted and obeyed.

30.7.2. Bulk storage fuel tanks are not permitted on PEPPER projects without permission.

30.7.3. Portable fuel tanks will be installed in accordance with federal, state and local requirements. It is the Contractor's responsibility to secure all required permits and provide proof of same.

30.7.4. Flammable liquids shall be stored outside, away from buildings, in a safe and secure location in standard approved storage containers or tanks.

30.7.5. No flammables may be stored inside tool trailers, job toolboxes or other closed locations.

30.7.6. Storage of fuel gas cylinders shall be outside in an area approved by PEPPER.

30.7.7. Portable tanks not to be nearer than 20 feet from any building. Portable fuel tanks/containers are not allowed inside the building under any circumstances.

30.7.8. At least one portable fire extinguisher having a rating of not less than 20-B units shall be located not less than 25 feet, nor more than 75 feet, from any flammable liquid storage area located outside.

30.7.9. Fueling and refueling operations for equipment, whether gasoline or diesel, shall be done outside of the building, no closer than 35' from the building.

30.7.10. Liquefied Petroleum Gas (L-P Gas) - Storage of L-P gas cylinders within buildings is strictly prohibited. L-P gas containers, when in use, must stand on a substantially level, firm surface and secured in an upright position to prohibit falling, tipping or toppling of containers. Heating equipment must be located at least 6 feet from L-P gas containers and the heat directed away from the containers.

31. HAZARD COMMUNICATION

31.1. In accordance with PEPPER's Hazard Communication Program, all hazardous material containers must be properly labeled. Every TRADE PARTNER must supply a Safety Data Sheet (SDS) to the PEPPER site Superintendent at least seven (7) days before introducing a hazardous material to the jobsite. A list of the hazardous materials used on the jobsite by the TRADE PARTNER will be maintained in the TRADE PARTNER's file. An additional set will be maintained in PEPPER's site job file.

31.2. The TRADE PARTNER must maintain their written HAZCOM Program at the jobsite, along with the training program utilized for their employees. Revision to this program must be provided when requested by the PEPPER Site Superintendent or Safety Department.

31.3. The SDS must be maintained on the job site. A copy of the PEPPER HAZCOM Program may be obtained from PEPPER upon written request.

31.4. All chemicals on site will be stored in their original or approved containers with a proper label attached. Any container not properly labeled should be given to the Contractor Supervisor for labeling or proper disposal.

31.4.1. Immediate us means that the hazardous chemical will be under the control of and used only by the person who transfers it from a labeled container and only within the work shift in which it is transferred.

32. HOUSEKEEPING

32.1. Our policy is “nothing hits the floor”. All work operations shall be provided with appropriate trash receptacles for debris, scrap, cutoffs and packaging. All debris, especially combustible scraps and debris must be cleared from the building and work areas daily.

32.2. Daily housekeeping by each TRADE PARTNER is essential for maintaining a safe job site. TRADE PARTNERS are responsible for housekeeping procedures in their respective work areas. The working definition for Daily Housekeeping at PEPPER is as follows:

32.2.1. All debris, especially combustible scraps and debris must be cleared from the building and work areas daily.

32.2.2. Nails, wire ties, and other accessories shall be promptly removed from lumber or any other used lumber at the time of stripping or dismantling. If it is not practical to remove or bend nails in used lumber to avoid tripping hazards and nail traps, the lumber must be stacked for cleaning and re-use. Lumber must not be scattered.

32.2.3. The work site, especially stairways and walkways, shall be kept clear of obstructions that may create tripping or other hazards.

32.2.4. Tools must be stored in toolboxes. If laid aside temporarily, the tools must be placed where they will not present a hazard. Tools must not be placed in a position to fall on someone at a lower level.

32.2.5. All construction materials and supplies stored neatly in designated areas.

32.2.6. Floors shall be swept daily using wax based sweeping compound to remove accumulated construction dust.

32.2.7. All materials shall be stored on carts, pallets or the like to allow movement and better organization and containment of such materials.

32.3. TRADE PARTNER failure to maintain their work areas as required or directed will result in PEPPER performing this clean-up. The cost for this activity will not be negotiable, based on our Subcontract with the respective firm.

33. INDOOR AIR QUALITY - In General the use of gas-powered equipment is prohibited within the building structure. If no other feasible option, the contractor using said gas powered equipment must provide safeguards: such as, continuous CO air monitoring for the duration of the work in that same area, installation of scrubbers on the equipment used, local ventilation, or scheduling off hours. All Federal and Local requirements must be followed.

34. LADDERS - Our goal is to reduce the risk posed by using ladders to access work at height by reducing the overall percentage of work completed using ladders. This involves Identifying alternatives to ladder use for work scopes at the planning phase. Alternatives to ladders include scissor lifts, man lifts, and scaffolds.

When ladders are determined to be the best option the following requirements apply:

34.1. All ladders must be used in strict accordance with the manufacturers and ANSI requirements.

34.2. Step and extension ladders shall be constructed of fiberglass and rated Type IA, IAA or IAAA. Wood and metal ladders are prohibited.

34.3. Whether using portable, fixed, or job-made ladders, proper safety precautions must always be followed. Employees must always ascend or descend a ladder with three (3) points of contact.

34.4. TRADE PARTNERS must inspect their ladders daily; broken or damaged ladders will be removed from service immediately and destroyed.

34.5. Extension ladders cannot be separated for use as single units. Extension or straight single ladders must be properly secured at the top and if possible, the bottom. A minimum of thirty-six (36) inches is required above the top access point of an extension or straight ladder.

34.6. Documentation of ladder safety training must be provided at the request of the PEPPER site Superintendent.

34.7. For work from ladders near an exposed edge or perimeter of the building or structure, where a worker could fall off the ladder and over the guardrail system, a positive means of fall protection, such as but not limited to personal fall arrest systems (PFAS), will be employed.

35. MASONRY CONSTRUCTION

35.1. A Limited Access Zone shall be established whenever a freestanding masonry wall is being constructed.

35.2. The Limited Access Zone shall be established before the start of the wall construction, equal to the height of the wall to be constructed plus four feet, run the entire length of the wall, and established on the side of the wall that will not have scaffold installed.

35.3. Limited Access Zone entry is restricted to employees who are actively engaged in the construction of the wall. No other employees shall be permitted to enter the zone.

35.4. The Limited Access Zone shall remain in place until the wall is adequately supported to prevent overturning. OSHA considers bracing as adequate support.

35.5. An engineered bracing design shall be used for all freestanding masonry walls over eight (8) feet in height to prevent overturning and collapse. Bracing shall remain in place until permanent supporting elements of the structure are in place.

35.6. All block and brick cutting activities that create the potential for respirable crystalline silica dust exposure shall use water as an engineering control. If it is determined by PEPPER that water cannot be used, all exposed employees shall wear approved respirators and the

operation shall be in an area where non-protected employees and the general public are not exposed to silica containing dust.

36. MATERIAL HANDLING

36.1. Materials shall not be stored outside of designated construction areas.

36.2. Sheet materials (ex: drywall, plywood, oriented strand board, hardboard, fiberboard, overlay plywood) and doors shall not be stored on edge or on drywall carts.

36.3. Loading of drywall carts shall be limited to the manufacturers rated weight capacity.

36.4. Metal banding shall not be used for concrete formwork. Acceptable means include poly or nylon.

36.5. Material Handling for Multi-Story Structures

36.5.1. The practice of swinging or pulling a suspended load into a building by any method is strictly prohibited. This practice places employees, equipment, and the structure at substantial and unnecessary risk. This operation must be analyzed in the site-specific safety plan.

36.5.2. Proper loading systems including, but not limited to, are: material/man hoists, platform lifts, landing platforms or lookouts.

36.5.3. If guardrails are removed on landing platforms, lookouts or hoists, personal fall protection must be provided for exposed employees. Additionally, if guardrails are removed, flagging must be installed to warn of fall hazard or unprotected edge condition. TRADE PARTNER who removed guardrails shall reinstall guardrails upon completion of material handling activities.

36.6. Free-Rigging is prohibited: Free rigging is the direct attachment to or placement of rigging equipment (slings, shackles, rings, etc.) onto the tines of a powered industrial truck for a below-the-tines lift. This type of lift does not use an approved lifting attachment.

36.7. Personnel are strictly forbidden from riding on material hoisting equipment at any time.

37. MOTORIZED EQUIPMENT

37.1. All motorized equipment that has limited or obstructed view by the operator during reverse or backing up movement, must have a back-up alarm installed and operating. This includes skid steer equipment.

37.2. All operators of motorized equipment/machinery must wear seatbelts if said equipment has been manufactured with one.

37.3. All equipment operators must shut down their engines during the refueling process. Fire extinguisher(s) must be readily available during refueling, located within twenty-five (25) feet of lateral distance.

37.4. Only authorized person's licensed and certified as required by local, state or federal mandates, shall operate machinery, equipment, tools or vehicles.

37.5. No riders on machinery or equipment without proper seating accommodations. Riders in trucks are to be seated, in a seat while the vehicle is moving. No workers may be transported in the back of a pick-up truck AT ANY TIME.

37.6. All mobile machinery must have operable backup alarms and/or flashing strobe type lights at ALL times.

37.7. A flag person must be used to direct the backing up of a vehicle in any congested or noisy area. Any flag person exposed to vehicular traffic must be properly trained and certified for this task and must always wear a reflective vest.

37.8. The use of a mobile phone while operating any power-industrial trucks or power- industrial equipment and earth moving equipment is strictly prohibited.

38. TRANSPORTATION OF PERSONNEL

38.1. Transportation of persons in the back of pick-up trucks is prohibited.

38.2. No person will be permitted to ride with arms or legs outside of a vehicle body, in a standing position on the body, on running boards, seated on side fenders, cabs, cab shields, bed of the truck or on the load.

38.3. The number of passengers in passenger-type vehicles shall not exceed the number that can be seated

38.4. Trucks used to transport personnel shall be equipped with a securely anchored seating arrangement, a rear end gate, and guardrail. Steps or ladders, for mounting and dismounting, shall be provided.

38.5. All tools and equipment shall be guarded, stowed, and secured when transported with personnel.

38.6. Vehicles transporting personnel shall not be moved until the driver has ascertained that all persons are seated, and the guardrails and rear end gates are in place or doors closed.

38.7. Getting on or off any vehicle while it is in motion is prohibited.

38.8. All motor vehicles shall be shut down prior to and during fueling operations.

39. PERSONAL PROTECTIVE EQUIPMENT

39.1. TRADE PARTNERS are responsible for providing their employees with all necessary PPE.

39.2. Clothing - Appropriate clothing must always be worn. Clothing must consist of long pants and a shirt that covers the shoulders with a minimum 4" sleeve. Clothing must not be torn and must be free of offensive sayings or pictures. Loose clothing, shorts, athletic shoes, or sleeveless shirts are not permitted on the jobsite. Jewelry of any kind is strongly discouraged

on the jobsite. The risk of becoming “caught on” or “caught in” increases substantially when necklaces, dangling jewelry, or rings are worn.

39.2.1. High Visibility Clothing

39.2.1.1. Flaggers and workers exposed to hazards posed by vehicles, earth moving equipment, extendable boom forklifts and cranes shall wear high visibility reflective clothing. High visibility clothing is defined as reflective and fluorescent vests or shirts that workers should wear to make them more visible when working near traffic and heavy equipment, in all light conditions, day and night. The following guidelines shall be used for selection of high visibility clothing:

39.2.1.2. ANSI Class 1 garment: For workers that are separated from vehicular traffic that does not exceed 25 miles per hour; where background settings and worker tasks are not complex.

39.2.1.3. ANSI Class 2 garments: Necessary for greater visibility during inclement weather; where work background is more complex and is close to moving traffic and vehicles; workers’ attention will likely be diverted from traffic traveling at speeds from 25 to 50 miles per hour.

39.2.1.4. ANSI Class 3 garments: Traffic speed is greater than 50 miles per hour; worker must be conspicuous and identifiable as a person through the full range of body motions at a minimum of 1,280 feet.

39.2.1.5. At the discretion of PEPPER, projects may require high visibility clothing 100% of the time.

39.3. Footwear - Construction workers and visitors are required to wear a well-constructed hard sole, closed-toe work shoe.

39.4. Gloves – Appropriate hand protection is required when employees’ hands are exposed to hazards such as those from skin absorption of harmful substances; severe cuts or lacerations; severe abrasions; punctures; chemical burns; thermal burns; and harmful temperature extremes. Leather and cotton gloves are not considered cut resistant.

39.5. Hard Hats - Approved hard hats must be worn on the job site at all times. TRADE PARTNERS are not allowed to work without hard hats. PEPPER will not provide loaner hard hats to TRADE PARTNER’s employees.

39.6. Hearing Protection - Appropriate hearing protection must be utilized for the anticipated noise levels encountered. The threshold for hearing protection is 90dBA.

39.7. Respirators - The use of some types of respirators requires a medical examination and documented fit testing. Documentation must be provided to PEPPER upon request.

39.8. Eye Protection - The use of safety glasses with side shields or other suitable eye protection is required at all times. Additionally, face shields must be worn during the use of powder actuated tools, chop saws, partner saws, grinders, or for tasks that create flying debris that can strike the face.

39.9. Welding shields shall attach to hard hats.

39.10. Roofing - All workers involved with charging of roofing kettles shall wear task specific PPE. These items would include hood that provides face/neck protection, suitable outer- wear and gauntlet gloves.

40. POWDER ACTUATED TOOLS

40.1. Only employees who have been trained in the operation of the tool in use shall be allowed to operate a powder-actuated tool.

40.2. All Personal Protective Equipment (PPE) required (including but not limited to eye protection, face protection, gloves and hearing protection) must be used during the operation of the tool. All live loads remaining in a used clip shall be discarded properly.

40.3. Proper disposal could include a container of water or other closed container that does not allow accidental detonation of unused loads.

41. PUBLIC PROTECTION - Construction activities attract the public. TRADE PARTNERS must provide safety barriers, walkways, lighting, fences, and any other means necessary to protect the public from possible injury because of the TRADE PARTNERS work. This must be part of the site-specific safety plan.

41.1. Construction work areas must be barricaded and/or posted with appropriate signage. At no time shall work be performed over persons or aisles without such barricades in place to prevent access.

41.2. Red barricade tape is to be used to enclose hazardous work areas. Entry into these areas is restricted to authorized personnel.

41.3. Yellow barrier tape shall be used to enclose areas where caution must be exercised.

41.4. When steel plates, wood planking or similar covers are located where there is pedestrian traffic or exposure, they shall be tapered on all sides with cutback, cold mix or similar material to eliminate tripping hazards. Covers will be non-slip in nature or have a non- slip surface.

42. RADIOS - Electronic entertainment devices are prohibited in the job site work area. Radios are permitted in the site trailer or office primarily for public notification of emergencies (such as weather, security alerts, etc.). Repeat violations of this policy will result in the appropriate discipline, up to and including removal from the jobsite.

43. SCAFFOLDING

43.1. Per OSHA 1926 requirements, any employee that uses, erects, or dismantles a scaffolding system must be trained in this task. TRADE PARTNER documentation of this training must be provided to PEPPER upon request.

43.2. A scaffold tagging system shall be used to identify the status of each scaffold. Scaffold status should include the following categories: complete/all requirements met, complete/hazards noted, and/or incomplete do not use.

43.3. Fall protection at heights above 6 feet is required during scaffold erection and dismantlement. Fall protection systems may include horizontal static lines or vertical lifelines. 1926.451 states that the employer shall have a competent person determine the feasibility and safety of providing fall protection for employees erecting or dismantling supported scaffolds. PEPPER supports this presumption that personal fall arrest systems are feasible.

43.4. The footings for scaffolding must be rigid, sound, and capable of carrying the load without settlement or displacement. Unstable objects such as barrels, boxes, loose brick, concrete blocks, or pieces of scrap lumber shall not be used to support scaffolding. Mudsills, base plates, and leveling jacks must be used.

43.5. Standard scaffolding, whenever feasible, shall have guardrails (top and mid rails) whenever the work platform is located at six (6) feet or greater above lower level. If X- brace pivot point is greater than thirty- eight (38) inches but less than forty-eight (48) inches above work platform, only a midrail is required. If X-brace pivot point is greater than twenty (20) inches but less than thirty (30) inches above the work platform only a top rail is required. All other scaffolding situations require guardrails per OSHA standards.

43.6. All scaffolding that is less than forty-five (45) inches wide must have guardrails whenever the work platform is at forty-eight (48) inches or greater above lower level. This includes Perry and Baker-type scaffolds. Toe boards are required to provide for falling object protection, unless the area below is barricaded and be considered a limited access zone.

43.7. Work platforms must be fully planked, except during the erection and dismantling process. At that time, two planks or an eighteen (18) inch wide (minimum) work platform will be provided. Planks must be scaffold grade or documentation provided substantiating that plank material to be of equal or greater strength. This includes planking used by concrete contractors on forming systems. All planking of work platforms must be overlapped a minimum of twelve (12) inches or secured from movement with cleats. Scaffold planks shall extend over their end supports not less than six (6) inches or more than twelve (12) inches. Planks must be inspected before each use and cracked or damaged planks must be removed from service prior to use.

43.8. An access ladder or equivalent device, to allow safe access, must be provided for all scaffolding. If the fall distance exceeds 15’, stair towers or internal ladder systems must be

used. Safe access includes a gate, chains or other barriers that eliminate fall hazards after platform is accessed.

43.9. All diagonal bracing must be in place and secure. Braces do not take the place of mid and top rails (except as noted above.)

43.10. The scaffold system must be tied to and securely braced against the structure per the minimum requirements of the OSHA standard. If the scaffolding system is to be enclosed for wind or weather protection, it must be designed by a competent person to withstand the additional loads.

43.11. When work is to be completed in stairwells rolling scaffolds shall not be used.

43.12. Narrow frame scaffolds (Perry/baker type), are not designed to support additional pick boards, walk boards, or scaffold planks. This practice is not allowed.

43.13. Training, inspection procedures, maintenance, and operation of self-propelled mobile scaffolds must comply with the manufacturer's requirements and documentation. This documentation must be provided when requested by the PEPPER Safety Department or site Superintendent.

43.14. Outriggers or stabilizers must be used, as required, by the manufacturer, guardrails in place and access gates closed while unit is in use.

43.15. Minimum safe distances from energized power lines must always be maintained (refer to the site-specific safety plan).

43.16. Manually Propelled Mobile Scaffolds - All casters shall be provided with a positive locking device to prevent scaffolding from rolling. Platforms will be tightly planked for their full width. The floor or work surface must be free from voids, holes, or obstructions. The height of rolling scaffolds must not exceed four (4) times the shortest base dimension.

43.17. Two-Point Suspension Scaffolds - The roof iron or hooks shall be of proper size, design, and material. Installation must be secure and anchored properly under the supervision of a trained, competent person. Tiebacks shall serve as a secondary means of anchorage installed at right angles to the face of the structure and secured to a structurally sound element of the building. All employees must be trained in the hazards associated with suspended scaffolding, as well as the controls necessary to eliminate each hazard. Fall protection systems must be used in conjunction with suspended scaffolds.

44. STILTS

44.1. A competent person shall first train each employee who is assigned to wear stilts in the safe use and inspection of the equipment. The competent person shall also make the determination that the tradesman is proficient in the use of stilts before the tradesman is assigned to work on them.

44.2. Stilts shall be thoroughly inspected before each use.

44.3. Stilts shall only be used on hard level terrain, which is free of debris, slippery surfaces, electrical cords, or other obstructions, such as stored materials in the work path.

44.4. Tradesmen are responsible to notify their supervisors of any unsafe conditions or hazards concerning the safe use of stilts. Stilts shall not be used until all unsafe conditions have been corrected.

45. SCISSORS AND AERIAL LIFTS

45.1. Scissors and Aerial Lifts may not be "field modified" for uses other than those intended by the manufacturer unless the manufacturer has certified the modification in writing.

45.2. All lifts shall be inspected before use. Any deficiencies or equipment in need of repair shall be reported to the Superintendent or Foreman before use. If any equipment needs repair, the equipment shall not be used until authorization is received from the Superintendent or Foreman. Equipment in need of repair shall be tagged out until serviced. Inspection documentation shall be maintained with each piece of equipment for review.

45.3. Employees shall always stand firmly on the floor of the basket or platform, and shall not sit or climb on the edge or rails of the basket or use planks, ladders, or other devices for a work position.

45.4. Lifts shall not be loaded in excess of the designed working load. Lifts are designed for lifting personnel and small hand tools. Lifts are not to be used in lieu of a crane. Aerial lifts shall not be used to transport construction materials.

45.5. A full body harness shall be worn with a self-retracting lanyard attached to the boom or basket when working from an aerial lift.

45.6. Operator must have documented proof of training (available upon request) and use equipment as intended.

45.7. Lifts must not be field altered and must use only engineered attachments approved by the manufacturer. It is highly recommended that operator of lift does not work alone.

46. SILICA EXPOSURES– any TRADE PARTNER that may create respirable silica dust must develop and implement a site silica exposure control plan in accordance with OSHA Subpart Z 1926.1153.

47. UTILITIES - Equipment operators and truck drivers must be cautioned not to operate closer than recommended distances from overhead or underground electrical wires. If work is required near these utilities, the TRADE PARTNER must consult with the PEPPER site Superintendent about alternative action plans. Whenever the TRADE PARTNER undertakes excavation work, it is their responsibility to contact the appropriate one call locating services. Work may not start until these dig numbers have been submitted to the PEPPER site Superintendent and the schedule of excavation approved.

48. UTV (Utility Type/Terrain Vehicles)

48.1. To safely operate a utility type vehicle, the operator must use similar safe work habits as used with tractors, skid steer loaders, and ATVs. A safe, successful driver should become familiar with the machine before using it. This can be done by reading the owner's manual and following safety labels found on the vehicle. A qualified operator(salesperson) can also demonstrate the correct operation.

48.2. Safety practices to follow when driving a UTV:

48.2.1. Maximum speed while operating a UTV on a PEPPER jobsite is 5 mph.

48.2.2. Always keep legs and arms inside the vehicle.

48.2.3. Drive slowly and turn smoothly to avoid an overturn.

48.2.4. When hauling cargo, the vehicle's center of gravity is raised, increasing the chance of overturning.

48.2.5. Drive completely up or down a slope or hill before making a turn. Do not turn the vehicle in mid-slope or hill as this increases the probability of overturning.

48.2.6. Use the appropriate speed on rough terrain.

48.2.7. Operators and passengers have been thrown from vehicles.

48.2.8. Stay clear of ditches and embankments.

48.2.9. Passengers must be tall enough to reach handhold while their backs are against the seat and their feet are flat on the floorboards.

48.2.10. Each passenger must ride in his/her own seat, not anywhere else on the UTV.

48.2.11. Operators must back up carefully and utilize horn.

48.2.12. Operators should be free from the influence of drugs or alcohol.

48.2.13. Due to the hauling purpose of a UTV, special attention should be paid to making sure cargo or material is properly secured during transport.

49. VISITORS - Any person not directly involved with the on-site construction of this Project shall not enter the site without first going to PEPPER's job office and signing a visitor's release and obtaining a hard hat and safety glasses which is to be returned to PEPPER. Visitors must always be accompanied by a person that has attended site orientation, is responsible for that (person/group) visitor on site and is familiar with the PEPPER Site Safety Plan. All visitors must wear required PPE items such as hardhats, safety glasses, well-constructed hard sole, closed-toe work shoe and long pants. Visitors must not enter Construction or Restoration areas wearing shorts, skirts, open--toed-shoes or high-heels. Visitors must sign-out when leaving the project. Note: Contractors are responsible and must always accompany equipment repair vendors brought on site.

50. WELDING AND CUTTING

50.1. The TRADE PARTNER must initiate a Hot Work permit with the PEPPER Superintendent prior to conducting welding and cutting operations.

50.2. When necessary to provide protection for other employees and materials, screens or shields must be used where it is feasible.

50.3. All equipment used for welding and cutting including welding cables, gas cylinders, regulators and gauges, hoses, and torch sets shall be inspected each day before use.

50.4. Flash back arrestors shall be installed at the oxy-acetylene regulators in addition to the required torch head protection.

50.5. Valve protection caps shall always be in place except where cylinders are in use or connected for use. Regulators and hoses will be removed at the end of the work shift.

50.6. Compressed gas cylinders will not be stored inside of any structure – this includes gang boxes, storage trailers and similar closed spaces.

50.7. Personal Protective Equipment – Head and eye protection must always be worn. Hard hats with eye and face protection for welding applications. Safety glasses with side shields or goggles are required when chipping or grinding a work piece if not wearing a welding helmet. All fabric garments must be resistant to spark, heat, and flame. Respiratory Protection is needed when ventilation is not sufficient to remove welding fumes or when there is risk of oxygen deficiency. Suitable welding gloves are required.

50.8. Welding fume extractors must be used for all hot work in occupied facilities to prevent the spread of fumes and smoke. Local exhaust ventilation shall consist of freely movable hoods intended to be placed by the welder or burner as close as practicable to the work. This system shall be of sufficient capacity and so arranged as to remove fumes, smoke at the source, and keep the concentration of them in the breathing zone within safe limits as defined in OSHA 1926 Subpart D.

50.9. For all welding and cutting operations, keep 35’ clear of combustibles in all directions.

50.10. Shield combustible flooring with wet sand, fire retardant tarpaulins or sheet metal. Clean the area of oily deposits and trash. Cover any storage or other combustibles that cannot be moved away. It is the responsibility of the TRADE PARTNER to provide, install and maintain welding blankets when conditions warrant their use. Block off any duct openings where sparks can spread.

SECTION 00 60 00
SAMPLE PRIME TRADE AGREEMENT

GENERAL

Included herein is a sample of the Pepper Construction Prime Trade Agreement. Upon trade package award, each Prime Trade Subcontractor will be issued the Prime Trade Agreement for the awarded trade package. Prime Trade subcontractors shall review and incorporate all terms and conditions of this Prime Trade Agreement. No modifications or alterations to this agreement will be accepted.

END OF SECTION 00 60 00

PRIME TRADE CONTRACT

This Contract is entered into this____day of_____, 20 between the Owner through its Construction Manager as its Agent:

OWNER INFORMATION **(“Owner”)** Phone: Fax: Attn:	**PEPPER CONSTRUCTION COMPANY** **Construction Manager and Agent (“Pepper”)** General Contractor License #TGC04179 Phone: Fax:

And
PRIME TRADE CONTRACTOR (“Contractor”) as **Contract No.**:

Attn:
Phone: Fax:

Location:

Project Name:

for Work at ("Project"):

And agree as follows: The Contractor shall furnish all labor, material, equipment, supervision and insurance as required to provide and fully complete all_____work (“Work”) for the above-referenced Project in strict accordance with the Contract Documents as further described in **Exhibit A**. This Work is to be performed for the_____price, including all applicable taxes, of_____and __/100 Dollars ($_____) ("Contract Price")**.** See Article 18, Miscellaneous Terms, for critical Exhibits and to determine if the Project is exempt from Retail Sales Tax.

This Prime Trade Contract must be signed and received in addition to submitting an acceptable Certificate of Insurance prior to working on site. This information must be submitted before any payouts or accounting functions may proceed.

The exchange of copies of this Prime Trade Contract and of signature pages by facsimile transmission (whether directly from one facsimile device to another by means of a dial-up connection or whether conveyed electronically by the worldwide web), by electronic mail in “portable document format” (“pdf”) form, or by any other electronic means intended to preserve the original graphic and pictorial appearance of a document, or by combination of such means, shall constitute effective execution and delivery of this Prime Trade Contract as to the Parties and may be used in lieu of the original Prime Trade Contract for all purposes. To that end, signatures of the Parties transmitted by facsimile and/or electronic format shall be deemed to be their original signatures for all purposes.

A COPY OF CONTRACTOR'S UP-TO-DATE INSURANCE CERTIFICATE MUST BE ON FILE WITH PEPPER’S SUPERINTENDENT AT THE JOBSITE PRIOR TO BEGINNING WORK ON THIS PROJECT. PLEASE SEE ARTICLE 11 AND **EXHIBIT C** FOR FURTHER INSTRUCTIONS**.** CONTRACTOR’S START WORK DATE ON THE JOBSITE IS_____. SEE PARAGRAPHS 1.3 AND 1.4 BELOW.

CONTRACTOR SHALL SUBMIT INVOICES BY THE 15th OF EACH MONTH. SEE PARAGRAPH 9.2, BILLING PROCEDURES.

BILLING, BONDING AND INSURANCE DETAILS:

Contract Dollar Value: Subject to retainage of % * (See Owner/Construction Manager Agreement or RFB for specific Retainage items)	Job No. - SubJob - Vendor # - Phase -	CGL INSURANCE (See Article 11 and **Exhibit C**) $_____Million Payment and Performance Bonds Required?(Y/N)– If yes, Premium is included in Contract Price.

EXECUTION OF THE AGREEMENT INDICATES THAT CONTRACTOR HAS READ AND UNDERSTANDS THE TERMS AND OBLIGATIONS OF THIS AGREEMENT AND THE ATTACHMENTS MADE A PART HEREOF THAT FOLLOW; EXECUTION IS REQUIRED BEFORE BEGINNING WORK ON THE JOBSITE.

	Pepper Construction Company as the Construction Agent for _____

By: _____	**By:** _____
Printed:	**Printed:**
Title:	**Title:**
Date:	**Date:**

PRIME TRADE CONTRACTOR OBLIGATIONS

By executing and returning the attached acceptance copy of this Prime Trade Contract Agreement, or if the acceptance copy is not executed and returned, by partial or complete performance under this Agreement, Prime Trade Contractor ("Contractor" or "Trade Contractor") agrees with Owner as follows:

1. General Terms

1.1 Project: The Project is generally described as_____.

1.2 Contract Documents. This Agreement includes: this Prime Trade Contract Agreement ("Agreement" or "Contract") and its exhibits listed in Article 18, below, any Project Labor Agreement for the Project to which Contractor is a party, and the Agreement between Owner and Pepper to the extent such terms and conditions pertain to the performance of Contractor's Work and other obligations necessary to fully complete such Work. A listing of the Contract Documents is found at **Exhibit A**, and Contractor's Scope of Work is found at **Exhibit B**.

1.3 Date of Commencement. The Date of Commencement of the Contractor's Work on the jobsite shall be_____. If such date is not specified, the Date of Commencement shall be the date of this Agreement, the date of the Letter of Intent or the date of the Notice to Proceed, whichever has occurred first. The Contractor shall act promptly in procuring and preparing necessary shop drawings, submittals, permits and licenses, as further described in Article 4, below, so as to not delay its date of Commencement of the Work.

1.4 Trade Contract Time. The Trade Contract Work shall be substantially completed on or before_____, subject to adjustments as provided for in the Contract Documents. If a Commencement Date is not stated above, the Work shall be substantially complete not later than_____(___) calendar days after commencement of its work on the jobsite, subject to adjustments provided by the Contract Documents. The Contractor is also to perform its Work in accordance with the Schedule as described in Paragraphs 3.1 and 3.2, below.

2. Parties to the Contract

2.1.1 Relationship of the Parties. Owner has selected Contractor to perform its Work pursuant to applicable laws. The Owner has directed Pepper to enter into this Agreement with the Contractor and has delegated full authority to Pepper, as the Construction Manager and representative of the Owner for this Project, to perform all of Owner's obligations and to exercise all of Owner's rights and powers under the terms of this Agreement.

2.2 Key Personnel and Communications. Contractor hereby agrees that key personnel assigned to the Project shall remain for the duration of this Work; reassignment or removal of said key personnel will require Pepper's approval. Pepper and Contractor shall each designate one or more persons who shall be their authorized representative(s). Such authorized representatives shall be the only person(s) the Contractor shall look to for instructions and orders, and the only person to whom Owner/Pepper shall issue instructions or orders, except in the case of an emergency. The Contractor shall also designate its Project Foreman at the job site as its Safety Representative.

Pepper's Representative:	Contractor's Office Representative:	Contractor's Safety Representative:
_____	_____	_____
411 Lake Zurich Road	_____	_____
Barrington, IL	_____	_____
40010	Phone:_____	Phone:_____
Phone: 847-381-2760	_____Fax:	_____Fax:
Fax 847-304-6510	_____	_____

Provide address and phone number for each if different from that shown at Page 1, above.

2.3 Assignments. Contractor shall not assign this Agreement, or portions thereof, without the prior written permission of Owner and Pepper. Contractor shall not sell or assign receivables acquired pursuant to this Agreement to any financial institution or third party; to do so is a material breach of this Agreement. A sale of a majority interest in Contractor shall be considered a default under this Prime Trade Contract Agreement.

2.4 Amendments. Once executed, this Agreement may only be amended in writing and executed by both parties.

2.5 Notices.

2.5.1 In performing the Work, Contractor shall give timely and proper notice as required by any federal, state and local authorities, with a copy to Pepper.

2.5.2 Written notice shall be deemed to have been duly served if delivered to the last business address known to the parties stated above in this Contract using one of the following methods:

2.5.2.1 in person to the individual or a member of the company or to an officer of the corporation for which it is intended;

2.5.2.2 by registered or certified mail;

2.5.2.3 by facsimile, with a hard copy to follow via U.S. Mail; or

2.5.2.4 by a private delivery service with tracking methods to confirm delivery.

3. Contract Time

3.1 Time. **TIME IS OF THE ESSENCE OF THIS CONTRACT!** Contractor shall supply a sufficient number of competent workers and shall cooperate with Pepper and other Prime Trade Contractors in the scheduling and performance of its Work. Contractor shall commence its Work upon notification from Pepper and will proceed toward completion in accordance with the Project Schedule ("Schedule") as described in **Exhibit E**, as established by Pepper, which may be adjusted from time to time to allow for proper coordination of all Trades' Work. Should Contractor fail to pursue or complete its Work in accordance with the Schedule, it hereby agrees to indemnify Owner and Pepper for any loss or damages caused by such delay, including all consequential damages suffered by Pepper as the result of such delay.

3.2 Schedule. Contractor is obligated to perform Work in accordance with the Schedule, as set forth at **Exhibit E**, as follows:

3.2.1 Contractor is required to prepare its detailed Schedule ("Detail Schedule") within the scope of the preliminary Project Schedule, so as not to impede the stated Project completion time.

3.2.2 Contractor's assistance and input, with detailed breakdown of Work items and duration for each, is required to develop an agreeable and accurate final Project Schedule. Contractor shall submit a statement outlining Start Date(s), a Completion Date and estimated times for delivery of the major components of its Work. Detail Schedules shall be in the form of a bar chart and indicate durations in weeks. The Detail Schedule shall indicate, in detail, the status and progress of Shop Drawings and submittals, fabrications, delivery and installation Start/Complete dates for various stages of Work. Contractor shall provide a Detail Schedule five (5) business days after being awarded the Work.

3.2.3 It is expressly understood that scheduling requirements may require temporary omissions and out of sequence Work as reasonably designated by Pepper's Superintendent. All "come back" Work required for this or other out of sequence Work, including re-mobilization, shall be completed on a timely basis at no additional cost to Owner/Pepper.

3.3 Progress Meetings.

3.3.1 Contractor shall designate a single representative assigned to the Project who will be responsible for attending meetings, monitoring schedules and coordinating all activities. Contractor's Representative shall have the authority to commit the Contractor to solutions and/or actions as agreed upon in these meetings.

3.3.2 Regularly scheduled Progress Meetings shall be held weekly, unless otherwise scheduled. It will be the responsibility of each Contractor to attend these meetings to determine the status of the Project and to report on the status of its Work.

3.4 Coordination. Contractor shall cooperate and coordinate its Work with all other Prime Trade Contractors and furnish them all details and information required for proper coordination of the Work. Contractor shall cooperate in scheduling activities in order that the Work of all parties can be completed on a timely basis and shall immediately advise Pepper of any interferences with its Work.

3.5 Excusable Delays. Extensions of time for delays not caused by the Contractor or not within the Contractor's control shall be strictly governed by the terms of the Contract Documents. Contractor must give Pepper notice of any potential delay within three (3) business days, or as otherwise stipulated within the Contract Documents, after such occurrence with an estimate of the additional time needed to overcome the delay. In no event will Contractor be entitled to any consideration for delays if it has concurrently delayed its own Work. If Contractor fails to give Pepper written notice of the excusable delay, the potential claim shall be deemed waived. The Contract Documents shall exclusively govern the Contractor's right to an increase in Contract Price or extension of time because of any excusable delay.

3.6 Overtime. When ordered in writing by Pepper, Contractor shall perform base Contract Work under this Agreement during overtime hours. In the event overtime work is required because of Contractor's own delays to the Project Schedule, *e.g.,* insufficient manpower or submitting Shop Drawings and other submittals too late for approval per the Project Schedule, no additional compensation will be granted. In the event overtime is required because of delays of others, Contractor shall only be compensated for the net increased labor costs.

4. Contractor's Responsibilities

4.1 Prime Trade Contractor. The Contractor, as an independent contractor, shall perform its obligations under this Contract using its best skill, care and diligence in the supervision and performance its Work according to the Contract Documents. Consistent with the Project Safety Requirements, as set forth at **Exhibit D**, the Contractor shall have complete responsibility and control over the performance of the Trade Contract Work, including construction means, methods, techniques, sequences and procedures for coordinating and completing its obligations under this Agreement.

4.2 Permits, Licenses and Prevailing Wage Act. In performing the Work, Contractor shall comply with all applicable laws and ordinances, including use of the most current statutory prevailing wage rates in effect for the location of the Project, and secure and pay for all necessary permits, licenses, inspections, tests and bonds required for the Work performed under this Contract. The general building permit will be obtained and paid for by others.

4.3 Examination of Site. Contractor warrants that it has visited and visually examined the Project site and general and local conditions

which could affect its Work. Contractor shall make no claim for extra Work on account of existing exposed site conditions or conditions of which it knew, or in the exercise of reasonable skill as a first-class contractor for this classification of Work, should have known.

4.4 Incomplete Details. The Work to be performed by the Contractor includes that Work specifically set forth in this Agreement, as well as any and all other work reasonably inferable from the work indicated by the Contract Documents. The Contractor shall take all field measurements necessary to perform its Work. Neither the Owner nor Pepper makes warranty, expressed or implied, as to the sufficiency of the Construction Documents furnished by the Owner. The Contractor shall furnish all required samples and Shop Drawings in order to ensure that the Contractor's Scope of Work is complete in every detail and free from any gaps, duplications, or omissions.

4.5 Layout and Engineering. All Prime Trade Contractors will perform layout and engineering, as required to complete the Work within the scope of their respective Agreements, from vertical and horizontal principal control lines and grades established by Pepper.

4.6 Shop Drawings and Submittals. Contractor shall promptly submit Shop Drawings, Product Data, Samples and similar submittals required by the Contract Documents with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of Pepper or other Prime Trade Contractors. Contractor shall be responsible to Owner/Pepper for the accuracy and conformity of its submittals to the Contract Documents. The review and/or approval of any Contractor submittal shall not be deemed to authorize deviations, substitutions or changes in the Contract Document requirements unless express written approval is obtained from Owner/Pepper, specifically authorizing such deviation, substitution or change.

4.7 Daily Reports. Each Contractor will submit a daily report to Pepper's Superintendent for each day Contractor is working on the Project. The daily report should state:

A. The number of tradesmen that worked;
B. The positions of those tradesmen;
C. The number of hours each tradesmen worked;
D. The specific hours each tradesman worked;
E. The shift worked by each tradesmen: 1st,2nd, or 3rd;
F. A brief description of the day's activities;
G. A two-day look ahead for scheduling purposes;
H. Any inspections, problems or otherwise pertinent information; and
I. Accidents that occurred during the day, if any.

4.8 Material Delivery. Material delivery to the jobsite shall be handled in accordance with the following:

4.8.1 Cost of all shipping of materials, freight to the jobsite and insurance of same to be the responsibility of the Contractor.

4.8.2 Contractor must notify Pepper's on-site Superintendent forty-eight (48) hours prior to delivering any materials. Copies of the delivery ticket will be stamped, showing the actual time and date shipment was received.

4.8.3 Each shipment of material shall contain a packing slip with the correct nomenclature of contents; the box or carton containing this information must be so marked. At the time of shipment, one (1) copy of said packing slip shall be forwarded to the destination of shipment to alert Pepper's Superintendent as to what material is in transit so that arrangements can be made at least forty-eight (48) hours in advance to receive, allocate and store said material.

4.8.4 If Contractor fails to adhere to the foregoing notification and other requirements, Pepper reserves the right to refuse, warehouse, or return to the carrier the shipment in question. All related costs incurred by Pepper, *e.g.,* handling, storage, protection, etc., will be borne by Contractor.

4.9 Hoisting and Scaffolding. Contractor agrees to be solely responsible for all hoisting of materials and all scaffolding necessary for the performance of its own Work unless otherwise stated. Unless expressly provided for in Contractor's Scope of Work, no provisions for hoisting or scaffolding will be provided by Pepper. Any scaffolding or hoisting equipment used by Contractor must conform to all local code requirements including, but not necessarily limited to, those of state and federal OSHA. All cranes employed by Contractor shall have maintenance logs current as of the date on the jobsite. All logs shall be readily available for review by Pepper upon request.

4.10 Dewatering. Contractors who are performing excavation, trenching, utility and/or concrete work are responsible for keeping their excavations free of water during construction.

4.11 Cutting and Patching. Contractor shall perform cutting, patching, fire safing and caulking, as required to complete the Work within the Scope of its respective Contract.

4.12 Testing. Contractor will be responsible for costs of retesting and correcting or replacing Work that fails the Owner/Pepper's testing or that of local authorities, as well as all costs incurred by other Trades whose Work is delayed or damaged due to the failure of Contractor's Work to meet inspection and test requirements.

4.13 Environmental Compliance. Contractor agrees to comply with pollution and environmental protection regulations for the use of water and other services. Contractor further agrees to discharge waste and storm water drainage from the Project site and to comply with any "Environmental Impact" commitments that may have been made by the Owner in securing approval to proceed with construction of this Project. All waste materials and substances (*e.g.*, solvents, cleaners, waste oils, etc.) shall be handled and/or disposed by Contractor in full compliance with all applicable federal, state and local statutes, regulations, ordinances and rules.

4.14 Cleanup. Contractor must provide cleanup and disposal of debris resulting from its Work on a daily basis in order to keep the Project clean, orderly and hazard free. Material will be placed in dumpsters provided by Pepper. Location of dumpsters will be at

Pepper's discretion.

Upon completion of Work and prior to leaving the site, Contractor must receive approval and acceptance by Pepper that all final cleanup requirements have been met and that the area is ready for final inspection. When directed in writing in the field by Pepper's Superintendent, Contractor agrees to cleanup all debris attributable to its Work within twenty-four (24) hours' notice for any given

work area, or accept the appropriate back charges for cleanup performed by Pepper or other contractors which will be billed to Contractor on a monthly basis no later than the following month in which the charges are incurred.

4.15 Protection of Work. Contractor shall take reasonable precautions for safety of and shall provide reasonable protection to prevent damage, injury, or loss to:

4.15.1 employees on the jobsite and other persons who may be affected;

4.15.2 the Work, materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor or Subcontractors; and

4.15.3 other property at the site or adjacent thereto, such as trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property as described above caused in whole or in part by the Contractor or its Subcontractor, or anyone directly or indirectly employed by any of them, or by anyone for whose acts they may be liable and for which the Contractor is responsible, except damage or loss attributable to acts or omissions of the Owner, Architect, Pepper or anyone directly or indirectly employed by them, or by anyone for whose acts they may be liable and not attributable to the fault or negligence of the Contractor.

4.16 Punch List. Contractor will give written notification upon completion of the punch list.

4.17 As-Built Documents & Operations Manuals. Contractor is required to maintain an up-to-date set of As-Built Drawings at all times. At the completion of Contractor's Work, Contractor will provide to Pepper the number of copies of As-Built Drawings that are required per the Contract Documents and one (1) additional copy for Pepper's use. Contractor shall provide copies of Owner's Operational/Instructional/Maintenance Manuals and training materials as required by the Project Specifications.

4.18 Payment and Performance Bonds. If required by the Request for Bid, Contractor shall furnish to Owner, within__ days after selection of Contractor as the lowest responsive and responsible bidder, and maintain throughout the Project, a 100% Payment and Performance Bond from a surety company acceptable to Owner. If not otherwise specified, the surety shall be A.M. Best-rated A/X or better. The Performance Bond shall include a Dual Obligee Rider naming both the Owner and Pepper as obligees. The Payment Bond shall include, among other things, a provision that will guarantee the faithful performance of the prevailing wage clause, as set forth at Paragraph 9.1, below, and pursuant to applicable laws.

4.19 Indemnity Bonds. Consistent with applicable law, in the event that Owner receives a notice or claim of non-payment from a Subcontractor or material supplier under contract with the Contractor, Owner shall have the right to require the Contractor to bond over the claim in an amount equal to One Hundred Seventy-Five percent (175%) of its amount. Should Pepper or Owner determine that Contractor is not justified in refusing to pay the claim, after three (3) days' written notice to Contractor, Owner shall have the right to pay a sum sufficient to discharge such claim or obligation and charge the same against any amount owed Contractor. Pepper shall also have the right to require Contractor to furnish and pay for an indemnity bond in an amount not less than One Hundred Seventy-Five percent (175%) of (a) the sum of any final lien waivers the Contractor fails to provide or (b) the amount of any unjustified claims. Provided payment is made for Work properly performed, Contractor agrees to defend, hold harmless and indemnify Owner and Pepper against all loss, damages, judgments and expenses (including attorneys' fees), which Owner or Pepper may sustain in connection with any claim.

4.20 Taxes. The Owner is not subject to the payment of Retailer's Occupational Tax or any other state sales or use tax. Such exemption, however, does not apply to tools, machinery, equipment or other property leased by the Contractor, or to supplies and materials that, even though consumed, are not incorporated into the completed Project. The Contractor shall be responsible for and pay all applicable taxes, including sales and use taxes, on such leased tools, machinery, equipment or other property, and upon unincorporated supplies and materials. Tax Exempt Letter attached at **Exhibit F**.

4.21 Price Escalation. This Agreement includes any and all price escalation throughout the duration of the Project.

4.22 Laws. This Agreement shall be governed by the law of the Project location. Laws include, but are not limited to, laws, ordinances, regulations, rules and orders of public authorities. The Contractor agrees to be bound by, and at its own cost, comply with all federal, state and local laws applicable to the Trade Contract Work, including, but not limited to, equal employment opportunity, minority business enterprise, women's business enterprise, disadvantaged business enterprise, and all others required by the Contract Documents or as may be set forth in the Request for Bid. The Contractor shall be liable to Owner/Pepper for all loss, cost and expense attributable to any failure of the Contractor, its employees, agents, and Subcontractors to comply with such laws, including, but not limited to, fines, penalties or corrective measures.

4.23 Performance. Pepper's failure to require strict performance of any provision of this Agreement shall not constitute a waiver of its right to require strict performance in the future.

5. Scope of Work

The Scope of Contractor's Work shall include, but not necessarily be limited to the following:
See Scope of Work, attached hereto at **Exhibit B.**

6. Subcontractors

6.1 Subcontracts. Contractor agrees not to subcontract more than five percent (5%) of this Contract without the prior written consent of Pepper. For all proposed Subcontracts in excess of five percent (5%), Contractor shall furnish to Pepper an AIA Document A-305 or equal Contractor's Qualification Statement, not less than five (5) working days prior to final execution of any Subcontract. In

accordance with the Contract Documents as defined in Article 1, above, Contractor agrees it shall not contract with any such proposed person or entity to which the Owner, Pepper or the Architect has a reasonable objection.

Contractor agrees that any part of Work performed for the Contractor by an approved Subcontractor shall be pursuant to a written Subcontract between the Contractor and each Subcontractor. Said written Subcontract shall contain provisions that:

6.1.1 Require the Work be performed in accordance with the requirements of these Contract Documents;

6.1.2 Require the Subcontractor to carry and maintain liability insurance coverage in accordance with these Contract Documents;

6.1.3 Require the Subcontractor to agree to the Construction Schedule as outlined and/or detailed in Paragraph 3.2, above; and

6.1.4 Require the Subcontractor to provide waivers and other required billing materials as set forth in Paragraph 9.2, below.

6.2 Payment/Waivers. Upon receipt of payment, Contractor shall promptly disburse from such payment, in exchange for waivers, the sums due and owing to any Subcontractor and/or material supplier for their Work included in payment to Contractor. Waivers must be supplied for Subcontractors and/or material suppliers at the time they are listed in the “This Payment” section of the affidavit provided with the waiver.

6.3 Labor Harmony. The Contractor shall (and shall expressly require in writing any of its Subcontractors, to) employ only field labor and tradesmen to perform Work on the site whose presence on the jobsite will not result in strikes, work stoppages, picketing, or other labor disputes with any other field labor and tradesmen present on the Project site. The Contractor shall manage its work force so as to avoid labor disputes with its own or other Trades on the job, and shall keep current in the payment of all wages and benefits required to be paid to or on behalf of its employees working on the job under any collective bargaining agreements or trust agreements to which it is signatory. The diligent progress of the Work is of the essence and Contractor’s violation of this Paragraph shall be a material breach of this Agreement.

7. Changes in the Work

7.1 Change Orders. When Pepper so orders in writing, the Contractor shall make any and all changes in the Work that are in the general Scope of this Agreement. Adjustments in the Contract Price or Contract Time, if any, resulting from such changes, shall be set forth in a Contract Change Order pursuant to the Contract Documents. No adjustment shall be made for any changes performed by the Contractor that have not been ordered in writing by Pepper.

7.2 Contractor Notification. As additional information or revisions are provided by the Owner, Pepper or Architect, the Contractor shall review such information for inclusion of its Work and notify Pepper within ten (10) working days of any cost or schedule changes to the Contract. If no response is received from Contractor within this time frame, it will be assumed that no additional costs or time extensions will apply. Any changes which are made without prior written authorization of Pepper's Project Manager will be done at Contractor's own risk and payment for such changes is not guaranteed. All revisions causing potential cost increases to the Contractor must be approved prior to commencement of said Work.

7.3 Compensation. Compensation for extra work shall be by one or more of the following methods at the option of Owner/Pepper:

A. Unit prices contained in the Scope of Work;

B. Alternate prices contained in the Scope of Work;

C. Negotiated Lump Sums;

D. Negotiated unit prices; or

E. Cost plus compensation. In the case of cost plus compensation, costs shall be defined as and specifically include the following: cost of materials, including sales tax and cost of delivery; cost of labor in the field, including social security, old age and unemployment insurance; Workers’ Compensation and general liability costs; bond premiums; and rental value of the power tools and equipment at rates not to exceed those contained in the current edition of the Associated Equipment Distributors Construction Equipment Rental Rates.

7.4 Change Order Overhead and Profit.

7.4.1 Change Order overhead and profit shall include the following: costs to prepare estimates or Shop Drawings; wages of Superintendents, Project Managers, non-working foremen (unless specifically included in the Scope of Work), timekeepers, watchmen and clerks; hand tools, incidentals, general office expenses; interest expense; warranty expense; and all other expenses not included in "costs" as defined above.

7.4.2 Unless otherwise stipulated, the following percentages for overhead and profit shall be added to approved costs:

7.4.2.1 For any Work performed by Contractor's own forces: 10% for overhead and 5% for profit.

7.4.2.2 For Work performed by Contractor’s Subcontractor: 10% for overhead and 5% for profits due to the Subcontractor, plus 5% Fee due to the Contractor.

7.5 Change Order Proposals. To facilitate checking of quotations for extras or credits, all proposals must be accompanied by complete itemization of cost including labor, materials, equipment and Subcontractors.

7.6 Field Changes. For field changes, time and material tickets signed by the Pepper Superintendent at the jobsite are to be retained to verify actual hours worked, and materials and equipment used; such tickets must be signed within twenty-four (24) hours of completing the Work. The verification that the Work is additional work outside of the contractual Scope is subject to approval by Pepper's Project Manager. No changes will be approved without such itemization.

7.7 Pending Change Request Log. A Pending Change Request Log shall be submitted electronically by the Contractor to the Pepper Project Manager at the time of each monthly Application for Payment submission. Such Log shall identify any outstanding change requests ("CRs") as well as correlating CR date, description, dollar value and the status of the Change Request. Receipt of such Log does not imply acknowledgement or approval of identified CRs, but rather that such CRs have been submitted for review. CRs are finalized when incorporated into Contractor's Contract via Change Order. Change Order pricing must be in accordance with the Contract. Monthly progress payments may be delayed or withheld by Pepper if such Pending CR Log is not timely provided by Contractor to Pepper.

7.8 Concealed Site Conditions. If conditions are encountered at the Project site that are: (1) subsurface or other physical conditions which differ materially from those indicated in the Contract Documents; or (2) unknown physical conditions of an unusual nature, which differ materially from those ordinarily found to exist and generally recognized as inherent in construction and activities in the area of the Project, written notice by the observing party shall be given to the other party promptly before conditions are disturbed and in no event, later than two (2) days after first observance of such conditions. Unless otherwise provided for in the Contract Documents, equitable adjustment to the Prime Trade Contract Price and Time shall be made by Change Order.

8. Jobsite

8.1 Access/Parking. The use of and access to the site shall be restricted to those areas and limited to those temporary roads authorized and designated by Pepper's on-site Superintendent. Parking on the jobsite is restricted to company vehicles and equipment only if allowed by Pepper's Superintendent. Contractor's employees shall park in designated areas.

8.2 Jobsite Offices/Storage. The Project site may have limited space available for storage; therefore, any on-site storage will require prior approval of Pepper's Superintendent. Contractors' jobsite trailers, materials, tools and equipment may be stored on the jobsite at locations approved by Pepper and must be removed or relocated when directed. Contractor shall use, for this purpose only, the minimum space that is absolutely required for proper performance of the Work. Any damage or losses resulting from storage of material, tools and equipment shall be remedied at the cost of the Contractor. Each Prime Trade Contractor shall be responsible for erection, dismantling, maintenance, utilities, security, etc., that it may deem necessary in setting up its trailers, sheds and storage area.

8.3 Temporary Facilities.

8.3.1 Contractor may establish a temporary office at the jobsite; the exact size and location of said facilities shall be subject to the approval of Pepper's Superintendent. The temporary office, along with any electrical, telephone or similar service for such field office, shall be the responsibility of the Contractor. As the Work progresses, Contractor agrees to relocate and/or remove said facilities upon seventy-two (72) hours written notice from Pepper's Superintendent.

8.3.2 Temporary facilities furnished by Pepper for Contractor's use on the site shall be limited to the following:

8.3.2.1 Temporary sanitary services for Contractor's personnel.

8.3.2.2 Temporary non-potable water service only after the permanent tap is made at water main. Water will be available at a minimum of one location, adjacent to the construction area. It shall be the Contractor's responsibility to provide hook-ups and extensions as required and to coordinate with Pepper's on-site Superintendent.

8.3.2.3 Temporary power and lighting for the building shall be specific to OSHA standards and provided by the Electrical Trade Contractor for all Prime Trade Contractors' use. If special or additional services are required, arrangements through Pepper's on-site Superintendent will be necessary. However, the contractual relationship shall be directly between the on-site Electrical Trade Contractor and Contractor.

8.3.2.4 Temporary power will be limited to 120-volt, single-phase temporary electric service in the construction area only after temporary or permanent power is established on the jobsite. If temporary power is not available or is insufficient for the Contractor, the Contractor shall furnish generators at its expense. The Contractor shall be required to provide extension cords for all power tools.

9. Wage Scale and Payments

9.1 Prevailing Wage Requirements.

9.1.1 Not less than the prevailing rate of wages for work of a similar character in the locality of the Project, as determined by the Illinois Department of Labor, shall be paid to all laborers, workers and mechanics performing Work under this Contract. Contractor shall comply with all requirements of the Illinois Wages of Employees on Public Works Act.

9.1.2 It shall be mandatory upon Contractor to cause to be inserted into each lower tiered subcontract and into the Project Specifications for each lower tiered subcontractor a stipulation to the effect of this Paragraph 9.1.

9.2 Billing Procedures. The following terms and conditions are an integral part of this Contract. Please direct any billing questions to

Pepper's Accountant for this Project,_____at_____and____@pepperconstruction.com.

9.2.1 **PEPPER CONSTRUCTION COMPANY IS ONLY ABLE TO PROCESS INVOICES THROUGH ITS ACCOUNTING SYSTEM AFTER THE CONTRACT AGREEMENT HAS BEEN SIGNED WITHOUT ALTERATION AND RETURNED TO PEPPER, INCLUDING APPROPRIATE INSURANCE AND SAFETY DOCUMENTATION**.

9.2.2 CHANGES TO CONTRACTOR'S AGREEMENT CANNOT BE BILLED UNTIL A FORMAL CHANGE ORDER HAS BEEN RECEIVED BY CONTRACTOR FROM AN AUTHORIZED REPRESENTATIVE OF PEPPER CONSTRUCTION COMPANY AND EXECUTED BY BOTH CONTRACTOR AND PEPPER. ONCE APPROVED, CHANGES SHOULD NOT BE SEPARATELY BILLED, BUT SHOULD BE INCLUDED IN CONTRACTOR'S MONTHLY BILLING AT THE REVISED CONTRACT AMOUNT.

9.2.3 All billings for materials delivered or Work completed will be done per the Pepper billing procedures. The affidavit, a sample of which is attached, **must** accompany **all** invoicing or Contractor's invoice will be returned unprocessed. See the attached Affidavit Completion Requirements for instructions. All amounts to be billed must be approved before requisitions or billings are submitted. Payments received from Owner shall be held for Contractor's account and promptly disbursed according to the terms of this Agreement.

9.2.4 Applications for Payment for Work performed and accepted by Owner and Pepper shall include one (1) copy of the following:

9.2.4.1 Affidavit which must include values for subcontractors in the "Amount of This Request" column at the time the subcontractors are listed in the "Completed This Period" column of the Schedule of Values;

9.2.4.2 Application and Certificate for Payment signed and notarized (AIA G702);

9.2.4.3 Schedule of Values (AIA G703) in format approved by Pepper;

9.2.4.4 Signed documents for stored material, as required by Owner; and

9.2.4.5 Pending Change Request Log, submitted electronically, identifying outstanding Change Requests ("CRs"), as well as correlating CR date, description, dollar value and status of the Change Request, as further described at Paragraph 7.7, above.

9.2.5 Applications for Payment for Work performed and accepted by Owner and Pepper shall include three (3) Partial or Final Waivers of Lien, as appropriately required, including waivers from all Subcontractors and material suppliers listed in the "This Payment" section of the Contractor's Affidavit provided within the Waiver, and for further lower tiers upon request.

9.2.6 All invoice packages must be received no later than the 15th day of the month for Work performed, as projected, from the first to the last day of the month. Invoice packages not received by this deadline WILL NOT be processed until the following month.

9.2.7 Unless the Owner requires current Waivers of Lien with each Application for Payment, upon Pepper's receipt of payment from the Owner, Contractor will be contacted with the correct information to be included in the Waiver of Lien. The Waiver and Affidavit format to be used shall be that attached hereto, unless otherwise specified by Owner, to ensure that Contractor has paid all parties furnishing any labor, material, or services in furtherance of any Work furnished hereunder. If required by Pepper, the furnishing of such lien waivers and releases shall be a condition precedent to any payment hereunder unless the Owner's refusal to pay is due to a material breach by Pepper of its Agreement with the Owner unrelated to the Work of the Contractor. Moreover, no prior failure of Pepper to require such releases and waivers shall limit Pepper's right to subsequently require them.

9.2.8 Accordingly, Contractor is intended to assume the risk of Owner's non-payment under the circumstances set forth herein. Owner's payment to Pepper of public funds is a condition precedent to Pepper's obligation to pay Contractor unless the Owner's refusal to pay is due to a material breach by Pepper of its Agreement with the Owner unrelated to the Work of the Contractor. When payment to Contractor is received from Owner, and provided the billing and insurance requirements have been met as required under this Contract, all payments by Pepper for Contractor's Work accepted by Owner shall be made in the net amount of its request within two (2) business days of receipt of Owner's payment.

9.2.9 Contractor shall, as often as requested by Pepper, furnish such information, evidence, and substantiation as Pepper may require with respect to the extent and value of the current progress of Contractor's Work. Contractor shall also furnish, upon request, similar detail regarding the nature and extent of all obligations incurred by Contractor in connection with the Work and all payments made by Contractor on account thereof.

9.2.10 At the time the Final Waiver is required, it shall be in the full amount of the adjusted Contract Price.

9.2.10.1 Retainage shall be held as indicated on Page 1, above, and paid to Contractor after approval and acceptance by Owner or Pepper and upon payment by Owner to Pepper.

9.2.10.2 The Affidavit must accompany all invoicing or Contractor's invoice will be returned unprocessed. All amounts to be billed must be approved before the billings are submitted.

9.2.11 In the event Contractor suffers financial distress as described in Paragraph 14.1, below, Pepper, on Owner's behalf, may pay Subcontractors or material suppliers directly or tender payment jointly to Contractor and lower tiers.

9.3 Accounting Records. Contractor shall make and keep, for a period of not less than three (3) years, true and accurate records of the name, address, telephone number (when available), last four (4) digits of the Social Security number and labor classification of all laborers, workers, and mechanics employed by them in connection with the Project. The records shall also show actual hourly wages paid in each pay period to each employee and the hours worked each day in each work week by each employee. While performing the Work of this Agreement, Contractor's payroll records shall include the starting and ending times of work for each employee. Such records shall be open at all reasonable hours to the inspection of the Owner, consistent with applicable law.

9.4 Off Site Materials. Unless expressly made a part of the Scope of Work for this Agreement or approved in advance in writing, the cost of construction work completed does not include materials or equipment stored off the site.

9.5 Contractor and its lower tier subcontractors shall be solely responsible for and make all contributions or payments required to be made to any health and welfare, pension, vacation, apprenticeship, training or other fringe benefit or employee benefit program or trust with whom Contractor or its lower tier subcontractors are affiliated (collectively, a "Trust") within thirty (30) days from receipt of payment from Pepper. As a condition precedent to any progress payment, Pepper shall have the right to:

A. require lien waivers and other certification of payment and confirmation (such as a letter of good standing), for the benefit of Pepper that Contractor and its lower tier subcontractors are current (within thirty (30) days) in making all contributions or payments to a Trust;
B. require Contractor to submit payroll reports on a weekly basis, in form and substance as required by Pepper, signed and attested to by a duly authorized officer of the Contractor (a "Certified Payroll Report"); and/or
C. pay a Trust directly as part of a progress payment.

10. Safety Regulations

A Pepper representative is required to be on site any time Work is being performed by the Contractor. The Contractor, its agents, employees, Subcontractors and materialmen will comply with all laws, ordinances, and industry standards applicable to the performance of its Scope of the Work on the Project in a safe and responsible manner. In particular, Contractor shall, at its own expense, conform to the safety policies and regulations established by Pepper as listed within this Agreement and within the "Trade Partner Safety Handbook", set forth at **Exhibit D**, and shall comply with all specific safety requirements promulgated by any government authority, including, without limitation, the requirements of the Occupational Safety and Health Act of 1970, the Construction Safety Act of 1969, and all standards and regulations which have been or shall be promulgated by the parties or agencies which administer the Acts.

The Trade Partner Safety Handbook, Exhibit D, may be accessed at www.pccsafety.com,
If for any reason Contractor is unable to access the Trade Partner Safety Handbook, contact the Pepper Project Manager.

Contractor shall comply with said requirements, standards, and regulations and require and be directly responsible for compliance therewith on the part of its agents, employees, Subcontractors, and materialmen and shall directly receive, respond to, defend and be responsible for all citations, assessments, fines or penalties which may be incurred by reason of its failure on the part of its agents, employees, Subcontractors or materialmen to so comply.

10.1 Contractor Safety Plan. The Contractor must develop a site-specific pre-job safety plan outlining any hazards and the procedures it will use to eliminate those hazards. Contractor will review its plan with Pepper's field supervisory personnel and crews. This plan is to be submitted to the Pepper Superintendent at least two (2) weeks prior to commencing Work.

10.2 Drug & Alcohol Policy. The Contractor's field personnel assigned to this Project, including Subcontractors of the Contractor, will abide by the Pepper **Drug & Alcohol Policy** as further detailed in the Trade Partner Safety Handbook. In addition, Contractor will commit to no drug or alcohol use by its employees over the lunch period or any other break time. Contractor agrees to remove from the jobsite any of its employees or Subcontractor employees who violate this policy.

10.3 Accident Report. Contractor shall report immediately to Pepper any injuries suffered by its employees or any injuries to other persons or property damage arising out of its operation. Pepper shall be furnished one (1) copy of the written accident report within twenty-four (24) hours of the injury or damage.

10.4 Protective Equipment. Contractor will equip its personnel with all necessary personal protective equipment required by law or Pepper. This includes, but is not limited to, hard hats, eye protection, foot and hand protection, ear protection, fall protection and respiratory protection.

10.5 Ground Fault Circuit Interrupters. Contractor will assure protection of all of its employees when using electric power equipment by utilizing Ground Fault Circuit Interrupters **at all times**. As supplemental protection, the Assured Equipment Grounding Program may be implemented. All branch circuit conductors shall be permitted only within cable assemblies or be multi-conductor cord or cable of a type identified for *hard usage or extra hard usage*. NEC Table 400-4 lists "hard" and "extra hard" usage wire types.

10.6 Scaffolds and Ladders. All of the Contractor's scaffolds and ladders shall be in accordance with all required safety regulations and manufacturers' requirements.

10.7 Fall Protection. Contractor will comply with all applicable standards contained within OSHA's Construction Industry Regulations, Subpart M. With regard to steel erection and decking, Contractor and its employees shall comply with **specific fall protection guidelines**, as contained within the Pepper Trade Partner Safety Handbook and within the Instructions to Bidders. In addition, those Contractors engaged in the steel erection process will comply with all requirements of the revised Subpart R Standard, except where the requirements of Pepper's Trade Partner Safety Handbook are more stringent. In such cases, the Contractor will abide by the stricter standard.

10.8 Safety Policies. Contractor agrees to require all of its employees and Subcontractor's employees to abide by OSHA regulations and Pepper's Trade Partner Safety Handbook, **Exhibit D,** on all Pepper Projects. Contractor shall provide training to all its employees of the possible hazards associated with the tasks each employee performs and each employee must know and understand all of these safety regulations. Prior to entering the jobsite, **ALL PERSONS** performing Work must attend the Pepper jobsite safety orientation training.

10.9 Jobsite Orientation. Contractor's employees are required to attend Pepper's Jobsite Orientation prior to beginning Work at the site. Contractor shall coordinate and schedule the orientation with Pepper's Superintendent in a timely manner for all personnel for this

Project. This mandatory orientation consists of a general safety orientation and a Project-specific orientation for each person entering the jobsite.

10.10 OSHA Training. Contractor shall ensure that its jobsite Supervisor has completed the thirty (30) hour OSHA Construction Safety Course and Contractor shall provide Pepper with certification of such training prior to start of its Work.

10.11 Daily Task Hazard Analysis. Contractor shall perform a daily task hazard analysis and provide documentation of the same to the PEPPER Superintendent.

10.12 Tool Box Safety Meetings. Contractor will hold weekly Tool Box Safety Meetings, led by its jobsite Supervisor. Minutes of the Tool Box Safety Meetings, as well as a signature sheet of all attendees, are to be turned in to the Pepper jobsite Superintendent weekly.

10.13 First Aid. Contractor must provide first aid equipment to be made accessible to its employees.

10.14 Hazardous Materials.

10.14.1 Contractor agrees to submit all necessary Safety Data Sheets, SDS-OSHA Form 20 or equivalent, for all hazardous substances introduced on the jobsite and shall inform Pepper's office prior to its introduction to the jobsite. Contractor must be in compliance with the OSHA Hazard Communication Standard 1926.59. It is imperative that the Material Safety Data Sheets be on file in Pepper's office prior to Contractor's starting Work on the site.

10.14.2 Should Contractor encounter existing asbestos, polychlorinated biphenyl (PCB) or other hazardous substances at the site which potentially are harmful to persons or property, Contractor shall take all actions required by the Contract Documents and by law to protect persons and property from injury or damage, including stopping the Contractor's Work in the affected areas and immediately notifying the Owner/Pepper verbally, and shortly thereafter in writing.

10.14.3 Should Contractor be required to stop its Work as a result of existing hazardous materials located at the jobsite, Contractor shall not resume its Work in the affected area until the hazardous substances have been removed or rendered harmless or the Owner/Pepper and Contractor agree in writing to commence Work in all or a portion of the area.

11. Insurance

11.1 Insurance Requirements. Contractor shall maintain, at its own expense, during the progress of the Work and throughout the warranty period, all insurance coverages as required in the attached Insurance **Exhibit C - Non-CCIP** [or in the event of a CCIP, **Exhibit C – CCIP**]. Pepper reserves the right to implement a Contractor Controlled Insurance Program ("CCIP") in Pepper's sole discretion, for the provision of Commercial General Liability and Umbrella Liability coverages for the Project. In the event a CCIP is implemented, Contractor shall credit against the Prime Trade Contract Price the actual cost of insurance not required from the Contractor for the Project, and shall comply with and maintain all other insurance as set forth in **Exhibit C – CCIP.**

11.2 Contractor's Tools and Equipment. Contractor shall assume all risks and liability for damage or loss to all materials, tools or equipment not incorporated in the Work and which belong to it or are under its care, custody or control.

11.3 Indemnification. To the fullest extent permitted by law, the Contractor shall defend, indemnify and hold harmless the Owner, Pepper, the Architect and others required in the Contract Documents and their agents, other employees and invitees, from and against first- and third-party claims, damages, losses and expenses, including by not limited to, attorneys' fees ("Claims"), arising out of or resulting from: 1) Contractor's performance of or failure to perform its obligations under this Contract; 2) defective workmanship or materials; 3) bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), including loss of use resulting therefrom, but only to the extent caused by acts or omissions of the Contractor, or anyone directly or indirectly employed by Contractor or anyone for whose acts Contractor may be liable; 4) fines, penalties and other charges levied against the Project by any governmental entity or authority having jurisdiction as the result of Contractor's acts or omissions; 5) mechanics lien and bond claims asserted by Contractor or its suppliers or lower tier subcontractors or suppliers; 6) patent, trademark, copyright or trade dress infringement Claims arising out of Contractor's Work; and 7) claims for wages or benefits by employees of Subcontractor or Sub-subcontractors. This indemnification shall not be limited in any way by any limitations on the amount or type of damages, compensation or benefits payable by or for the Contractor under Workers' Compensation, disability benefit or other employee benefit acts and shall survive the Completion and the final payment of this Contract.

Contractor further agrees to obtain, maintain, and pay for such insurance as will insure the provisions of this Paragraph 11.3.

12. Warranties

Contractor shall provide a separate written warranty in triplicate at the time of final billing, guaranteeing its Work against defects in materials and/or workmanship for the period required in the Specifications. If required by the Contract Documents and Request for Proposal, Contractor shall also provide a Manufacturer's Warranty for installed materials and equipment. All warranties shall meet the express terms and conditions required under the provisions of the Contract Documents for the period called for in the Specifications or, if not specified, for twelve (12) months from acceptance of Project by Owner. Contractor shall promptly repair or replace any such defects occurring within the warranty period without cost or liability to Owner or Pepper.

13. Equal Employment Opportunity

During the performance of this Contract, the **Contractor shall incorporate the requirements of 41 C.F.R. §§60-1.4(a)(7), 60-250.5 and/or 60-300.5, 60-741.5, EO 13496 and 29 C.F.R. part 471, Appendix A to Subpart A, if applicable,** and agrees as follows:

13.1. Non-Discrimination.

13.1.1 The Contractor will not discriminate against any employee or applicant for employment because of race, color, religion, sex, or national origin. The Contractor will take affirmative action to ensure that applicants are employed, and that employees are treated during employment, without regard to their race, color, religion, sex, or national origin. Such action shall include, but not be limited to the following: employment, upgrading, demotion, or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in

conspicuous places, available to employees and applicants for employment, notices to be provided by the contracting officer setting forth the provisions of this nondiscrimination clause.

13.1.2 The Contractor will, in all solicitations or advertisements for employees placed by or on behalf of the Contractor, state that all qualified applicants will receive consideration for employment without regard to race, color, religion, sex, or national origin.

13.1.3 The Contractor will send to each labor union or representative of workers with which it has a collective bargaining agreement or other contract or understanding, a notice to be provided by the agency contracting officer, advising the labor union or workers' representative of the Contractor's commitments under section 202 of Executive Order 11246 of September 24, 1965, and shall post copies of the notice in conspicuous places available to employees and applicants for employment.

13.1.4 The Contractor will comply with all provisions of Executive Order 11246 of September 24, 1965, and of the rules, regulations, and relevant orders of the Secretary of Labor.

13.1.5 The Contractor will furnish all information and reports required by Executive Order 11246 of September 24, 1965, and by the rules, regulations, and orders of the Secretary of Labor, or pursuant thereto, and will permit access to his books, records, and accounts by the contracting agency and the Secretary of Labor for purposes of investigation to ascertain compliance with such rules, regulations, and orders.

13.1.6 In the event of the Contractor's noncompliance with the nondiscrimination clauses of this Contract or with any of such rules, regulations, or orders, this Contract may be canceled, terminated or suspended in whole or in part and the Contractor may be declared ineligible for further Government contracts in accordance with procedures authorized in Executive Order 11246 of September 24, 1965, and such other sanctions may be imposed and remedies invoked as provided in Executive Order 11246 of September 24, 1965, or by rule, regulation, or order of the Secretary of Labor, or as otherwise provided by law.

13.1.7 The Contractor will include the provisions of Subparagraphs 13.1.1 – 13.1.6, above, in every Subcontract or purchase order unless exempted by rules, regulations, or orders of the Secretary of Labor issued pursuant to section 204 of Executive Order 11246 of September 24, 1965, so that such provisions will be binding upon each Subcontractor or vendor. The Contractor will take such action with respect to any Subcontract or purchase order as may be directed by the Secretary of Labor as a means of enforcing such provisions including sanctions for noncompliance: Provided, however, that in the event the Contractor becomes involved in, or is threatened with, litigation with a Subcontractor or vendor as a result of such direction, the Contractor may request the United States to enter into such litigation to protect the interests of the United States.

13.2 Affirmative Action.

13.2.1 The Contractor will not discriminate against any employee or applicant for employment because he or she is a disabled veteran or veteran of the Vietnam era in regard to any position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified disabled veterans and veterans of the Vietnam era without discrimination based upon their disability or veterans status in all employment practices such as the following: employment upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

13.2.2 The Contractor agrees that all suitable employment openings of the Contractor which exist at the time of the execution of this Contract and those which occur during the performance of this Contract, including those not generated by this Contract and including those occurring at an establishment of the Contractor other than the one wherein the Contract is being performed but excluding those of independently operated corporate affiliates, shall be listed at an appropriate local office of the State employment service system wherein the opening occurs. The Contractor further agrees to provide such reports to such local offices regarding employment openings and hires as may be required.

State and local government agencies holding Federal contracts of $10,000 or more shall also list all their suitable openings with the appropriate office of the State employment service, but are not required to provide those reports set forth in Subparagraphs 13.2.4 and 13.2.5, below.

13.2.3 Listing of employment openings with the employment service system pursuant to this Clause shall be made at least concurrently with the use of any other recruitment source or effort and shall involve the normal obligations which attach to the placing of a bona fide job order, including the acceptance of referrals of veterans and non-veterans. The listing of employment openings does not require the hiring of any particular job applicant or from any particular group of job applicants, and nothing herein is intended to relieve the Contractor from any requirements in Executive orders or regulations regarding non-discrimination in employment.

13.2.4 The reports required by Subparagraph 13.2.2 of this Clause shall include, but not be limited to, periodic reports which shall be filed at least quarterly with the appropriate local office or, where the Contractor has more than one hiring location in a State, with the central office of that State employment service. Such reports shall indicate for each hiring location: (1) the number of individuals hired during the reporting period; (2) the number of non-disabled veterans of the Vietnam era hired; (3) the number of disabled veterans of the Vietnam era hired; and (4) the total number of disabled veterans hired. The reports should include covered veterans hired for on-the-job training under 38 U.S.C. 1787. The Contractor shall submit a report within thirty (30) days after the end of each reporting period wherein any performance is made on this Contract identifying data for each hiring location. The Contractor shall maintain at each hiring location copies of the reports submitted until the expiration of one (1) year after final payment under the Contract, during which time these reports and related documentation shall be made available, upon request, for examination by any authorized representatives of the contracting officer or of the Secretary of Labor. Documentation would include personnel records respecting job openings, recruitment and placement.

13.2.5 Whenever the Contractor becomes contractually bound to the listing provisions of this clause, it shall advise the employment service system in each State where it has establishments of the name and location of each hiring location in the State. As long as the Contractor is contractually bound to these provisions and has so advised the State system, there is no need to advise the State

system of subsequent contracts. The Contractor may advise the State system when it is no longer bound by this Contract clause.

13.2.6 This Clause does not apply to the listing of employment openings which occur and are filled outside of the 50 States, the District of Columbia, Puerto Rico, Guam, and the Virgin Islands.

13.2.7 The provisions of Subparagraphs 13.2.2-13.2.5 of this Clause do not apply to openings which the Contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement. This exclusion does not apply to a particular opening once an employer decides to consider applicants outside of his own organization or employer-union arrangement for that opening.

13.2.8 As used in this Clause:

13.2.8.1 "All suitable employment openings" includes, but is not limited to, openings which occur in the following job categories: Production and non-production; plant and office; laborers and mechanics; supervisory and non-supervisory; technical; and executive, administrative, and professional openings as are compensated on a salary basis of less than $25,000 per year. This term includes full-time employment, temporary employment of more than 3 days' duration, and part-time employment. It does not include openings which the Contractor proposes to fill from within his own organization or to fill pursuant to a customary and traditional employer-union hiring arrangement or openings in an educational institution which are restricted to students of that institution. Under the most compelling circumstances an employment opening may not be suitable for listing, including such situations where the needs of the Government cannot reasonably be otherwise supplied, where listing would be contrary to national security, or where the requirement of listing would otherwise not be for the best interest of the Government.

13.2.8.2 "Appropriate office of the State employment service system" means the local office of the Federal-State national system of public employment offices with assigned responsibility for serving the area where the employment opening is to be filled, including the District of Columbia, Guam, Puerto Rico, and the Virgin Islands.

13.2.8.3 "Openings which the Contractor proposes to fill from within his own organization" means employment openings for which no consideration will be given to persons outside the Contractor's organization (including any affiliates, subsidiaries, and the parent companies) and includes any openings which the Contractor proposes to fill from regularly established "recall" lists.

13.2.8.4 "Openings which the Contractor proposes to fill pursuant to a customary and traditional employer-union hiring arrangement," means employment openings which the Contractor proposes to fill from union halls, which is part of the customary and traditional hiring relationship which exists between the Contractor and representatives of his employees.

13.2.9 The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

13.2.10 In the event of the Contractor's non-compliance with the requirements of this Clause, actions for non-compliance may be taken in accordance with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

13.2.11 The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, provided by or through the contracting officer. Such notice shall state the Contractor's obligation under the law to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era for employment, and the rights of applicants and employees.

13.2.12 The Contractor will notify each labor union or representative of workers with which it has a collective bargaining Agreement or other contract understanding, that the Contractor is bound by the terms of the Vietnam Era Veterans Readjustment Assistance Act, and is committed to take affirmative action to employ and advance in employment qualified disabled veterans and veterans of the Vietnam era.

13.2.13 The Contractor will include the provisions of this Clause in every Subcontract or purchase order of $10,000 or more unless exempted by rules, regulations, or orders of the Secretary issued pursuant to the Act, so that such provisions will be binding upon each Subcontractor or vendor. The Contractor will take such action with respect to any Contract or purchase order as the Director of the Office of Federal Contract Compliance Programs may direct to enforce such provisions, including action for non-compliance.

13.2.14 The Contractor will not discriminate against any employee or applicant for employment because of physical or mental handicap in regard to a position for which the employee or applicant for employment is qualified. The Contractor agrees to take affirmative action to employ, advance in employment and otherwise treat qualified handicapped individuals without discrimination based upon their physical or mental handicap in all employment practices such as the following: employment, upgrading, demotion or transfer, recruitment, advertising, layoff or termination, rates of pay or other forms of compensation, and selection for training, including apprenticeship.

13.2.15 The Contractor agrees to comply with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

13.2.16 In the event of the Contractor's non-compliance with the requirements of this Clause, actions for non-compliance may be taken in accordance with the rules, regulations, and relevant orders of the Secretary of Labor issued pursuant to the Act.

13.2.17 The Contractor agrees to post in conspicuous places, available to employees and applicants for employment, notices in a form to be prescribed by the Director, provided by or through the contracting officer. Such notices shall state the Contractor's obligation under

the law to take affirmative action to employ and advance in employment qualified handicapped employees and applicants for employment, and the rights of applicants and employees.

13.2.18 The Contractor will notify each labor union or representative of workers with which it has a collective bargaining Agreement or other contract understanding, that the Contractor is bound by the terms of section 503 of the Rehabilitation Act of 1973, and is committed

to take affirmative action to employ and advance in employment physically and mentally handicapped individuals.

13.2.19 The Contractor will include the provisions of this Clause in every Subcontract or purchase order of $2,500 or more unless exempted by rules regulations, or orders of the Secretary issued pursuant to section 503 or the Act, so that such provisions will be binding upon each Subcontractor or vendor. The Subcontractor will take such action with respect to any Contract or purchase order as the Director of the Office of Federal Contract Compliance. Programs may direct to enforce such provisions, including action for non-compliance.

13.3 Contractor Compliance. The Contractor shall comply with all federal, state, and local equal employment and affirmative action statutes, rules and regulations including, to the extent applicable given the geographical location of the Project (and not in limitation of any other particular law that would pertain to the Contractor's Scope of Work), the City of Chicago Human Rights Ordinance and the Illinois Human Rights Act, 775 ILCS 5/1-101 et seq. (1993), the Illinois Prevailing Wage Act, 820 ILCS 130/1 et seq., and any subsequent amendments to or regulations thereof.

Violation of any anti-discrimination or affirmative action requirements, whether or not expressly described herein, that are lawfully imposed on the operation of the Contractor's business in the performance of the Scope of Work described herein, shall be a material breach of this Contract and a basis for default under Article 14, below.

14. Default and Termination

14.1 Default by Contractor. Should the Contractor fail in any manner to perform this Work properly or default in the performance of any provision of this Agreement or suffer any delay not accepted by Owner and Pepper as authorized under the Contract Documents, or should the Contractor suffer any form of financial distress so that it could not give reasonable assurance to Pepper that it can continue to perform its obligations under this Agreement, Pepper may give written notice to the Contractor to begin with all necessary diligence to cure such defaults within a twenty-four (24) hour period or failing to do so, Pepper may, without prejudice to any other remedies it may have under the law or in equity, terminate this Agreement and look to the Contractor or its surety for payment of all damages which it incurs ("Termination for Default"). Owner's and Pepper's remedies shall include, but not be limited to, completing the Work and correcting any defective Work at a commercially reasonable cost given exigent circumstances, the cost of which will be charged against the balance of any sums due Contractor. In the event of such a breach, in addition to any other remedy Owner and Pepper may have, the Contractor agrees to indemnify, defend, and hold Owner and Pepper harmless from all losses, damages, expenses, (including reasonable attorneys' fees) as well as any judgments suffered by Owner and Pepper as a result of Contractor's acts or omissions in the performance of its Work. As to any damages incurred by Pepper, Pepper shall have the right of set off and to deduct from any balance due under this Agreement or from any other accounts under separate contracts under which Pepper is holding net funds due the Contractor.

14.2 Default by Owner.

14.2.1 Pepper does not financially guarantee the Owner's ability to fund the Project cost. It is an express condition of this Agreement that Pepper's obligation to pay Contractor is contingent upon receipt of payment from Owner for Contractor's Work. Owner's withholding of a Pepper payment, due to an alleged failure by Pepper to perform any of its obligations unrelated to this Prime Trade Contract Agreement, will not excuse payment to Contractor according to the terms of this Contract Agreement. Retainage shall be held by Pepper as provided in the Owner/Pepper Agreement, or as deemed necessary by Pepper until any failure of performance is corrected and Contractor is in compliance with this Contract Agreement.

14.2.2 In the event of Owner's nonpayment, nothing contained in this Agreement shall be construed as a waiver or impairment of Contractor's mechanic lien rights.

14.3 Termination for Convenience. Pepper and the Owner shall have the absolute right to terminate all or part of the Work under this Agreement for convenience with or without reason and in the Owner's or Pepper's discretion by giving notice of termination effective upon receipt thereof by Contractor ("Termination for Convenience"). Termination for Default if wrongly made shall be treated as Termination for Convenience. If all or part of this Agreement is terminated for convenience, the Contractor shall be paid the actual cost of the Work, materials and labor in place, plus the actual cost of any materials properly delivered and stored on or off site at the direction of Pepper (if Pepper elects to retain such stored materials), plus a pro rata percentage of the Contractor's fee or stated profit equal to the percentage of completion, whichever is less. If the Prime Trade Contract is terminated for convenience, Contractor shall not be entitled to anticipated profits on unperformed portions of the Work or to punitive or consequential damages. All of Contractor's warranty, guaranty, indemnity and dispute obligations for Work performed shall survive such Termination for Convenience.

14.4 Prevailing Party/Attorneys' Fees and Costs. In the event any arbitration, legal proceeding, or other form of dispute resolution is commenced between the parties to this Agreement, the prevailing party shall be entitled, in addition to such other relief as may be granted, to a reasonable sum for attorneys' fees and costs, which award shall be determined at the conclusion of the proceedings by the presiding arbitrator(s) or judge.

15. UAS Usage

Contractor shall not be permitted to use an unmanned aircraft system ("UAS") on the Project site without the prior written approval of Pepper. Should the use of any UAS be permitted, Contractor shall enter into a separate agreement ("UAS Agreement") with Pepper with regard to such usage, submit proof of compliance with all Federal Aviation Administration, state, county, local, and any other applicable laws and regulations in effect, and provide proof of insurance as set forth within such UAS Agreement.

16. Dispute Resolution

16.1 Arbitration Provided in Contract Documents. If arbitration of disputes is provided for in the Contract Documents, and if Pepper, in its sole discretion, elects to demand arbitration with Contractor individually, or as part of joint proceedings with Owner or others, any dispute between Pepper and Contractor involving or arising out of this Prime Trade Contract Agreement, including the breach

thereof, shall be decided by arbitration as provided for in the Contract Documents. If Pepper elects to demand arbitration with Contractor individually and subject to applicable law, such arbitration proceedings shall be held in Chicago, IL or such other place as Pepper may designate. The award rendered by the arbitrator(s) shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

16.2 Arbitration Not Provided in Contract Documents. If the Contract Documents do not provide for arbitration, and if Pepper, in its sole discretion, elects to demand arbitration with Contractor individually, or as part of proceedings with Owner or other parties, any dispute arising between Pepper and Contractor under the Prime Trade Contract Agreement, including the breach thereof, shall be decided by arbitration in accordance with the then current Construction Industry Arbitration Rules of the American Arbitration Association. The venue of such arbitration shall be Chicago, IL or such other place as Pepper may designate. The award rendered by the arbitrator(s) shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

16.3 Consolidation. Contractor further agrees that, upon request by Pepper, resolution of any dispute between Pepper and Contractor may be consolidated with resolution of any dispute between Owner and Pepper, whether in litigation or arbitration, at Pepper's sole discretion, and that Contractor will join in and be bound by the result of any such dispute resolution process, even if such consolidation and/or joinder requires resolution of Contractor disputes in a forum not provided for in this Contract and/or otherwise not selected by Contractor and even if Contractor is not permitted to become a named party to such proceeding or process. Contractor agrees not to institute (and to stay) legal remedies against Pepper until all legal proceedings against Owner with respect to such claim are final and complete. Contractor hereby agrees to make no claim, and shall not be entitled to further payment beyond the Prime Trade Contract Price arising out of the site conditions, acts, errors, or omissions of Owner, Architect, or other agents or representatives of Owner, other than to the extent that Pepper may receive funds from Owner on behalf of Contractor, which funds shall be paid by Pepper to Contractor less costs and expenses incurred by Pepper in prosecuting such claims.

16.4 Governing Law. Notwithstanding any provision to the contrary, any dispute involving Owner, Pepper and Contractor shall be resolved in accordance with the law specified in the Owner Agreement.

17. Legal Fees

In the event that Pepper is deemed to be the prevailing party in any legal proceeding, arbitration or other form of dispute resolution procedure that may be commenced between the parties to this Agreement, whether in contract or in tort, Pepper shall be entitled, in addition to such other relief as may be granted, to a reasonable sum for attorneys' fees and costs, which sum shall be determined by the court or forum in such proceeding.

18. Miscellaneous Terms

18.1 Enumeration of Documents.
In addition to this Prime Trade Contract and the Construction Manager Agreement between Owner and Pepper, the Contract Documents are comprised of the following:

- Exhibit A – Contract Document Listing
- Exhibit B – Scope of Work
- Exhibit C –Insurance Requirements (Non-CCIP or CCIP, as applicable)
- Exhibit D – 01/01/22 Trade Partner Safety Handbook (See Article 10 for on-line access)
- Exhibit E – Project Schedule as prepared by Pepper Construction Company
- Exhibit F – Tax Exempt Letter

18.2 Exemption Status.
This Project is / is not exempt from Retail Sales Tax.

Prime Trade Contractor's Affidavit Completion Requirements

All Affidavits produced by Prime Trade Contractor ("Contractor") to PEPPER CONSTRUCTION COMPANY for the purpose of requesting construction payments shall include the following:

A. Identification of the State in which the Project is located;
B. Identification of the County in which the Project is located;
C. Identification of the Affiant as an authorized representative of the ~~Y~~
D. Contractor entity;
E. Identification of the Owner with whom PEPPER CONSTRUCTION COMPANY has contracted as Agent;
F. Identification of the Project for which services or materials are provided by Contractor;
G. Description of the improvements or type of labor, service or materials furnished under the Contract (*i.e.*, type of trade work);
H. Identification of the real estate legal description, if available, or commonly known address of the Project;
I. Identification of the type of payment being requested: Partial or Final;

For Contractor and each Subcontractor, vendor or material supplier engaged by Contractor, provide:
J1. Names and addresses;
J2. Identification of the type of labor, service or materials furnished;
J3. Base Contract amounts;
J4. Approved Change Order amounts;
J5. Base Contract amount (J3) plus/minus Change Order amounts (J4);
J6. Cumulative previously requested amounts;
J7. Current payment amounts requested;
J8. Balance of payments to become due (including retainage, if any);
J9. Total base Contract amounts for Contractor and all sub-tier entities;
J10. Total approved Change Order amounts for Contractor and all sub-tier entities;
J11. Total Revised Contract amounts for Contractor and all sub-tier entities;
J12. Total previously requested amounts for Contractor and all sub-tier entities;
J13. Total current payment amounts requested for Contractor and all sub-tier entities;
J14. Total balance of payments to become due (including retainage, if any) for Contractor and all sub-tier entities;

K1. Base Contract amount;
K2. Approved extras to the Contract;
K3. Total of base Contract amount plus amount of approved extras;
K4. Approved credits to the Contract;
K5. Total adjusted Contract amount;
K6. Total amount requested to date;
K7. Percentage retained;
K8. Total dollar amount of retained funds to date;
K9. Net amount earned;
K10. Total of payments previously requested;
K11. Amount of current requested payment;
K12. Balance due to completion of the Work (including retainage);
L. Percentage of Work completed to date;
M. Signature and title of Affiant, as shown at A., above;
N. Contractor Company name, as shown at D., above;
O. Current date of Affidavit notarization; and
P. Signature and stamp of Notary to whom the Affidavit is subscribed and sworn.

AFFIDAVIT

State of *A*)
) ss
County of *B*)

The Affiant, _____*C*_____, being first duly sworn, on oath deposes and says that he/she is an Authorized Representative of ___*D*_____,

who is a Prime Trade Contractor ("Contractor"), under an Owner Agreement with _____*E*_____ to which PEPPER CONSTRUCTION COMPANY has executed as Agent of the Owner for the Project known as _____*F*_____ , to provide _____*G*_____ on the following described premises in said County, to wit:
_____*H*_____
That, for the purpose of said Contract, the following persons have been contracted with and have furnished, or are furnishing and preparing materials for, and have performed or are performing labor on said improvement; that there is due and to become due them, respectively, the amounts set forth opposite their names for materials or labor as stated; that this statement is made to said Owner for the purpose of procuring from said Owner _____*I*_____ on said Contract; and this is a full, true and complete statement of all such persons, and of the amounts paid, due, and to become due them.

NAME AND ADDRESS	CONTRACT FOR	BASE CONTRACT AMOUNT	EXTRAS TO CONTRACT	REVISED CONTRACT AMOUNT	TOTAL PREVIOUS REQUEST	AMOUNT OF THIS REQUEST	BALANCE TO COMPLETE
J1	*J2*	*J3*	*J4*	*J5*	*J6*	*J7*	$ *J8*
							$
							$
							$
							$
							$
	TOTALS	**$ *J9***	**$ *J10***	**$ *J11***	$ *J12*	$ *J13*	$ *J14*

AMOUNT OF ORIGINAL CONTRACT	$ *K1*	TOTAL AMOUNT EQUESTED	$ *K6*
EXTRAS TO CONTRACT	$ *K2*	LESS *K7* % RETAINED	$ *K8*
TOTAL CONTRACT & EXTRAS	$ *K3*	NET AMOUNT EARNED	$ *K9*
CREDIT TO CONTRACT	$ *K4*	AMOUNT OF PREVIOUS PAYMENTS	$ *K10*
NET AMOUNT OF CONTRACT	$ *K5*	AMOUNT DUE THIS PAYMENT	$ *K11*
		BALANCE TO COMPLETE	$ *K12*

It is understood that the total amount paid to date plus the amount requested in this Application shall not exceed *L* ___% of the Cost of the Work completed to date. I agree to furnish Waivers of Lien for all materials under my Contract when demanded.

SIGNED: _____*M*_____
Signatory Name and Title

For: _____*N*_____
Contractor Name

Subscribed and sworn to before me this _____*O*_____ day of_____, 20___.

NOTARY PUBLIC: _____*P*_____

The above sworn statement should be obtained by the Owner before each and every payment.

WAIVER OF LIEN TO DATE

STATE of _____) SS
County of _____) SS

TO WHOM IT MAY CONCERN:
WHEREAS the undersigned has been employed by_____to furnish_____for the premises known as_____of which_____is the owner.

THE undersigned, for and in consideration of_____($_____) Dollars, and other good and valuable considerations, the receipt whereof is hereby acknowledged, do(es) hereby waive and release any and all lien or claim of, or right to, lien, under the statutes of the State of_____, relating to mechanics' liens, with respect to and on said above-described premises, and the improvements thereon, and on the material, fixtures, apparatus or machinery furnished, and on the moneys, funds or other considerations due or to become due from the owner, on account of labor, services, material, fixtures, apparatus or machinery, furnished to this date by the undersigned for the above-described premises, including extras*.

Given under my hand and sealed this_____day of_____, 20_____

Signature and Seal: _____

*Extras include but are not limited to change orders, both oral and written, to the contract.

CONTRACTOR'S AFFIDAVIT

STATE of _____) SS
County of _____) SS

TO WHOM IT MAY CONCERN:
THE undersigned, being duly sworn, deposes and says that he/she is_____of the_____who is contractor for the_____work on the building located at_____owned by_____.
That the total amount of the contract, including additional work and Change Orders, is $_____on which he/she has received payment of $_____prior to this payment. That all waivers are true, correct and is genuine and delivered unconditionally and that there is no claim, either legal or equitable, to defeat the validity of said waivers. That the following are the names of all parties who have furnished material or labor, or both, for said work and all parties having contracts or subcontracts for specific portions of said work or for material entering into the construction thereof and the amount due or to become due to each, and that the items mentioned include all labor and material required to complete said work according to plans and specifications:

NAMES	WHAT FOR	CONTRACT PRICE INCLUDING EXTRAS*	AMOUNT PAID	THIS PAYMENT	BALANCE DUE
TOTAL LABOR AND MATERIAL INCLUDING EXTRAS* TO COMPLETE					

That there are no other contracts for said work outstanding, and that there is nothing due or to become due to any person for material, labor or other work of any kind done or to be done upon or in connection with said work other than above stated.

Signed this_____day of_____, 20_____

Signature: _____

Subscribed and sworn to before me this_____day of_____, 20_____

Signature: _____

*Extras include but are not limited to change orders, both oral and written, to the contract.

FINAL WAIVER OF LIEN

STATE of _____) SS
County of _____) SS

TO WHOM IT MAY CONCERN:
WHEREAS the undersigned has been employed by_____to furnish_____for the premises known as_____of which_____is the owner.

THE undersigned, for and in consideration of_____($_____) Dollars, and other good and valuable considerations, the receipt whereof is hereby acknowledged, do(es) hereby waive and release any and all lien or claim of, or right to, lien under the statutes of the State of_____, relating to mechanics' liens, with respect to and on said above-described premises, and the improvements thereon, and on the material, fixtures, apparatus or machinery furnished, and on the moneys, funds or other considerations due or to become due from the owner, on account of labor, services, material, fixtures, apparatus or machinery, heretofore furnished, or which may be furnished at any time hereafter, by the undersigned for the above-described premises, including extras*.

Given under my hand and sealed this_____day of_____, 20_____

Signature and Seal: _____

*Extras include but are not limited to change orders, both oral and written, to the contract.

CONTRACTOR'S AFFIDAVIT

STATE of _____) SS
County of _____) SS

TO WHOM IT MAY CONCERN:
THE undersigned, being duly sworn, deposes and says that he/she is_____of the_____who is contractor for the_____work on the building located at_____owned by_____.
That the total amount of the contract, including additional work and Change Orders, is $_____on which he/she has received payment of $_____prior to this payment. That all waivers are true, correct and is genuine and delivered unconditionally and that there is no claim, either legal or equitable, to defeat the validity of said waivers. That the following are the names of all parties who have furnished material or labor, or both, for said work and all parties having contracts or subcontracts for specific portions of said work or for material entering into the construction thereof and the amount due or to become due to each, and that the items mentioned include all labor and material required to complete said work according to plans and specifications:

NAMES	WHAT FOR	CONTRACT PRICE INCLUDING EXTRAS*	AMOUNT PAID	THIS PAYMENT	BALANCE DUE
			T		
TOTAL LABOR AND MATERIAL INCLUDING EXTRAS* TO COMPLETE					

That there are no other contracts for said work outstanding, and that there is nothing due or to become due to any person for material, labor or other work of any kind done or to be done upon or in connection with said work other than above stated.

Signed this_____day of_____, 20_____

Signature: _____

Subscribed and sworn to before me this_____day of_____, 20_____

Signature: _____

*Extras include but are not limited to change orders, both oral and written, to the contract.

00 50 01 EXHIBIT C–Non-CCIP

Pepper Construction Company
Prime Trade Contractor Insurance Requirements

Contractor: Hargrave Builders, Inc.
Vendor#: HAR045

PLEASE ISSUE A CERTIFICATE OF INSURANCE FOR THE PROJECT REFERENCED BELOW IN ACCORDANCE WITH THE FOLLOWING REQUIREMENTS. SUBMIT TO THE SAME ADDRESS AS SHOWN AS CERTIFICATE HOLDER. THANK YOU.

JOB DESCRIPTION:

Job Number:	DKA Project Number: 24-027 MCC Bid Number: IFB#08202024
Job Name:	McHenry County College Engagement Hall
Job Address:	8900 US Highway 14 Crystal Lake, IL 60012

ADDITIONAL INSUREDS TO BE LISTED: (Must be listed exactly as shown)

PEPPER CONSTRUCTION COMPANY (General Contractor)
McHenry County College (Owner)
Demonica Kemper Architects (Architect)

CERTIFICATE HOLDER:

PEPPER CONSTRUCTION COMPANY
Attention: Josh Warriner
411 Lake Zurich Road,
Barrington, IL 60010-3141

EXPERIENCE MODIFICATION RATING (EMR):

PEPPER CONSTRUCTION COMPANY (“PEPPER”) has a strong commitment to safety on our construction projects and it is important that our contractors display that same commitment. Therefore, PEPPER requests that each Prime Trade Contractor (“Contractor”) instruct its insurance company to send PEPPER a letter indicating its Experience Modification Rating (EMR) for the last three (3) years.

Contractually, the Contractor is required to keep a valid Certificate of Insurance on file for a period of three (3) years from the date of Substantial Completion.

Any questions, please call 847-381-2760

00 50 01 EXHIBIT C–Non-CCIP

Contractor shall maintain, at its own expense, during the progress of the Work and throughout the warranty period, insurance written by insurance companies acceptable to PEPPER(as further described below) with the minimum limits and coverage as shown below or, if higher, the requirements set forth in the Contract Documents. For purposes of this **Exhibit C – Non-CCIP**, contractors performing, in whole or in part, the following major trade classifications shall be referred to as "Major Trade Contractors": Concrete//Pre-cast Concrete; Curtainwall; Electrical; Elevator; Excavation/Earthwork; Fire Protection; Hoisting/Tower Crane; HVAC; Plumbing/Piping; Shoring/Underpinning; Soil Stabilization; Special Foundations/Caissons; and Steel. To the fullest extent allowed under applicable law, Contractor shall comply with the following insurance requirements:

A. Unless otherwise required by the Contract Documents, at a minimum, Contractor's insurance shall be provided by:
   1) Insurer(s) authorized to transact business in the state where the Work or operations will be performed by Contractor; and
   2) Admitted insurers that maintain an A.M. Best's rating of not less than A-/VIII.

B. WORKERS' COMPENSATION including Employers' Liability insurance in an amount of at least:
   1) **$1,000,000**, bodily injury by accident – each accident;
   2) **$1,000,000**, bodily injury by disease – policy limit; and
   3) **$1,000,000**, bodily injury by disease each employee.

   Where applicable, evidence of coverage shall be required for Longshore and Harbor Workers' Compensation, Maritime coverage, and Federal Employers' Liability Act; additionally, Contractor's coverage shall include all Other States coverage and other unique exposures requiring endorsement of coverage.

   Workers' Compensation coverage must extend to every employee, including owners/officers of a closely held corporation and/or individuals operating as a sole proprietorship or partnership.

C. COMMERCIAL GENERAL LIABILITY ("CGL"). Major Trades Contractors shall provide and maintain **a minimum CGL primary insurance limit** of not less than **$2,000,000** per occurrence for both Premises/Ongoing Operations, **$2,000,000** Products-Completed Operations aggregate; and **$2,000,000** general aggregate applicable to claims other than Products-Completed Operations. All other contractors shall provide and maintain CGL insurance with a limit of not less than **$1,000,000** per occurrence for both Premises/Ongoing Operations, **$1,000,000** Products-Completed Operations aggregate; and **$1,000,000** general aggregate applicable to claims other than Products-Completed Operations. To the extent that Contractor's CGL insurance is subject to aggregate limits, the policy shall be endorsed so as to apply such aggregate limits separately to each Project with an **ISO Endorsement CG 25 03** or equivalent.

   Coverage afforded under Contractor's CGL and any Commercial Umbrella insurance shall be provided on an occurrence basis and shall be subject to the terms of the Insurance Services Office ("ISO") Commercial General Liability Coverage Form CG 0001, or an equivalent form providing coverage at least as broad as the ISO form specified. There shall be no limitations or exclusions of coverage beyond those contained in the standard coverage form and coverage shall include liability arising from Premises/Operations, Elevators, Broad Form Property Damage, Independent Contractors, Contractual Liability, Products-Completed Operations including Construction Defect, Contractual Liability or Personal Injury and Advertising Injury.

   Contractor's CGL coverage shall include an endorsement or other policy provision providing for a modified definition of occurrence establishing faulty workmanship as an occurrence; this includes but is not limited to Work done in the States of Delaware, Illinois, Iowa, Kentucky, Montana, New Jersey, North Carolina, Ohio, Oklahoma, Pennsylvania, West Virginia, and the District of Columbia.

   If Contractor's Scope of Work requires the use of a crane, rigging operations, hoisting, or coverage related to the movement of others' property in connection with this Prime Trade Contract, Contractor shall have the "care, custody, and control" exclusion deleted from its General Liability policy. In the event such exclusion is not deleted, Contractor shall purchase and maintain in effect Rigger's Liability coverage at least equal to the highest value of property to be hoisted or moved.

   All coverages shall be maintained in force for a period of three (3) years after Substantial Completion of the Project or for such period of time as is described in the Contract Documents ("Products-Completed Operations Period"). All terms and conditions of such coverage shall be maintained during this Products-Completed Operations Period, including the required coverage limits and the requirement to provide PEPPER and Owner with coverage as an **Additional Insured** for Products-Completed Operations. XCU and Work From Height Exclusions must be deleted when applicable to operations performed by the Contractor. XCU coverage must be identified as being included on the Certificate of Insurance.

D. COMMERCIAL UMBRELLA LIABILITY ("Umbrella Liability") shall be maintained by Contractor, providing the same coverage and with the same **Additional Insureds** as the primary policy in the amount of **$5,000,000** for Major Trade Contractors and **$1,000,000** for all other Contractors. All terms and conditions of such coverage shall be maintained during the three (3) year Project-Completed Operations Period, including the required coverage limits and the requirement to provide PEPPER and Owner with coverage as an **Additional Insured** for Products- Completed Operations. Umbrella Liability insurance required under this Prime Trade Contract shall follow the form of the Commercial General Liability insurance, Business\Commercial Automobile insurance, and Employers' Liability insurance as required in the Prime Trade Contract. The Umbrella Liability policy must be identified as 'follow form' on the Certificate of Insurance. To the extent that Contractor's Umbrella Liability insurance is subject to aggregate limits, policies shall be endorsed so as to apply such aggregate limits separately to each Project.

   When providing a Blanket Certificate of Insurance, the following wording must be included: "*All Work performed by [Contractor Company Name] for all Pepper Construction Company jobsites. Additional Insureds: Pepper Construction Company and all others identified at **Exhibit C – Non-CCIP** of the Prime Trade Contract Agreement."*

E. BUSINESS/COMMERCIAL AUTOMOBILE LIABILITY on an accident basis covering all Owned, Leased, Non-Owned and Hired Vehicles providing limits of liability for Bodily Injury and Property Damage of **$1,000,000** each occurrence, including its own employees.

The waiver of subrogation, as required in Article P, below, shall be in favor of Indemnitees and Additional Insureds and shall be affirmed on the policy by **ISO Endorsement CA 04 44 03 10** or equivalent.

When applicable, the Business/Commercial Automobile Liability policy shall include **MCS-90 Endorsement** in compliance with the Federal Motor Carrier Safety Administration ("FMCSA").

If Contractor's Work involves the transport of pollutants, its Business/Commercial Automobile Liability policy shall be endorsed with Pollution Liability – Broadened Pollution for Covered Autos **ISO CA 99 48 10 01** or equivalent.

F. **CONTRACTOR'S POLLUTION LIABILITY insurance shall be provided by Contractor with minimum limits of $1,000,000** per occurrence and **$1,000,000** per aggregate and shall apply to bodily injury, property damage or other losses due to a pollution incident or event arising from Contractor's activities and shall apply for at least the following types of contractors: building enclosure systems, drywall/insulation, MEP (including but not limited to HVAC, plumbing, sprinkler), and excavating. Further, such Pollution Liability policy shall include coverage for microbial matter, silica, mold, bacteria, and fungi. The policy must include the parties listed in this **Exhibit C – Non-CCIP** Insurance Requirements as **Additional Insureds** on a primary and non-contributory basis. Occurrence or claims-made coverage is acceptable. Occurrence-based coverage is to be maintained for three (3) years after completion. Claims-made coverage is to have a retroactive date prior to the date the Contractor commences contracting services on the Project and shall include an Extended Reporting Period of three (3) years. **Additional Insured** coverage under the Contractor's Pollution Liability shall apply to both ongoing and completed operations

Contractor's Pollution Liability policy shall include coverage for actual or alleged on-site and off-site bodily injury and loss of damage to, or loss of use of property, directly or indirectly arising out of the discharge, dispersal, release or escape of smoke, vapors, soot, fumes, acids, alkalis, toxic chemicals, liquids or gas, waste materials or other irritants, contaminants or pollutants into or upon the land, the atmosphere or any water course or body of water, whether it be gradual or sudden and accidental.

Contractor and its lower tiers shall provide prompt notice to PEPPER of any claim asserted, the entry of any settlement, or rendering of any judgment which may be covered by this Pollution Liability policy with a total reserve valued at twenty-five percent (25%) of available policy limits of the Pollution Liability policy. Coverage shall not be limited to the dollar amount of the Prime Trade Contract Price, including all modifications.

G. CONTRACTOR'S PROFESSIONAL LIABILTY INSURANCE ("Design Liability"). If Contractor provides any architectural or professional engineering service, by its employees or through others, (regardless whether such service does not result in stamped or sealed submissions) including any surveying, soils analysis, approval of materials, equipment or design, connections, or sizing of members for any earth retention, shoring, dewatering, mechanical, electrical, plumbing, fire protection, windows, wall systems, structural walls, precast, elevators, roofing, drainage or communications systems, the Contractor shall furnish PEPPER with an appropriate certificate, including any endorsements, directly relating to the Project which shall remain in effect for a period of three (3) years after the date of final completion identifying the Contractor's professional liability insurance coverage and stipulating amounts of coverage at not less than **$2,000,000** with Contractor's deductible not to exceed **$100,000** insuring Contractor's proper performance of its Design Services. The Professional Liability policy shall be maintained without interruption for no less than three (3) years after the date of final payment to Contractor. If the insurance policy is written on a "claims-made" form, the policy must include a three (3) year "Extended Reporting Period" endorsement (coverage option). The "Extended Report Period" coverage shall commence to the degree that continuous Professional Liability coverage has not been kept in force from the inception of the contracted project and three (3) years thereafter. Contractor agrees that coverage thereunder will not be cancelled or not renewed until at least thirty (30) days' prior written notice has been given to PEPPER.

H. AVIATION INSURANCE.

1. If either of the following aviation options (H2 or H3, below) are applicable to this Project, Contractor shall request in writing and obtain PEPPER's written approval for proposed aviation events. With such request, Contractor shall include a detailed description of the proposed event, identifying specific dates, times, and proof of pilot licensing, as described below. If approved, Contractor shall provide evidence of the required liability coverage, as identified below in H2 or H3, as applicable.

   To the extent that **Contractor** shall provide aviation services, it is required to:

   a. provide prior written notice to PEPPER that Contractor shall provide such aviation services ("Contractor Notice");
   b. provide such Contractor Notice to PEPPER at least ten (10) days prior to the scheduled flight;
   c. obtain approval for aviation events and provide written evidence of the Contractor's required insurance coverage, as identified below at H2 or H3, as applicable, including Owner, PEPPER, and others per the Owner Agreement as an **Additional Insured** on a primary and non-contributory basis for bodily injury or property damage with respect to the ownership, maintenance, or use of the aircraft and provide a Waiver of Subrogation in favor of the parties as set forth in Article J, below;
   d. provide to PEPPER proof of Contractor's FAA pilot license, with Commercial Helicopter Rating, or FAA 107 Commercial UAS License, as applicable;
   e. provide written evidence of Non-Owned Aviation liability coverage to the same extent as required by H2 or H3; and
   f. advise PEPPER's Project Manager and Director of Corporate Risk Management of the financial risk exposures involved at least ten (10) days prior to the scheduled flight.

   To the extent that **Contractor's lower-tier subcontractor** shall provide aviation services, **Contractor** is required to:

   g. provide prior written notice to PEPPER that a Subcontractor shall provide such aviation services ("Sub Notice");
   h. provide such Sub Notice to PEPPER at least ten (10) days prior to the scheduled flight;
   i. notify Subcontractor, in writing, that all terms of this Article H are applicable to Subcontractor;
   j. obtain approval for aviation events and provide written evidence of the Subcontractor's required insurance coverage, as identified below at H2 or H3, as applicable, including Owner, PEPPER, and others per the Owner Agreement as **Additional Insureds** on a primary and non-contributory basis for bodily injury or property damage with respect to the ownership, maintenance, or use of the aircraft and provide a Waiver of Subrogation in favor of the parties as set forth in Article J, below;
   k. provide to PEPPER proof of Subcontractor's FAA pilot license, with Commercial Helicopter Rating, or FAA 107 Commercial UAS License, as applicable;

l. provide written evidence of its own **and** Subcontractor's Non-Owned Aviation liability coverage to the same extent as H2 or H3; and
m. advise PEPPER's Project Manager and Director of Corporate Risk Management of the financial risk exposures involved at least ten (10) days prior to the scheduled flight.

2. Commercial Aviation (Manned Fixed and Rotor Wing Aircraft) Liability Insurance Coverage: Should Contractor's or Subcontractor's Work include the approved use of any owned, leased, chartered, or hired aircraft of any type on the Project, minimum limits in an amount not less than **$10,000,000** per occurrence, including Passenger Liability, shall apply. Cargo/Sling coverage with limits of **$250,000** per load shall apply. PEPPER reserves the right to determine and require higher limits of liability based on jobsite exposure.

3. Commercial Aviation Liability (Unmanned Aircraft System or Aerial Drones ("UAS")) Insurance Coverage: Should Contractor's or Subcontractor's Work include the approved use of any owned, leased, borrowed, or hired UAS on the Project, minimum limits of liability of **$2,000,000** each occurrence shall apply.

4. Coverage in Sections H2 and H3, above, shall include:
   a. Bodily Injury, Property Damage, Contractual Liability, and Hired and Non-Owned Aircraft Liability. Coverage under this policy shall also be extended to the authorized pilot in command of the aircraft when performing on behalf of the Named Insureds. NOTE: Approved usage of all drones (not to exceed 40 pounds in total unit weight) shall be strictly limited to aerial photography and survey work; and
   b. any aircraft, equipment, or property used in the aviation event shall:
      i. be specifically scheduled on the aircraft liability insurance policy; and
      ii. carry hull and physical damage coverage for the replacement cost value of the aircraft.

5. With regard to both H2 and H3, above, the Contractor and any Subcontractor shall agree that:
   a. if the pilot for such aviation event has not previously flown on a PEPPER project, and has neither been interviewed nor approved by PEPPER to fly, PEPPER and the Contractor (and Subcontractor, if involved) shall timely arrange for the pilot to participate in an interview with a PEPPER drone pilot prior to the first scheduled flight, and the Contractor, Subcontractor and pilot shall all fully cooperate; and
   b. PEPPER reserves the right to decline the drone flight request based on the results of the interview conducted by PEPPER; such decision to decline the flight request shall be in PEPPER's sole discretion and may be based on factors including, but not limited to, the pilot's demonstrated incompetence, lack of experience, or failure to meet PEPPER's standards and requirements.

I. NETWORK SECURITY AND PRIVACY PROTECTION LIABILITY coverage ("Cyber Liability") is required of all Contractors and Subcontractors as determined by PEPPER, in circumstances where physical or wireless connection will be made to any PEPPER network (including a Guest internet connection) or Owner's Network at the site of the Project. Such networks include, without limitation, Building Automation, Computer Maintenance Management, HVAC, MEP, Building Security/Access Controls, Fire Protections/Alarm, and Telecommunication/Data Management systems. The Contractor shall provide evidence of Cyber Liability with limits of not less than **$2,000,000** per occurrence and **$2,000,000** annual aggregate. Coverage shall be sufficiently broad to respond to the cyber and network liability exposure resulting from or arising out of Contractor's performance of its duties and obligations under this Prime Trade Contract Agreement, and shall provide coverage for loss occurrences which include, but are not limited to, claims involving invasion of privacy violations, information theft, damage to or destruction of electronic information, release of private information, alteration of electronic information, extortion, network security, installation of malware/ransomware, loss of network use, and infringement of intellectual property (including infringement of copyright, trademark, and trade dress). The policy shall provide coverage sufficient to defend and indemnify the **Additional Insureds** and shall also provide coverage for breach response costs, regulatory fines and penalties, and credit monitoring expenses.

J. ADDITIONAL INSURED: To the fullest extent of coverage allowed under applicable law, the following entities shall be included as Additional Insureds under the General Liability, Business/Commercial Automobile Liability, Umbrella/Excess Liability, and Pollution Liability (where applicable). The Contractor's CGL and Umbrella Liability policies must include the parties listed in **Exhibit C – Non-CCIP** as **Additional Insureds**, on an ISO **Additional Insured** Endorsement (CG 2010 and CG 2037, Edition #07 04 or older, or equivalent) covering Ongoing and Completed Operations. Contractor's insurance will be primary and non-contributory to any insurance carried by any of the **Additional Insured**. Contractor's required insurance shall apply separately to each **Additional Insured**. Any other insurance or self-insurance maintained by PEPPER or Owner shall be excess of, and non-contributory with, the coverage afforded by Contractor's CGL and Umbrella Liability insurance.

K. A Certificate of Insurance on an ACORD form, and the **Additional Insured** Endorsement (including a waiver of subrogation), must be delivered to the PEPPER Project Manager of record and PROVIDED TO THE PEPPER JOBSITE FIELD SUPERINTENDENT ***PRIOR TO THE COMMENCEMENT OF ANY WORK***. The Contractor shall notify PEPPER by email within thirty (30) days if such Certificate is to be altered, cancelled or allowed to expire.

L. Equivalent insurance coverage must be obtained from each subcontractor or supplier, if any, before permitting them on the Project site. In the event Contractor fails to obtain such coverage from its lower tiers, protection of such parties shall be included within Contractor's insurance policies.

M. PEPPER may furnish, erect or provide equipment, appurtenances and devices, motorized or otherwise, for its use to complete its Contract with the Owner. Contractor may use such items upon PEPPER's prior written authorization. In the event of any such Contractor use, the Contractor agrees to insure against claims of injury or damage caused by such items while in Contractor's care, custody or control by naming PEPPER as an insured party. Liability limits shall be the same as in Section C, above. Physical Damage insurance against damage to the items themselves shall be on a "Replacement Cost" basis.

N. Contractor will be responsible for any deductible or self-insured retention under its insurance policies.

O. It is understood and agreed that PEPPER shall withhold payments to the Contractor until a properly executed Certificate of Insurance and endorsement providing insurance as required herein, accompanied by a signed Prime Trade Contract Agreement, are received by PEPPER. The failure of PEPPER to withhold such payments or obtain the required Certificate or endorsement shall not be deemed to be a waiver of Contractor's obligation to provide the insurance required under the Prime Trade Contract Agreement.

P. Contractor hereby waives any rights of subrogation against PEPPER, the Owner, the Architect, and any other **Additional Insureds** as required by this Prime Trade Contract, the Owner Agreement or the Invitation to Bid. If insurance policies specified within this **Exhibit C – Non-CCIP** require an endorsement to provide for continued coverage where there is a waiver of subrogation, the Contractor will cause them to be so endorsed with an **ISO Endorsement CG20 01** or equivalent. This waiver shall apply to all first-party Property, Equipment, Vehicle, Business/Commercial Automobile and Workers' Compensation claims (unless prohibited under applicable state statutes), and all third-party liability claims.

Q. Provided the minimum required primary limits under the Commercial General Liability are provided as stated in Section C., above, CGL, Business/Commercial Auto Liability, and Employer's Liability policies can be obtained by any combination of primary and excess coverage.

R. Any self-insured retention on any of the coverages required above must be clearly disclosed on the Contractor's Certificate of Insurance and are subject to PEPPER's approval. PEPPER reserves the right to require a proper form of collateral for any self-insured retention.

S. Upon PEPPER's written request, Contractor shall provide to PEPPER copies of all of its insurance policies, including all policy endorsements, as required herein.

T. Failure of Contractor to comply with all insurance requirements set forth in this Exhibit C will be deemed a material breach of Contractor's obligations under the Prime Trade Contract Agreement.

U. Contractor-provided policy terms, limits, and coverages shall equal or exceed any requirements specified in the Contract Documents or required by law, and in no event shall they be less than required herein. If Contractor maintains insurance policies with limits greater or coverage broader than the limits and coverage stated above, Contractor agrees that such higher limits and broader coverage shall be deemed to be the minimum limits and coverage required under this Prime Trade Contract. Contractor further agrees that the higher limits and broader coverage shall be available to the Additional Insureds on a primary and non-contributory basis.

V. Certificates of Insurance shall show all limits of liability in U.S. dollars.

SECTION 00 64 00
PEPPER QUALITY COORDINATION GUIDELINES

GENERAL

Each Prime Trade Subcontractor shall review and incorporate the Pepper Quality Coordination Guideline included herein.

END OF SECTION 00 64 00

SECTION 00 65 00
PEPPER EXHIBIT K COORDINATION PROTOCOL

GENERAL

Each Prime Trade Subcontractor shall review and incorporate the Pepper Exhibit K Coordination Protocol included herein.

END OF SECTION 00 64 00

SECTION 00 67 00
GROUND PENETRATING & UTILITY PLAN (PEPPER GPUP)

GENERAL

Subcontractors performing any underground work must comply with the Pepper Ground Penetrating & Utility Plan (GPUP) Process identified herein. Including but not limited to private utility locating costs, potholing/ hydro excavations, existing & new utility as-built information daily excavation permits, etc. Prime Trade Subcontractors shall include all costs associated with the GPUP process.

END OF SECTION 00 67 00

SECTION 00 80 00
BUSINESS ENTERPRISE PROGRAM: PARTICIPATION AND UTILIZATION PLAN

The Business Enterprise for Minorities, Females and Persons with Disabilities Act (BEP) establishes a goal for community colleges contracting with businesses that have been certified as owned and controlled by persons who are minorities (MBE), female (FBE/ also referred to as WBE), or persons with disabilities (DBE) (collectively, BEP certified vendor(s)). 30 ILCS 575

Contract Goal to be Achieved by Vendor: This solicitation includes a specific **BEP** participation goal of 30% of the total dollar amount awarded to MBEs and FBEs.

The BEP participation goal is applicable to all bids or offers. In addition to the award criteria established for this solicitation, the College will award this contract to a Vendor that meets the goal or demonstrates good faith efforts to meet the goal. This goal is applicable to change orders and allowances within the scope of work provided by the BEP certified vendors. If Vendor is an MBE and FBE certified vendor, the entire goal is met and no subcontracting with a BEP certified vendors is required; however, **Vendor must submit a Utilization Plan indicating that the goal will be met by self-performance.**

Following are guidelines for Vendor's completion of the Utilization Plan. The Utilization Plan must demonstrate that Vendor has either: (1) met the entire contract goal; or (2) made good faith efforts towards meeting the goal.

At the time of bid or offer, Vendor, or Vendor's proposed Subcontractor, must be certified with the Illinois Department of Central Management Services as a BEP certified vendor**.**

Failure to complete a Utilization Plan or provide Good Faith Effort documentation shall render the bid or offer non- responsive; and subject to rejection and/or disqualification in the College's sole discretion.

1. If applicable where there is more than one prime vendor, the Utilization Plan should include an executed Joint Venture Agreement specifying the terms and conditions of the relationship between the parties and their relationship and responsibilities to the contract. The Joint Venture Agreement must clearly evidence that the BEP certified vendor will be responsible for a clearly defined portion of the work and that its responsibilities, risks, profits and contributions of capital, and personnel are proportionate to its ownership percentage. It must include specific details related to the parties' contributions of capital, personnel, and equipment and share of the costs of insurance and other items; the scopes to be performed by the BEP certified vendor under its supervision; and the commitment of management, supervisory personnel, and operative personnel employed by the BEP certified vendor to be dedicated to the performance of the contract. Established Joint Venture Agreements will only be credited toward BEP goal achievements for specific work performed by the BEP certified vendor. **Each party to the Joint Venture Agreement must execute the bid or offer prior to submission of the bid or offer to the College.**

2. An agreement between a vendor and a BEP certified vendor in which a BEP certified vendor promises not to provide subcontracting or pricing quotations to other vendors is prohibited.

The College may request additional information to demonstrate compliance. Vendor agrees to cooperate promptly with the College in submitting to interviews, allowing entry to places of business, providing further documentation, and to soliciting the cooperation of a proposed BEP certified vendor. Failure to cooperate by Vendor and BEP certified vendor may render the bidder or offeror non-responsive or not responsible. **The contract will not be awarded to Vendor unless Vendor's Utilization Plan is approved by the College.**

3. **BEP Certified Vendor Locator References:** Vendor may consult CMS' BEP Vendor Directory at https://supplierdiversitymanagementportal.illinois.gov/home.aspxs, as well as the directories of other certifying agencies, but firms **must be certified with CMS as BEP certified vendors at the time of bid or offer.**

4. **Vendor Assurance:** Vendor shall not discriminate on the basis of race, color, national origin, sexual orientation or sex in the performance of this contract. Failure by Vendor to carry out these requirements is a material breach of this contract, which may result in the termination of this contract or such other remedy, as the College deems appropriate. This assurance must be included in each subcontract that Vendor signs with a subcontractor or supplier.

5. **Calculating BEP Certified Vendor Participation:** The Utilization Plan documents work anticipated to be performed, or goods/equipment provided by all BEP certified vendors and paid for upon satisfactory completion/delivery. Only the value of payments made for the work actually performed by BEP certified vendors, by subcontractors or suppliers to such vendors, is counted toward the contract goal. Applicable guidelines for counting payments attributable to contract goals are summarized below:

    5.1. The value of the work actually performed or goods/equipment provided by the BEP certified vendor shall be counted towards the goal. The entire amount of that portion of the contract that is performed by the BEP certified vendor, including supplies purchased or equipment leased by the BEP certified vendor shall be counted, except supplies purchased and equipment rented from the Prime Vendor submitting this bid or offer.

    5.2. A vendor shall count the portion of the total dollar value of the BEP contract equal to the distinct, clearly defined portion of the work of the contract that the BEP certified vendor performs toward the goal. A vendor shall also count the dollar value of work subcontracted to other BEP certified vendor. Work performed by the non- BEP certified party shall not be counted toward the goal. **Work that a BEP certified vendor subcontracts to a non-BEP certified vendor will not count towards the goal.**

    5.3. A Vendor shall count toward the goal 100% of its expenditures for materials and supplies required under the contract and obtained from a BEP certified vendor manufacturer, B E P certified regular dealer, or B E P certified supplier. A Vendor shall count toward the goal the following expenditures to BEP certified vendors that are not manufacturers, regular dealers, or suppliers:

        5.3.1. The fees or commissions charged for providing a bona fide service, such as professional, technical, consultant or managerial services and assistance in the

procurement of essential personnel, facilities, equipment, materials or supplies required for performance of the contract, provided that the fee or commission is determined by College to be reasonable and not excessive as compared with fees customarily allowed for similar services.

5.3.2. The fees charged for delivery of materials and supplies required by the contract (but not the cost of the materials and supplies themselves) when the hauler, trucker, or delivery service is not also the manufacturer or a supplier of the materials and supplies being procured, provided that the fee is determined by the College to be reasonable and not excessive as compared with fees customarily allowed for similar services. The BEP certified vendor's trucking firm must be responsible for the management and supervision of the entire trucking operation for which it is responsible on the contract, and must itself own and operate at least one fully licensed, insured and operational truck used on the contract.

5.3.3. The fees or commissions charged for providing any bonds or insurance specifically required for the performance of the contract, provided that the fee or commission is determined by the College to be reasonable and not excessive as compared with fees customarily allowed for similar services.

5.4. BEP certified vendors who are performing on contract as second tier subcontractors may be counted in meeting the established BEP goal for this contract as long as the Prime Vendor can provide documentation indicating the utilization of these vendors.

5.5. A Vendor shall count towards the goal only expenditures to firms that perform a commercially useful function in the work of the contract.

5.5.1. A firm is considered to perform a commercially useful function when it is responsible for execution of a distinct element of the work of a contract and carries out its responsibilities by actually performing, managing, and supervising the work involved. The BEP certified vendor must also be responsible, with respect to materials or supplies used on the contract, for negotiating price, determining quality and quantity, ordering the materials or supplies, and installing the materials (where applicable) and paying for the material or supplies. To determine whether a firm is performing a commercially useful function, the College shall evaluate the amount of work subcontracted, whether the amount the firm is to be paid under the contract is commensurate with the work it is actually performing and the credit claimed for its performance of the work, industry practices, and other relevant factors.

5.5.2. A BEP certified vendor does not perform a commercially useful function if its role is limited to that of an extra participant in a transaction or contract through which funds are passed through in order to obtain BEP certified vendor participation. In determining whether a BEP certified vendor is such an extra participant, the College shall examine similar transactions, particularly those in which BEP certified vendors do not participate, and industry practices.

5.6. A Vendor shall not count towards the goal expenditures that are not direct, necessary and related to the work of the contract. Only the amount of services or goods that are directly attributable to the performance of the contract shall be counted. Ineligible expenditures include general office overhead or other Vendor support activities.

6. **Good Faith Effort Procedures**: Vendor must submit Utilization Plans, subcontract documents, and/or Letters of Intent that meet or exceed the published goal. If Vendor cannot meet the stated goal, Vendor must document and explain within the Utilization Plan the good faith efforts it undertook to meet the goal. Utilization Plans are due at the time of and must be enclosed and sealed with the bid or offer submission. Copies of subcontract documents and/or Letters of Intent shall be due upon request.

7. **Contract Compliance:** Compliance with this section is an essential part of the contract. The following administrative procedures and remedies govern Vendor's compliance with the contractual obligations established by the Utilization Plan. **After approval of the Plan and award of the contract, the Utilization Plan becomes part of the contract.** If Vendor did not succeed in obtaining BEP certified vendor participation to achieve the goal and the Utilization Plan was approved and contract awarded based upon a determination of good faith, the total dollar value of BEP certified vendor work calculated in the approved Utilization Plan as a percentage of the awarded contract value shall become the contract goal.

7.1. The Utilization Plan may not be amended after contract execution without the College's prior written approval.

7.2. **Vendor may not make changes to its contractual BEP certified vendor commitments or substitute BEP certified vendors without the prior written approval of the College**. Unauthorized changes or substitutions, including performing the work designated for a BEP certified vendor with Vendor's own forces, shall be a violation of the utilization plan and a breach of the contract, and shall be cause to terminate the contract, and/or seek other contract remedies or sanctions.

7.3. If it becomes necessary to substitute a BEP certified vendor or otherwise change the Utilization Plan, Vendor must notify the College in writing of the request to substitute a BEP certified vendor or otherwise change the Utilization Plan. The request must state specific reasons for the substitution or change. The College shall notify the Council or its delegate of the request to substitute a BEP certified vendor or change the Utilization Plan. The College reserves the right to approve or deny a request for substitution or other change in the Utilization Plan.

7.4. Where Vendor has established the basis for the substitution to the College's satisfaction, it must make good faith efforts to meet the contract goal by substituting a BEP certified vendor. Documentation of a replacement BEP certified vendor, or of good faith efforts to replace the BEP certified vendor, must meet the requirements of the initial Utilization Plan. If the goal cannot be reached and good faith efforts have been made, Vendor may substitute with a non- BEP certified vendor or Vendor may perform the work.

7.5. If a Vendor plans to hire a subcontractor for any scope of work that was not previously disclosed in the Utilization Plan, Vendor must obtain the approval of the College to modify the Utilization Plan and must make good faith efforts to ensure that BEP certified vendors have a fair opportunity to submit a bid or offer on the new scope of work.

7.6. A new BEP certified vendor agreement must be executed and submitted to the College within five business days of Vendor's receipt of the College's approval for the substitution or other change.

7.7. Vendor shall maintain a record of all relevant data with respect to the utilization of BEP certified vendors, including but without limitation, payroll records, invoices, canceled checks and books of account for a period of at least three years after the completion of the contract. Full access to these records shall be granted by Vendor upon 48 hours written demand by the College to any duly authorized representative thereof, or to any municipal, state or federal authorities. The College shall have the right to obtain from Vendor any additional data reasonably related or necessary to verify any representations by Vendor. After the performance of the final item of work or delivery of material by the BEP certified vendor and final payment to the BEP certified vendor by Vendor, but not later than 30 calendar days after such payment, Vendor shall submit a statement confirming the final payment and the total payments made to the BEP certified vendor under the contract.

7.8. The College will periodically review Vendor's compliance with these provisions and the terms of its contract. Without limitation, Vendor's failure to comply with these provisions or its contractual commitments as contained in the Utilization Plan, failure to cooperate in providing information regarding its compliance with these provisions or its Utilization Plan, or provision of false or misleading information or statements concerning compliance, certification status or eligibility of the BEP certified vendor, good faith efforts or any other material fact or representation shall constitute a material breach of this contract and entitle the College to declare a default, terminate the contract, or exercise those remedies provided for in the contract or at law or in equity.

7.9. The College reserves the right to withhold payment to Vendor to enforce these provisions and Vendor's contractual commitments. Final payment shall not be made pursuant to the contract until Vendor submits sufficient documentation demonstrating compliance with its Utilization Plan.

More information can be found at the below link along with a link to the Utilization Plan Version 25.1 which has fillable forms for download: https://cei.illinois.gov/purchasing-entity-resources/compliance.html

BEP UTILIZATION PLAN MATRIX

The following firms will be utilized to meet the goals of the BEP Program

Name of Firm	Contract Value	Type of Firm MBE/WBE	Description of Work	% of Total Bid
Totals:				

Enter the dollar value of the total bid amount, including the sum of the all alternates and allowances:

Total Bid Amount $_____

Signature of authorized representative of bidder:

Bidding Company: _____ Name: _____

Signature: _____

END OF SECTION 00 80 00

SECTION 01 10 00 - SUMMARY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Project information.
2. Work covered by Contract Documents.
3. Access to site.
4. Work restrictions.
5. Specification and drawing conventions.
6. Miscellaneous provisions.

B. Related Requirements:

1. Section 01 50 00 "Temporary Facilities and Controls" for limitations and procedures governing temporary use of Owner's facilities.

1.3 PROJECT INFORMATION

A. Project Identification: Engagement Hall

1. Project Location: McHenry County College, 8900 US Hwy 14, Crystal Lake, IL 60012.

B. Owner: The Board of Trustees, McHenry County College.

1. Owner's Representative: Mr. Pat Sullivan, Assistant VP of Facilities

C. Architect: Demonica Kemper Architects, LLC.

1.4 WORK COVERED BY CONTRACT DOCUMENTS

A. The Work of Project is defined by the Contract Documents.

B. Type of Contract:

1. Project will be constructed under a Prime Trade Agreement.

C. Insurance:

1. Designated Purchaser:

a. Contractor shall purchase and maintain Builder's Risk Insurance in accordance with the General Conditions.

1.5 ACCESS TO SITE

A. General: Contractor shall have limited use of Project site for construction operations as indicated on Drawings by the Contract limits and as indicated by requirements of this Section.

B. Use of Site: Limit use of Project site to areas within the Contract limits indicated. Do not disturb portions of Project site beyond areas in which the Work is indicated.

1. Driveways, Walkways and Entrances: Keep driveways loading areas, and entrances serving premises clear and available to Owner, Owner's employees, and emergency vehicles at all times. Do not use these areas for parking or storage of materials.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.
b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Condition of Existing Building: Maintain portions of existing building affected by construction operations in a weathertight condition throughout construction period. Repair damage caused by construction operations. Contractor shall photo-document condition of existing facilities prior to beginning work to identify any damage that exists prior to beginning work.

1.6 WORK RESTRICTIONS

A. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and with other requirements of authorities having jurisdiction.

B. Date of Commencement: Work may commence on site on or after the following dates:

1. Procurement Commencement: June 26, 2025

2. On-Site Construction Commencement: September 15, 2025.

C. Date of Substantial Completion: Work must be substantially complete on or before July 14, 2026.

D. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7:00 a.m. to 10:00 p.m., Monday through Friday, unless otherwise indicated.

1. Weekend Hours: All workers must check in at the office of the McHenry County College Police Department.

E. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than three days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.
3. Schedule all interruptions to occur between 10:00 pm and 6:00 am.

F. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than three days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

G. Nonsmoking Campus: Smoking is not permitted on Campus.

H. Controlled Substances: Use of tobacco products and other controlled substances on Project site is not permitted.

I. Employee Identification: Provide identification tags for Contractor personnel working on Project site. Require personnel to use identification tags at all times.

J. Employee Screening: Comply with Owner's requirements for drug and background screening of Contractor personnel working on Project site.

1. Maintain list of approved screened personnel with Owner's representative.

1.7 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 10 00

SECTION 01 21 00 - ALLOWANCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements governing allowances.

B. Related Requirements:

1. Section 01 22 00 "Unit Prices" for procedures for using unit prices, including adjustment of quantity allowances when applicable.
2. Section 01 40 00 "Quality Requirements" for procedures governing the use of allowances for field testing by an independent testing agency.

1.3 DEFINITIONS

A. Allowance is a quantity of work or dollar amount established in lieu of additional requirements, used to defer selection of actual materials and equipment to a later date when direction will be provided to Contractor. If necessary, additional requirements will be issued by Change Order.

1.4 SELECTION AND PURCHASE

A. At the earliest practical date after award of the Contract, advise Architect of the date when final selection, or purchase and delivery, of each product or system described by an allowance must be completed by the Owner to avoid delaying the Work.

B. At Architect's request, obtain proposals for each allowance for use in making final selections. Include recommendations that are relevant to performing the Work.

C. Purchase products and systems selected by Architect from the designated supplier.

1.5 ACTION SUBMITTALS

A. Submit proposals for purchase of products or systems included in allowances in the form specified for Change Orders.

1.6 INFORMATIONAL SUBMITTALS

A. Submit invoices or delivery slips to show actual quantities of materials delivered to the site for use in fulfillment of each allowance.

B. Submit time sheets and other documentation to show labor time and cost for installation of allowance items that include installation as part of the allowance.

C. Coordinate and process submittals for allowance items in same manner as for other portions of the Work.

1.7 LUMP-SUM ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.8 UNIT-COST ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.9 QUANTITY ALLOWANCES

A. Allowance shall include cost to Contractor of specific products and materials ordered by Owner or selected by Architect under allowance and shall include taxes, freight, and delivery to Project site.

B. Unless otherwise indicated, Contractor's costs for receiving and handling at Project site, labor, installation, overhead and profit, and similar costs related to products and materials ordered by Owner or selected by Architect under allowance shall be included as part of the Contract Sum and not part of the allowance.

C. Unused Materials: Return unused materials purchased under an allowance to manufacturer or supplier for credit to Owner, after installation has been completed and accepted.

1. If requested by Architect, retain and prepare unused material for storage by Owner. Deliver unused material to Owner's storage space as directed.

1.10 CONTINGENCY ALLOWANCES

A. Use the contingency allowance only as directed by Architect for Owner's purposes and only by Change Orders that indicate amounts to be charged to the allowance.

B. Contractor's overhead, profit, and related costs for products and equipment ordered by Owner under the contingency allowance are included in the allowance and are not part of the Contract Sum. These costs include delivery, installation, taxes, insurance, equipment rental, and similar costs.

C. Change Orders authorizing use of funds from the contingency allowance will include Contractor's related costs and reasonable overhead and profit.

D. At Project closeout, credit unused amounts remaining in the contingency allowance to Owner by Change Order.

1.11 ADJUSTMENT OF ALLOWANCES

A. Allowance Adjustment: To adjust allowance amounts, prepare a Change Order proposal based on the difference between purchase amount and the allowance, multiplied by final measurement of work-in-place where applicable. If applicable, include reasonable allowances for cutting losses, tolerances, mixing wastes, normal product imperfections, and similar margins.

1. Include installation costs in purchase amount only where indicated as part of the allowance.
2. If requested, prepare explanation and documentation to substantiate distribution of overhead costs and other markups.
3. Submit substantiation of a change in scope of Work, if any, claimed in Change Orders related to unit-cost allowances.
4. Owner reserves the right to establish the quantity of work-in-place by independent quantity survey, measure, or count.

B. Submit claims for increased costs because of a change in scope or nature of the allowance described in the Contract Documents, whether for the purchase order amount or Contractor's handling, labor, installation, overhead, and profit.

1. No change to Contractor's indirect expense is permitted for selection of higher- or lower-priced materials or systems of the same scope and nature as originally indicated.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

3.2 PREPARATION

A. Coordinate materials and their installation for each allowance with related materials and installations to ensure that each allowance item is completely integrated and interfaced with related work.

B. See Construction Manager's "Scope of Work" documents for allowances to be included by each Contractor.

3.3 SCHEDULE OF ALLOWANCES

A. Refer to Section 00 31 00 Bid Form and 00 32 00 Scope Sheets for allowances required with the individual bid packages.

END OF SECTION 01 21 00

SECTION 01 23 00 - ALTERNATES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for alternates.

1.3 DEFINITIONS

A. Alternate: An amount proposed by bidders and stated on the Bid Form for certain work defined in the bidding requirements that may be added to or deducted from the base bid amount if Owner decides to accept a corresponding change either in the amount of construction to be completed or in the products, materials, equipment, systems, or installation methods described in the Contract Documents.

1. Alternates described in this Section are part of the Work only if enumerated in the Agreement.
2. The cost or credit for each alternate is the net addition to or deduction from the Contract Sum to incorporate alternate into the Work. No other adjustments are made to the Contract Sum.

1.4 PROCEDURES

A. Coordination: Revise or adjust affected adjacent work as necessary to completely integrate work of the alternate into Project.

1. Include as part of each alternate, miscellaneous devices, accessory objects, and similar items incidental to or required for a complete installation whether or not indicated as part of alternate.

B. Notification: Immediately following award of the Contract, notify each party involved, in writing, of the status of each alternate. Indicate if alternates have been accepted, rejected, or deferred for later consideration. Include a complete description of negotiated revisions to alternates.

C. Execute accepted alternates under the same conditions as other work of the Contract.

D. Schedule: A schedule of alternates is included at the end of this Section. Specification Sections referenced in schedule contain requirements for materials necessary to achieve the work described under each alternate.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 SCHEDULE OF ALTERNATES

A. ALTERNATE NO. 1: ADD to the Lump Sum Base Bid to provide one of the following systems in lieu of the Reinforced Concrete Pipe scheduled for the storm piping under the Engagement Hall and Connecting Link. Refer to civil drawings for more information.

1. ALTERNATE NO. 1A: Provide Reinforced Concrete pipe with Cured-in-Place Liner System.

2. ALTERNATE NO. 1B: Provide HDPE pipe encased in cast-in-place concrete.

3. ALTERNATE NO. 1C: Provide ADS N-12 pipe in a HOBAS liner system.

B. ALTERNATE NO. 2: DEDUCT from the Lump Sum Base Bid to provide continuous wood trim in lieu of the continuous linear wall wash lights indicated at the perimeter of the Engagement Hall. Refer to architectural and electrical drawings for additional details.

C. ALTERNATE NO. 3: DEDUCT from the Lump Sum Base Bid to provide raised concrete curbs in lieu of the seated planter walls and remove the electrical outlets, AV speakers, and F8 up-light fixtures and all associated utilities at the North Patio Area. Refer to Civil, Electrical, and Technology drawings for additional details.

D. ALTERNATE NO. 4: DEDUCT from the Lump Sum Base Bid to remove (11) exterior light bollards and (1) exterior power bollard and all associated supports and utilities from the project scope. (8) exterior light bollards are located at the North Patio area and (3) exterior light bollards and (1) exterior power bollard are located at the south terrace. Refer to electrical drawings for additional details.

E. ALTERNATE NO. 5: DEDUCT from the Lump Sum Base Bid to remove all exterior tree up-light fixtures and associated utilities. Refer to electrical drawings for additional details.

F. ALTERNATE NO. 6: DEDUCT from the Lump Sum Base Bid to remove the exterior back-lit aluminum signage and all associated utilities on the existing west brick wall at the South Entrance. Refer to architectural and electrical drawings for additional details.

G. ALTERNATE NO. 7: DEDUCT from the Lump Sum Base Bid to remove the recessed interior electronic window shades and all associated supports and utilities at the South and West Entrances to the Engagement Hall. Refer to architectural and electrical drawings for additional details.

H. ALTERNATE NO. 8: DEDUCT from the Lump Sum Base Bid to provide painted gyp walls and ceilings in lieu of flush wood panel system at the South Entrance into the Engagement Hall. Refer to architectural drawings for additional details.

I. ALTERNATE NO. 9: DEDUCT from the Lump Sum Base Bid to provide painted gyp walls and ceilings in lieu of flush wood panel system at the West Entrance into the Engagement Hall. Refer to architectural drawings for additional details.

END OF SECTION 01 23 00

SECTION 01 25 00 - SUBSTITUTION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for substitutions.

B. Related Requirements:

1. Section 01 23 00 "Alternates" for products selected under an alternate.
2. Section 01 60 00 "Product Requirements" for requirements for submitting comparable product submittals for products by listed manufacturers.

1.3 DEFINITIONS

A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.

1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.

1.4 ACTION SUBMITTALS

A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Substitution Request Form: Use CSI Form 13.1A .
2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:

a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, that will be necessary to accommodate proposed substitution.

c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
e. Samples, where applicable or requested.
f. Certificates and qualification data, where applicable or requested.
g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
k. Cost information, including a proposal of change, if any, in the Contract Sum.
l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.

3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

1.5 QUALITY ASSURANCE

A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

1.6 PROCEDURES

A. Coordination: Revise or adjust affected work as necessary to integrate work of the approved substitutions.

PART 2 - PRODUCTS

2.1 SUBSTITUTIONS

A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 15 days prior to time required for preparation and review of related submittals.

1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:

a. Requested substitution is consistent with the Contract Documents and will produce indicated results.
b. Substitution request is fully documented and properly submitted.
c. Requested substitution will not adversely affect Contractor's construction schedule.
d. Requested substitution has received necessary approvals of authorities having jurisdiction.
e. Requested substitution is compatible with other portions of the Work.
f. Requested substitution has been coordinated with other portions of the Work.
g. Requested substitution provides specified warranty.
h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

B. Substitutions for Convenience: Not allowed.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 25 00

SECTION 01 26 00 - CONTRACT MODIFICATION PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for handling and processing Contract modifications.

B. Related Requirements:

1. Section 01 25 00 "Substitution Procedures" for administrative procedures for handling requests for substitutions made after the Contract award.

1.3 MINOR CHANGES IN THE WORK

A. Architect will issue supplemental instructions authorizing minor changes in the Work, not involving adjustment to the Contract Sum or the Contract Time, on AIA Document G710, "Architect's Supplemental Instructions" or similar form

1.4 PROPOSAL REQUESTS

A. Owner-Initiated Proposal Requests: Architect will issue a detailed description of proposed changes in the Work that may require adjustment to the Contract Sum or the Contract Time. If necessary, the description will include supplemental or revised Drawings and Specifications.

1. Work Change Proposal Requests issued by Architect are not instructions either to stop work in progress or to execute the proposed change.
2. Within time specified in Proposal Request after receipt of Proposal Request, submit a quotation estimating cost adjustments to the Contract Sum and the Contract Time necessary to execute the change.

a. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
b. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
c. Include costs of labor and supervision directly attributable to the change.
d. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.

e. Quotation Form: Use CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." or similar forms acceptable to Architect.

B. Contractor-Initiated Proposals: If latent or changed conditions require modifications to the Contract, Contractor may initiate a claim by submitting a request for a change to Architect.

1. Include a statement outlining reasons for the change and the effect of the change on the Work. Provide a complete description of the proposed change. Indicate the effect of the proposed change on the Contract Sum and the Contract Time.
2. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made. If requested, furnish survey data to substantiate quantities.
3. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
4. Include costs of labor and supervision directly attributable to the change.
5. Include an updated Contractor's construction schedule that indicates the effect of the change, including, but not limited to, changes in activity duration, start and finish times, and activity relationship. Use available total float before requesting an extension of the Contract Time.
6. Comply with requirements in Section 01 25 00 "Substitution Procedures" if the proposed change requires substitution of one product or system for product or system specified.
7. Proposal Request Form: Use CSI Form 13.6A, "Change Order Request (Proposal)," with attachments CSI Form 13.6D, "Proposal Worksheet Summary," and Form 13.6C, "Proposal Worksheet Detail." or similar form acceptable to Architect.

1.5 ADMINISTRATIVE CHANGE ORDERS

A. Allowance Adjustment: See Section 01 21 00 "Allowances" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect actual costs of allowances.

B. Unit-Price Adjustment: See Section 01 22 00 "Unit Prices" for administrative procedures for preparation of Change Order Proposal for adjusting the Contract Sum to reflect measured scope of unit-price work.

1.6 CHANGE ORDER PROCEDURES

A. On Owner's approval of a Work Changes Proposal Request, Architect will issue a Change Order for signatures of Owner and Contractor on AIA Document G701 .

1.7 CONSTRUCTION CHANGE DIRECTIVE

A. Construction Change Directive: Architect may issue a Construction Change Directive on AIA Document G714 or similar form acceptable to Architect. Construction Change Directive instructs Contractor to proceed with a change in the Work, for subsequent inclusion in a Change Order.

1. Construction Change Directive contains a complete description of change in the Work. It also designates method to be followed to determine change in the Contract Sum or the Contract Time.

B. Documentation: Maintain detailed records on a time and material basis of work required by the Construction Change Directive.

1. After completion of change, submit an itemized account and supporting data necessary to substantiate cost and time adjustments to the Contract.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 26 00

SECTION 01 29 00 - PAYMENT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements necessary to prepare and process Applications for Payment.

B. Related Requirements:

1. Section 01 26 00 "Contract Modification Procedures" for administrative procedures for handling changes to the Contract.
2. Section 01 32 00 "Construction Progress Documentation" for administrative requirements governing the preparation and submittal of the Contractor's construction schedule.

1.3 DEFINITIONS

A. Schedule of Values: A statement furnished by Contractor allocating portions of the Contract Sum to various portions of the Work and used as the basis for reviewing Contractor's Applications for Payment.

1.4 SCHEDULE OF VALUES

A. Coordination: Coordinate preparation of the schedule of values with preparation of Contractor's construction schedule. Cost-loaded Critical Path Method Schedule may serve to satisfy requirements for the schedule of values.

1. Coordinate line items in the schedule of values with other required administrative forms and schedules, including the following:

a. Application for Payment forms with continuation sheets.
b. Submittal schedule.
c. Items required to be indicated as separate activities in Contractor's construction schedule.

2. Submit the schedule of values to Architect at earliest possible date, but no later than seven days before the date scheduled for submittal of initial Applications for Payment.
3. Subschedules for Separate Elements of Work: Where the Contractor's construction schedule defines separate elements of the Work, provide subschedules showing values coordinated with each element.

B. Format and Content: Use Project Manual table of contents as a guide to establish line items for the schedule of values. Provide at least one line item for each Specification Section.

1. Identification: Include the following Project identification on the schedule of values:

    a. Project name and location.
    b. Name of Architect.
    c. Architect's project number.
    d. Contractor's name and address.
    e. Date of submittal.

2. Arrange the schedule of values in tabular form with separate columns to indicate the following for each item listed:

    a. Related Specification Section or Division.
    b. Description of the Work.
    c. Name of subcontractor.
    d. Name of manufacturer or fabricator.
    e. Name of supplier.
    f. Change Orders (numbers) that affect value.
    g. Dollar value of the following, as a percentage of the Contract Sum to nearest one-hundredth percent, adjusted to total 100 percent.

        1) Labor.
        2) Materials.
        3) Equipment.

3. Provide a breakdown of the Contract Sum in enough detail to facilitate continued evaluation of Applications for Payment and progress reports. Coordinate with Project Manual table of contents. Provide multiple line items for principal subcontract amounts in excess of five percent of the Contract Sum.
4. Round amounts to nearest whole dollar; total shall equal the Contract Sum.
5. Provide a separate line item in the schedule of values for each part of the Work where Applications for Payment may include materials or equipment purchased or fabricated and stored, but not yet installed.

    a. Differentiate between items stored on-site and items stored off-site. If required, include evidence of insurance.

6. Provide separate line items in the schedule of values for initial cost of materials, for each subsequent stage of completion, and for total installed value of that part of the Work.
7. Allowances: Provide a separate line item in the schedule of values for each allowance. Show line-item value of unit-cost allowances, as a product of the unit cost, multiplied by measured quantity. Use information indicated in the Contract Documents to determine quantities.
8. Each item in the schedule of values and Applications for Payment shall be complete. Include total cost and proportionate share of general overhead and profit for each item.

a. Temporary facilities and other major cost items that are not direct cost of actual work-in-place may be shown either as separate line items in the schedule of values or distributed as general overhead expense, at Contractor's option.

9. Schedule Updating: Update and resubmit the schedule of values before the next Applications for Payment when Change Orders or Construction Change Directives result in a change in the Contract Sum.

1.5 APPLICATIONS FOR PAYMENT

A. Each Application for Payment following the initial Application for Payment shall be consistent with previous applications and payments as certified by Architect and Construction Manager and paid for by Owner.

1. Initial Application for Payment, Application for Payment at time of Substantial Completion, and final Application for Payment involve additional requirements.

B. Payment Application Times: The date for each progress payment is indicated in the Agreement between Owner and Contractor. The period of construction work covered by each Application for Payment is the period indicated in the Agreement.

C. Application for Payment Forms: Use AIA Document G702 and AIA Document G703 as form for Applications for Payment.

D. Application Preparation: Complete every entry on form. Notarize and execute by a person authorized to sign legal documents on behalf of Contractor. Architect will return incomplete applications without action.

1. Entries shall match data on the schedule of values and Contractor's construction schedule. Use updated schedules if revisions were made.
2. Include amounts for work completed following previous Application for Payment, whether or not payment has been received. Include only amounts for work completed at time of Application for Payment.
3. Include amounts of Change Orders and Construction Change Directives issued before last day of construction period covered by application.
4. Indicate separate amounts for work being carried out under Owner-requested project acceleration.

E. Payroll Certification: Submit Payroll Certification in accordance with the Prevailing Wage Act as amended in Public Act 094-0515, including, but not limited to, the following:

1. Certified payroll for all laborers, mechanics, and other workers employed on the project, including each worker's name, address, telephone number (when available,) social security number, classification, the hourly wages paid in each pay period, the number of hours worked each day, and the starting and ending times of work each day.
2. Statement signed by the contractor or subcontractor which states that:

a. Such records are true and accurate;
b. The hourly rate paid to each worker is not less than the general prevailing rate of hourly wages required by the Prevailing Wage Act;

c. The contractor or subcontractor is aware that filing a certified payroll that he/she knows to be false is a Class B misdemeanor. A General Contractor is not prohibited from relying on the certification of a lower tier subcontractor, provided the General Contractor does not knowingly rely on a subcontractor's false certification. Any contractor or subcontractor subject to the Prevailing Wage Act who fails to submit a certified payroll or knowingly files a false certified payroll is in violation of the Prevailing Wage Act and guilty of a Class B misdemeanor.

F. Stored Materials: Include in Application for Payment amounts applied for materials or equipment purchased or fabricated and stored, but not yet installed. Differentiate between items stored on-site and items stored off-site.

1. Provide certificate of insurance, evidence of transfer of title to Owner, and consent of surety to payment, for stored materials.
2. Provide supporting documentation that verifies amount requested, such as paid invoices. Match amount requested with amounts indicated on documentation; do not include overhead and profit on stored materials.
3. Provide summary documentation for stored materials indicating the following:

   a. Value of materials previously stored and remaining stored as of date of previous Applications for Payment.
   b. Value of previously stored materials put in place after date of previous Application for Payment and on or before date of current Application for Payment.
   c. Value of materials stored since date of previous Application for Payment and remaining stored as of date of current Application for Payment.

G. Transmittal: Submit three signed and notarized original copies of each Application for Payment to Architect by a method ensuring receipt within 24 hours. One copy shall include waivers of lien and similar attachments if required.

1. Transmit each copy with a transmittal form listing attachments and recording appropriate information about application.

H. Waivers of Mechanic's Lien: With each Application for Payment, submit waivers of mechanic's lien from entities lawfully entitled to file a mechanic's lien arising out of the Contract and related to the Work covered by the payment.

1. Submit partial waivers on each item for amount requested in previous application, after deduction for retainage, on each item.
2. When an application shows completion of an item, submit conditional final or full waivers.
3. Owner reserves the right to designate which entities involved in the Work must submit waivers.
4. Waiver Forms: Submit executed waivers of lien on forms acceptable to Owner.

I. Initial Application for Payment: Administrative actions and submittals that must precede or coincide with submittal of first Application for Payment include the following:

1. List of subcontractors.
2. Schedule of values.
3. Contractor's construction schedule (preliminary if not final).

4. Combined Contractor's construction schedule (preliminary if not final) incorporating Work of multiple contracts, with indication of acceptance of schedule by each Contractor.
5. Products list (preliminary if not final).
6. Schedule of unit prices.
7. Submittal schedule (preliminary if not final).
8. List of Contractor's staff assignments.
9. List of Contractor's principal consultants.
10. Copies of building permits.
11. Copies of authorizations and licenses from authorities having jurisdiction for performance of the Work.
12. Initial progress report.
13. Report of preconstruction conference.
14. Certificates of insurance and insurance policies.
15. Performance and payment bonds.
16. Data needed to acquire Owner's insurance.

J. Application for Payment at Substantial Completion: After Architect issues the Certificate of Substantial Completion, submit an Application for Payment showing 100 percent completion for portion of the Work claimed as substantially complete.

1. Include documentation supporting claim that the Work is substantially complete and a statement showing an accounting of changes to the Contract Sum.
2. This application shall reflect Certificate(s) of Substantial Completion issued previously for Owner occupancy of designated portions of the Work.

K. Final Payment Application: After completing Project closeout requirements, submit final Application for Payment with releases and supporting documentation not previously submitted and accepted, including, but not limited, to the following:

1. Evidence of completion of Project closeout requirements.
2. Insurance certificates for products and completed operations where required and proof that taxes, fees, and similar obligations were paid.
3. Updated final statement, accounting for final changes to the Contract Sum.
4. AIA Document G706, "Contractor's Affidavit of Payment of Debts and Claims."
5. AIA Document G706A, "Contractor's Affidavit of Release of Liens."
6. AIA Document G707, "Consent of Surety to Final Payment."
7. Evidence that claims have been settled.
8. Final meter readings for utilities, a measured record of stored fuel, and similar data as of date of Substantial Completion or when Owner took possession of and assumed responsibility for corresponding elements of the Work.
9. Final liquidated damages settlement statement.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 29 00

SECTION 01 31 00 - PROJECT MANAGEMENT AND COORDINATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative provisions for coordinating construction operations on Project including, but not limited to, the following:

1. General coordination procedures.
2. Coordination drawings.
3. Requests for Information (RFIs).
4. Project Web site.
5. Project meetings.

B. Related Requirements:

1. Section 01 32 00 "Construction Progress Documentation" for preparing and submitting Contractor's construction schedule.
2. Section 01 73 00 "Execution" for procedures for coordinating general installation and field-engineering services, including establishment of benchmarks and control points.
3. Section 01 77 00 "Closeout Procedures" for coordinating closeout of the Contract.

1.3 DEFINITIONS

A. RFI: Request from Owner, Architect, or Contractor seeking information required by or clarifications of the Contract Documents.

1.4 INFORMATIONAL SUBMITTALS

A. Subcontract List: Prepare a written summary identifying individuals or firms proposed for each portion of the Work, including those who are to furnish products or equipment fabricated to a special design. Include the following information in tabular form:

1. Name, address, and telephone number of entity performing subcontract or supplying products.
2. Number and title of related Specification Section(s) covered by subcontract.
3. Drawing number and detail references, as appropriate, covered by subcontract.

B. Key Personnel Names: Within 15 days of starting construction operations, submit a list of key personnel assignments, including superintendent and other personnel in attendance at Project site. Identify individuals and their duties and responsibilities; list addresses and telephone numbers, including home, office, and cellular telephone numbers and e-mail addresses. Provide names, addresses, and telephone numbers of individuals assigned as alternates in the absence of individuals assigned to Project.

1. Post copies of list in project meeting room, in temporary field office, on Project Web site, and by each temporary telephone. Keep list current at all times.

1.5 GENERAL COORDINATION PROCEDURES

A. Coordination: Coordinate construction operations included in different Sections of the Specifications to ensure efficient and orderly installation of each part of the Work. Coordinate construction operations, included in different Sections, that depend on each other for proper installation, connection, and operation.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components to ensure maximum performance and accessibility for required maintenance, service, and repair.
3. Make adequate provisions to accommodate items scheduled for later installation.

B. Prepare memoranda for distribution to each party involved, outlining special procedures required for coordination. Include such items as required notices, reports, and list of attendees at meetings.

1. Prepare similar memoranda for Owner and separate contractors if coordination of their Work is required.

C. Administrative Procedures: Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and to ensure orderly progress of the Work. Such administrative activities include, but are not limited to, the following:

1. Preparation of Contractor's construction schedule.
2. Preparation of the schedule of values.
3. Installation and removal of temporary facilities and controls.
4. Delivery and processing of submittals.
5. Progress meetings.
6. Preinstallation conferences.
7. Project closeout activities.
8. Startup and adjustment of systems.

D. Conservation: Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water, and materials. Coordinate use of temporary utilities to minimize waste.

1. Salvage materials and equipment involved in performance of, but not actually incorporated into, the Work. See other Sections for disposition of salvaged materials that are designated as Owner's property.

1.6 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:

a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed dampers, valves, and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, fire-alarm, and electrical Work. Show locations of visible ceiling-mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the Work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical and electrical equipment, and related Work. Locate components within ceiling plenum to accommodate layout of light fixtures indicated on Drawings. Indicate areas of conflict between light fixtures and other components.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, fire-alarm, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Slab Edge and Embedded Items: Indicate slab edge locations and sizes and locations of embedded items for metal fabrications, sleeves, anchor bolts, bearing plates, angles, door floor closers, slab depressions for floor finishes, curbs and housekeeping pads, and similar items.
6. Mechanical and Plumbing Work: Show the following:

a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
c. Fire-rated enclosures around ductwork.

7. Electrical Work: Show the following:

a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
d. Location of pull boxes and junction boxes, dimensioned from column center lines.

8. Fire-Protection System: Show the following:

a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

9. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. BIM File Incorporation: Develop and incorporate coordination drawing files into Building Information Model established for Project.
2. Architect will furnish Contractor one set of digital data files of Drawings for use in preparing coordination digital data files.

a. Architect makes no representations as to the accuracy or completeness of digital data files as they relate to Drawings.
b. Digital Data Software Program: Drawings are available in Revit 2014.
c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.

1.7 REQUESTS FOR INFORMATION (RFIs)

A. General: Immediately on discovery of the need for additional information or interpretation of the Contract Documents, Contractor shall prepare and submit an RFI in the form specified.

1. Architect will return RFIs submitted to Architect by other entities controlled by Contractor with no response.
2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in Contractor's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing information or interpretation and the following:

1. Project name.
2. Project number.
3. Date.
4. Name of Contractor.
5. RFI number, numbered sequentially.
6. RFI subject.
7. Specification Section number and title and related paragraphs, as appropriate.
8. Drawing number and detail references, as appropriate.
9. Field dimensions and conditions, as appropriate.
10. Contractor's suggested resolution. If Contractor's suggested resolution impacts the Contract Time or the Contract Sum, Contractor shall state impact in the RFI.
11. Contractor's signature.
12. Attachments: Include sketches, descriptions, measurements, photos, Product Data, Shop Drawings, coordination drawings, and other information necessary to fully describe items needing interpretation.

    a. Include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments on attached sketches.

C. RFI Forms: Software-generated form with substantially the same content as indicated above, acceptable to Architect.

1. Attachments shall be electronic files in Adobe Acrobat PDF format.

D. RFI Log: Prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log weekly. Include the following:

1. Project name.
2. Name and address of Contractor.
3. RFI number including RFIs that were returned without action or withdrawn.
4. RFI description.
5. Date the RFI was submitted.

1.8 PROJECT WEB SITE

A. Provide, administer, and use Project Web site for purposes of hosting and managing project communication and documentation until Final Completion. Project Web site shall include the following functions:

1. Project directory.
2. Project correspondence.
3. Meeting minutes.
4. Contract modifications forms and logs.
5. RFI forms and logs.
6. Task and issue management.
7. Photo documentation.
8. Schedule and calendar management.
9. Submittals forms and logs.
10. Payment application forms.
11. Drawing and specification document hosting, viewing, and updating.

12. Online document collaboration.
13. Reminder and tracking functions.
14. Archiving functions.

B. On completion of Project, provide one complete archive copy(ies) of Project Web site files to Owner and to Architect in a digital storage format acceptable to Architect.

C. Provide the following Project Web site software packages under their current published licensing agreements:

1. Procore
2. Autodesk Plangrid
3. Submittal Exchange

D. Contractor, subcontractors, and other parties granted access by Contractor to Project Web site shall execute a data licensing agreement in the form of Agreement acceptable to Owner and Architect.

1.9 PROJECT MEETINGS

A. General: Schedule and conduct meetings and conferences at Project site unless otherwise indicated.

1. Attendees: Inform participants and others involved, and individuals whose presence is required, of date and time of each meeting. Notify Owner and Architect of scheduled meeting dates and times.
2. Agenda: Prepare the meeting agenda. Distribute the agenda to all invited attendees.
3. Minutes: Entity responsible for conducting meeting will record significant discussions and agreements achieved. Distribute the meeting minutes to everyone concerned, including Owner and Architect, within three days of the meeting.

B. Preconstruction Conference: Architect will schedule and conduct a preconstruction conference before starting construction, at a time convenient to Owner and Architect, but no later than 15 days after execution of the Agreement.

1. Conduct the conference to review responsibilities and personnel assignments.
2. Attendees: Authorized representatives of Owner Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the conference. Participants at the conference shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect progress, including the following:

a. Tentative construction schedule.
b. Phasing.
c. Critical work sequencing and long-lead items.
d. Designation of key personnel and their duties.
e. Lines of communications.
f. Procedures for processing field decisions and Change Orders.
g. Procedures for RFIs.
h. Procedures for testing and inspecting.

i. Procedures for processing Applications for Payment.
j. Distribution of the Contract Documents.
k. Submittal procedures.
l. Preparation of record documents.
m. Use of the premises and existing building.
n. Work restrictions.
o. Working hours.
p. Owner's occupancy requirements.
q. Responsibility for temporary facilities and controls.
r. Procedures for moisture and mold control.
s. Procedures for disruptions and shutdowns.
t. Construction waste management and recycling.
u. Parking availability.
v. Office, work, and storage areas.
w. Equipment deliveries and priorities.
x. First aid.
y. Security.
z. Progress cleaning.

4. Minutes: Entity responsible for conducting meeting will record and distribute meeting minutes.

C. Preinstallation Conferences: Conduct a preinstallation conference at Project site before each construction activity that requires coordination with other construction.

1. Attendees: Installer and representatives of manufacturers and fabricators involved in or affected by the installation and its coordination or integration with other materials and installations that have preceded or will follow, shall attend the meeting. Advise Architect of scheduled meeting dates.
2. Agenda: Review progress of other construction activities and preparations for the particular activity under consideration, including requirements for the following:

a. Contract Documents.
b. Options.
c. Related RFIs.
d. Related Change Orders.
e. Purchases.
f. Deliveries.
g. Submittals.
h. Review of mockups.
i. Possible conflicts.
j. Compatibility requirements.
k. Time schedules.
l. Weather limitations.
m. Manufacturer's written instructions.
n. Warranty requirements.
o. Compatibility of materials.
p. Acceptability of substrates.
q. Temporary facilities and controls.
r. Space and access limitations.
s. Regulations of authorities having jurisdiction.
t. Testing and inspecting requirements.
u. Installation procedures.
v. Coordination with other work.
w. Required performance results.

x. Protection of adjacent work.
y. Protection of construction and personnel.

3. Record significant conference discussions, agreements, and disagreements, including required corrective measures and actions.
4. Reporting: Distribute minutes of the meeting to each party present and to other parties requiring information.
5. Do not proceed with installation if the conference cannot be successfully concluded. Initiate whatever actions are necessary to resolve impediments to performance of the Work and reconvene the conference at earliest feasible date.

D. Project Closeout Conference: Schedule and conduct a project closeout conference, at a time convenient to Owner and Architect, but no later than 90 days prior to the scheduled date of Substantial Completion.

1. Conduct the conference to review requirements and responsibilities related to Project closeout.
2. Attendees: Authorized representatives of Owner, Architect, and their consultants; Contractor and its superintendent; major subcontractors; suppliers; and other concerned parties shall attend the meeting. Participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Discuss items of significance that could affect or delay Project closeout, including the following:

a. Preparation of record documents.
b. Procedures required prior to inspection for Substantial Completion and for final inspection for acceptance.
c. Submittal of written warranties.
d. Requirements for preparing operations and maintenance data.
e. Requirements for delivery of material samples, attic stock, and spare parts.
f. Requirements for demonstration and training.
g. Preparation of Contractor's punch list.
h. Procedures for processing Applications for Payment at Substantial Completion and for final payment.
i. Submittal procedures.
j. Coordination of separate contracts.
k. Owner's partial occupancy requirements.
l. Installation of Owner's furniture, fixtures, and equipment.
m. Responsibility for removing temporary facilities and controls.

4. Minutes: Entity conducting meeting will record and distribute meeting minutes.

E. Progress Meetings: Conduct progress meetings at weekly intervals.

1. Coordinate dates of meetings with preparation of payment requests.
2. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meeting shall be familiar with Project and authorized to conclude matters relating to the Work.
3. Agenda: Review and correct or approve minutes of previous progress meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Contractor's Construction Schedule: Review progress since the last meeting. Determine whether each activity is on time, ahead of schedule, or behind schedule, in relation to Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

1) Review schedule for next period.

b. Review present and future needs of each entity present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Resolution of BIM component conflicts.
4) Status of submittals.
5) Deliveries.
6) Off-site fabrication.
7) Access.
8) Site utilization.
9) Temporary facilities and controls.
10) Progress cleaning.
11) Quality and work standards.
12) Status of correction of deficient items.
13) Field observations.
14) Status of RFIs.
15) Status of proposal requests.
16) Pending changes.
17) Status of Change Orders.
18) Pending claims and disputes.
19) Documentation of information for payment requests.

4. Minutes: Entity responsible for conducting the meeting will record and distribute the meeting minutes to each party present and to parties requiring information.

a. Schedule Updating: Revise Contractor's construction schedule after each progress meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with the report of each meeting.

F. Coordination Meetings: Conduct Project coordination meetings at weekly intervals. Project coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.

1. Attendees: In addition to representatives of Owner and Architect, each contractor, subcontractor, supplier, and other entity concerned with current progress or involved in planning, coordination, or performance of future activities shall be represented at these meetings. All participants at the meetings shall be familiar with Project and authorized to conclude matters relating to the Work.
2. Agenda: Review and correct or approve minutes of the previous coordination meeting. Review other items of significance that could affect progress. Include topics for discussion as appropriate to status of Project.

a. Combined Contractor's Construction Schedule: Review progress since the last coordination meeting. Determine whether each contract is on time, ahead of schedule, or behind schedule, in relation to combined Contractor's construction schedule. Determine how construction behind schedule will be expedited; secure commitments from parties involved to do so. Discuss whether schedule revisions are required to ensure that current and subsequent activities will be completed within the Contract Time.

b. Schedule Updating: Revise combined Contractor's construction schedule after each coordination meeting where revisions to the schedule have been made or recognized. Issue revised schedule concurrently with report of each meeting.

c. Review present and future needs of each contractor present, including the following:

1) Interface requirements.
2) Sequence of operations.
3) Status of submittals.
4) Deliveries.
5) Off-site fabrication.
6) Access.
7) Site utilization.
8) Temporary facilities and controls.
9) Work hours.
10) Hazards and risks.
11) Progress cleaning.
12) Quality and work standards.
13) Change Orders.

3. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 31 00

SECTION 01 32 00 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for documenting the progress of construction during performance of the Work, including the following:

1. Startup construction schedule.
2. Contractor's construction schedule.
3. Construction schedule updating reports.
4. Daily construction reports.
5. Material location reports.
6. Site condition reports.
7. Special reports.

B. Related Requirements:

1. Section 01 33 00 "Submittal Procedures" for submitting schedules and reports.
2. Section 01 40 00 "Quality Requirements" for submitting a schedule of tests and inspections.

1.3 DEFINITIONS

A. Activity: A discrete part of a project that can be identified for planning, scheduling, monitoring, and controlling the construction project. Activities included in a construction schedule consume time and resources.

1. Critical Activity: An activity on the critical path that must start and finish on the planned early start and finish times.
2. Predecessor Activity: An activity that precedes another activity in the network.
3. Successor Activity: An activity that follows another activity in the network.

B. Cost Loading: The allocation of the schedule of values for the completion of an activity as scheduled. The sum of costs for all activities must equal the total Contract Sum unless otherwise approved by Architect.

C. CPM: Critical path method, which is a method of planning and scheduling a construction project where activities are arranged based on activity relationships. Network calculations determine when activities can be performed and the critical path of Project.

D. Critical Path: The longest connected chain of interdependent activities through the network schedule that establishes the minimum overall Project duration and contains no float.

E. Event: The starting or ending point of an activity.

F. Float: The measure of leeway in starting and completing an activity.

1. Float time is not for the exclusive use or benefit of either Owner or Contractor, but is a jointly owned, expiring Project resource available to both parties as needed to meet schedule milestones and Contract completion date.
2. Free float is the amount of time an activity can be delayed without adversely affecting the early start of the successor activity.
3. Total float is the measure of leeway in starting or completing an activity without adversely affecting the planned Project completion date.

G. Resource Loading: The allocation of manpower and equipment necessary for the completion of an activity as scheduled.

1.4 INFORMATIONAL SUBMITTALS

A. Format for Submittals: Submit required submittals in the following format:

1. Working electronic copy of schedule file, where indicated.
2. PDF electronic file.

B. Startup construction schedule.

1. Approval of cost-loaded, startup construction schedule will not constitute approval of schedule of values for cost-loaded activities.

C. Startup Network Diagram: Of size required to display entire network for entire construction period. Show logic ties for activities.

D. Contractor's Construction Schedule: Initial schedule, of size required to display entire schedule for entire construction period.

1. Submit a working electronic copy of schedule, using software indicated, and labeled to comply with requirements for submittals. Include type of schedule (initial or updated) and date on label.

E. CPM Reports: Concurrent with CPM schedule, submit each of the following reports. Format for each activity in reports shall contain activity number, activity description, cost and resource loading, original duration, remaining duration, early start date, early finish date, late start date, late finish date, and total float in calendar days.

1. Activity Report: List of all activities sorted by activity number and then early start date, or actual start date if known.
2. Logic Report: List of preceding and succeeding activities for all activities, sorted in ascending order by activity number and then early start date, or actual start date if known.
3. Total Float Report: List of all activities sorted in ascending order of total float.
4. Earnings Report: Compilation of Contractor's total earnings from [commencement of the Work] [the Notice to Proceed] until most recent Application for Payment.

F. Construction Schedule Updating Reports: Submit with Applications for Payment.

G. Material Location Reports: Submit at monthly intervals.

H. Site Condition Reports: Submit at time of discovery of differing conditions.

I. Special Reports: Submit at time of unusual event.

J. Qualification Data: For scheduling consultant.

1.5 QUALITY ASSURANCE

A. Prescheduling Conference: Conduct conference at Project site to comply with requirements in Section 01 31 00 "Project Management and Coordination." Review methods and procedures related to the preliminary construction schedule and Contractor's construction schedule, including, but not limited to, the following:

1. Review software limitations and content and format for reports.
2. Verify availability of qualified personnel needed to develop and update schedule.
3. Discuss constraints, including work stages .
4. Review delivery dates for Owner-furnished products.
5. Review schedule for work of Owner's separate contracts.
6. Review submittal requirements and procedures.
7. Review time required for review of submittals and resubmittals.
8. Review requirements for tests and inspections by independent testing and inspecting agencies.
9. Review time required for Project closeout and Owner startup procedures, including commissioning activities.
10. Review and finalize list of construction activities to be included in schedule.
11. Review procedures for updating schedule.

1.6 COORDINATION

A. Coordinate Contractor's construction schedule with the schedule of values, list of subcontracts, submittal schedule, progress reports, payment requests, and other required schedules and reports.

1. Secure time commitments for performing critical elements of the Work from entities involved.
2. Coordinate each construction activity in the network with other activities and schedule them in proper sequence.

PART 2 - PRODUCTS

2.1 CONTRACTOR'S CONSTRUCTION SCHEDULE, GENERAL

A. Time Frame: Extend schedule from date established for the Notice to Proceed to date of final completion.

1. Contract completion date shall not be changed by submission of a schedule that shows an early completion date, unless specifically authorized by Change Order.

B. Activities: Treat each story or separate area as a separate numbered activity for each main element of the Work. Comply with the following:

1. Activity Duration: Define activities so no activity is longer than 20 days, unless specifically allowed by Architect.
2. Procurement Activities: Include procurement process activities for the following long lead items and major items, requiring a cycle of more than 60 days, as separate activities in schedule. Procurement cycle activities include, but are not limited to, submittals, approvals, purchasing, fabrication, and delivery.
3. Submittal Review Time: Include review and resubmittal times indicated in Section 01 33 00 "Submittal Procedures" in schedule. Coordinate submittal review times in Contractor's construction schedule with submittal schedule.
4. Startup and Testing Time: Include no fewer than 15 days for startup and testing.
5. Punch List and Final Completion: Include not more than 30 days for completion of punch list items and final completion.

C. Constraints: Include constraints and work restrictions indicated in the Contract Documents and as follows in schedule, and show how the sequence of the Work is affected.

1. Products Ordered in Advance: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
2. Owner-Furnished Products: Include a separate activity for each product. Include delivery date indicated in Section 01 10 00 "Summary." Delivery dates indicated stipulate the earliest possible delivery date.
3. Work Restrictions: Show the effect of the following items on the schedule:

    a. Coordination with existing construction.
    b. Limitations of continued occupancies.
    c. Uninterruptible services.
    d. Partial occupancy before Substantial Completion.
    e. Use of premises restrictions.
    f. Provisions for future construction.
    g. Seasonal variations.
    h. Environmental control.

4. Work Stages: Indicate important stages of construction for each major portion of the Work, including, but not limited to, the following:

    a. Subcontract awards.
    b. Submittals.
    c. Purchases.
    d. Mockups.
    e. Fabrication.
    f. Sample testing.
    g. Deliveries.
    h. Installation.
    i. Tests and inspections.
    j. Adjusting.
    k. Curing.
    l. Startup and placement into final use and operation.

5. Construction Areas: Identify each major area of construction for each major portion of the Work. Indicate where each construction activity within a major area must be sequenced or integrated with other construction activities to provide for the following:

    a. Structural completion.
    b. Temporary enclosure and space conditioning.
    c. Permanent space enclosure.
    d. Completion of mechanical installation.
    e. Completion of electrical installation.
    f. Substantial Completion.

D. Milestones: Include milestones indicated in the Contract Documents in schedule, including, but not limited to, the Notice to Proceed, Substantial Completion, and final completion, and the following interim milestones:

1. Temporary enclosure and space conditioning.

E. Cost Correlation: Superimpose a cost correlation timeline, indicating planned and actual costs. On the line, show planned and actual dollar volume of the Work performed as of planned and actual dates used for preparation of payment requests.

1. See Section 01 29 00 "Payment Procedures" for cost reporting and payment procedures.

F. Upcoming Work Summary: Prepare summary report indicating activities scheduled to occur or commence prior to submittal of next schedule update. Summarize the following issues:

1. Unresolved issues.
2. Unanswered Requests for Information.
3. Rejected or unreturned submittals.
4. Notations on returned submittals.
5. Pending modifications affecting the Work and Contract Time.

G. Recovery Schedule: When periodic update indicates the Work is 14 or more calendar days behind the current approved schedule, submit a separate recovery schedule indicating means by which Contractor intends to regain compliance with the schedule. Indicate changes to working hours, working days, crew sizes, and equipment required to achieve compliance, and date by which recovery will be accomplished.

H. Computer Scheduling Software: Prepare schedules using current version of a program that has been developed specifically to manage construction schedules.

2.2 STARTUP CONSTRUCTION SCHEDULE

A. Bar-Chart Schedule: Submit startup, horizontal, bar-chart-type construction schedule within seven days of date established for the Notice to Proceed.

B. Preparation: Indicate each significant construction activity separately. Identify first workday of each week with a continuous vertical line. Outline significant construction activities for first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

2.3 CONTRACTOR'S CONSTRUCTION SCHEDULE (CPM SCHEDULE)

A. General: Prepare network diagrams using AON (activity-on-node) format.

B. Startup Network Diagram: Submit diagram within 14 days of date established for the Notice to Proceed. Outline significant construction activities for the first 90 days of construction. Include skeleton diagram for the remainder of the Work and a cash requirement prediction based on indicated activities.

C. CPM Schedule: Prepare Contractor's construction schedule using a cost- and resource-loaded, time-scaled CPM network analysis diagram for the Work.

1. Develop network diagram in sufficient time to submit CPM schedule so it can be accepted for use no later than 60 days after date established for the Notice to Proceed.

    a. Failure to include any work item required for performance of this Contract shall not excuse Contractor from completing all work within applicable completion dates, regardless of Architect's approval of the schedule.

2. Conduct educational workshops to train and inform key Project personnel, including subcontractors' personnel, in proper methods of providing data and using CPM schedule information.
3. Establish procedures for monitoring and updating CPM schedule and for reporting progress. Coordinate procedures with progress meeting and payment request dates.
4. Use "one workday" as the unit of time for individual activities. Indicate nonworking days and holidays incorporated into the schedule in order to coordinate with the Contract Time.

D. CPM Schedule Preparation: Prepare a list of all activities required to complete the Work. Using the startup network diagram, prepare a skeleton network to identify probable critical paths.

1. Activities: Indicate the estimated time duration, sequence requirements, and relationship of each activity in relation to other activities. Include estimated time frames for the following activities:

    a. Preparation and processing of submittals.
    b. Mobilization and demobilization.
    c. Purchase of materials.
    d. Delivery.
    e. Fabrication.
    f. Utility interruptions.
    g. Installation.
    h. Testing and commissioning.
    i. Punch list and final completion.
    j. Activities occurring following final completion.

2. Critical Path Activities: Identify critical path activities, including those for interim completion dates. Scheduled start and completion dates shall be consistent with Contract milestone dates.

3. Processing: Process data to produce output data on a computer-drawn, time-scaled network. Revise data, reorganize activity sequences, and reproduce as often as necessary to produce the CPM schedule within the limitations of the Contract Time.
4. Format: Mark the critical path. Locate the critical path near center of network; locate paths with most float near the edges.

    a. Subnetworks on separate sheets are permissible for activities clearly off the critical path.

5. Cost- and Resource-Loading of CPM Schedule: Assign cost to construction activities on the CPM schedule. Do not assign costs to submittal activities. Obtain Architect's approval prior to assigning costs to fabrication and delivery activities. Assign costs under main subcontracts for testing and commissioning activities, operation and maintenance manuals, punch list activities, Project record documents, and demonstration and training (if applicable), in the amount of 5 percent of the Contract Sum.

    a. Each activity cost shall reflect an appropriate value subject to approval by Architect.
    b. Total cost assigned to activities shall equal the total Contract Sum.

E. Contract Modifications: For each proposed contract modification and concurrent with its submission, prepare a time-impact analysis using a network fragment to demonstrate the effect of the proposed change on the overall project schedule.

F. Initial Issue of Schedule: Prepare initial network diagram from a sorted activity list indicating straight "early start-total float." Identify critical activities. Prepare tabulated reports showing the following:

1. Contractor or subcontractor and the Work or activity.
2. Description of activity.
3. Main events of activity.
4. Immediate preceding and succeeding activities.
5. Early and late start dates.
6. Early and late finish dates.
7. Activity duration in workdays.
8. Total float or slack time.
9. Average size of workforce.
10. Dollar value of activity (coordinated with the schedule of values).

G. Schedule Updating: Concurrent with making revisions to schedule, prepare tabulated reports showing the following:

1. Identification of activities that have changed.
2. Changes in early and late start dates.
3. Changes in early and late finish dates.
4. Changes in activity durations in workdays.
5. Changes in the critical path.
6. Changes in total float or slack time.
7. Changes in the Contract Time.

H. Value Summaries: Prepare two cumulative value lists, sorted by finish dates.

1. In first list, tabulate activity number, early finish date, dollar value, and cumulative dollar value.
2. In second list, tabulate activity number, late finish date, dollar value, and cumulative dollar value.
3. In subsequent issues of both lists, substitute actual finish dates for activities completed as of list date.
4. Prepare list for ease of comparison with payment requests; coordinate timing with progress meetings.

    a. In both value summary lists, tabulate "actual percent complete" and "cumulative value completed" with total at bottom.
    b. Submit value summary printouts one week before each regularly scheduled progress meeting.

2.4 REPORTS

A. Daily Construction Reports: Prepare a daily construction report recording the following information concerning events at Project site:

1. List of subcontractors at Project site.
2. List of separate contractors at Project site.
3. Approximate count of personnel at Project site.
4. Equipment at Project site.
5. Material deliveries.
6. High and low temperatures and general weather conditions, including presence of rain or snow.
7. Accidents.
8. Meetings and significant decisions.
9. Unusual events (see special reports).
10. Stoppages, delays, shortages, and losses.
11. Meter readings and similar recordings.
12. Emergency procedures.
13. Orders and requests of authorities having jurisdiction.
14. Change Orders received and implemented.
15. Construction Change Directives received and implemented.
16. Services connected and disconnected.
17. Equipment or system tests and startups.
18. Partial completions and occupancies.
19. Substantial Completions authorized.

B. Material Location Reports: At monthly intervals, prepare and submit a comprehensive list of materials delivered to and stored at Project site. List shall be cumulative, showing materials previously reported plus items recently delivered. Include with list a statement of progress on and delivery dates for materials or items of equipment fabricated or stored away from Project site. Indicate the following categories for stored materials:

1. Material stored prior to previous report and remaining in storage.
2. Material stored prior to previous report and since removed from storage and installed.
3. Material stored following previous report and remaining in storage.

C. Site Condition Reports: Immediately on discovery of a difference between site conditions and the Contract Documents, prepare and submit a detailed report. Submit with a Request for Information. Include a detailed description of the differing conditions, together with recommendations for changing the Contract Documents.

2.5 SPECIAL REPORTS

A. General: Submit special reports directly to Owner within one day(s) of an occurrence. Distribute copies of report to parties affected by the occurrence.

B. Reporting Unusual Events: When an event of an unusual and significant nature occurs at Project site, whether or not related directly to the Work, prepare and submit a special report. List chain of events, persons participating, response by Contractor's personnel, evaluation of results or effects, and similar pertinent information. Advise Owner in advance when these events are known or predictable.

PART 3 - EXECUTION

3.1 CONTRACTOR'S CONSTRUCTION SCHEDULE

A. Contractor's Construction Schedule Updating: At monthly intervals, update schedule to reflect actual construction progress and activities. Issue schedule one week before each regularly scheduled progress meeting.

1. Revise schedule immediately after each meeting or other activity where revisions have been recognized or made. Issue updated schedule concurrently with the report of each such meeting.
2. Include a report with updated schedule that indicates every change, including, but not limited to, changes in logic, durations, actual starts and finishes, and activity durations.
3. As the Work progresses, indicate final completion percentage for each activity.

END OF SECTION 01 32 00

SECTION 01 33 00 - SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

B. Related Requirements:

1. Section 01 29 00 "Payment Procedures" for submitting Applications for Payment and the schedule of values.
2. Section 01 32 00 "Construction Progress Documentation" for submitting schedules and reports, including Contractor's construction schedule.
3. Section 01 78 23 "Operation and Maintenance Data" for submitting operation and maintenance manuals.
4. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
5. Section 01 79 00 "Demonstration and Training" for submitting video recordings of demonstration of equipment and training of Owner's personnel.

1.3 DEFINITIONS

A. Action Submittals: Written and graphic information and physical samples that require Architect's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. Informational Submittals: Written and graphic information and physical samples that do not require Architect's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

C. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

D. Portable Document Format (PDF): An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

1.4 ACTION SUBMITTALS

A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.

1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
2. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.

    a. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

4. Format: Arrange the following information in a tabular format:

    a. Scheduled date for first submittal.
    b. Specification Section number and title.
    c. Submittal category: Action; informational.
    d. Name of subcontractor.
    e. Description of the Work covered.
    f. Scheduled date for Architect's final release or approval.
    g. Scheduled date of fabrication.
    h. Scheduled dates for purchasing.
    i. Scheduled dates for installation.
    j. Activity or event number.

1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.

1. Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.

    a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    b. Digital Drawing Software Program: The Contract Drawings are available in Revit 2017.
    c. Contractor shall execute a data licensing agreement in the form of Agreement form acceptable to Owner and Architect.
    d. The following digital data files will by furnished for each appropriate discipline:

        1) Floor plans.
        2) Reflected ceiling plans.

B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
2. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

    a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

C. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
2. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
3. Resubmittal Review: Allow 15 days for review of each resubmittal.
4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.

D. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
2. Name file with submittal number or other unique identifier, including revision identifier.

    a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

3. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
4. Transmittal Form for Electronic Submittals: Use electronic form acceptable to Owner**,** containing the following information:

a. Project name.
b. Date.
c. Name and address of Architect.
d. Name of Construction Manager.
e. Name of Contractor.
f. Name of firm or entity that prepared submittal.
g. Names of subcontractor, manufacturer, and supplier.
h. Category and type of submittal.
i. Submittal purpose and description.
j. Specification Section number and title.
k. Specification paragraph number or drawing designation and generic name for each of multiple items.
l. Drawing number and detail references, as appropriate.
m. Location(s) where product is to be installed, as appropriate.
n. Related physical samples submitted directly.
o. Indication of full or partial submittal.
p. Transmittal number, numbered consecutively.
q. Submittal and transmittal distribution record.
r. Other necessary identification.
s. Remarks.

E. Options: Identify options requiring selection by Architect.

F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of previous submittal.
2. Note date and content of revision in label or title block and clearly indicate extent of revision.
3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.

H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

PART 2 - PRODUCTS

2.1 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Post electronic submittals as PDF electronic files directly to Project Web site specifically established for Project.
2. Certificates and Certifications Submittals: Provide a statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.

    a. Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
    b. Provide a notarized statement on original paper copy certificates and certifications where indicated.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:

    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.

4. For equipment, include the following in addition to the above, as applicable:

    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

5. Submit Product Data before or concurrent with Samples.
6. Submit Product Data in the following format:

    a. PDF electronic file.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:

    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.

e. Notation of dimensions established by field measurement.
f. Relationship and attachment to adjoining construction clearly indicated.
g. Seal and signature of professional engineer if specified.

2. Sheet Size: Except for templates, patterns, and similar full-size drawings, submit Shop Drawings on sheets at least 8-1/2 by 11 inches, but no larger than 30 by 42 inches.
3. Submit Shop Drawings in the following format:

a. PDF electronic file.

4. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.

a. Prepare Shop Drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.
b. Refer to Section 01 31 00 "Project Management and Coordination" for requirements for coordination drawings.

D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of these characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.

1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
2. Identification: Attach label on unexposed side of Samples that includes the following:

a. Generic description of Sample.
b. Product name and name of manufacturer.
c. Sample source.
d. Number and title of applicable Specification Section.
e. Specification paragraph number and generic name of each item.

3. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.
4. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.

a. Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
b. Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.

5. Samples for Initial Selection: Submit manufacturer's color charts consisting of units or sections of units showing the full range of colors, textures, and patterns available.

a. Number of Samples: Submit one full set(s) of available choices where color, pattern, texture, or similar characteristics are required to be selected from manufacturer's product line. Architect will return submittal with options selected.

6. Samples for Verification: Submit full-size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.

a. Number of Samples: Submit three sets of Samples. Architect will retain one Sample sets; remainder will be returned. Mark up and retain one returned Sample set as a project record sample.

1) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
2) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.

E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:

1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
2. Manufacturer and product name, and model number if applicable.
3. Number and name of room or space.
4. Location within room or space.
5. Submit product schedule in the following format:

a. PDF electronic file.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 01 31 00 "Project Management and Coordination."

G. Contractor's Construction Schedule: Comply with requirements specified in Section 01 32 00 "Construction Progress Documentation."

H. Application for Payment and Schedule of Values: Comply with requirements specified in Section 01 29 00 "Payment Procedures."

I. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 40 00 "Quality Requirements."

J. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 77 00 "Closeout Procedures."

K. Maintenance Data: Comply with requirements specified in Section 01 78 23 "Operation and Maintenance Data."

L. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.

M. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

N. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

O. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

P. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

Q. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

R. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.

S. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

T. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

U. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

V. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

W. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

X. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

2.2 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

B. Delegated-Design Services Certification: In addition to Shop Drawings, Product Data, and other required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.

1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.

C. BIM File Incorporation: Incorporate delegated-design drawing and data files into Building Information Model established for Project.

1. Prepare delegated-design drawings in the following format: Same digital data software program, version, and operating system as the original Drawings.

PART 3 - EXECUTION

3.1 CONTRACTOR'S REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Project Closeout and Maintenance Material Submittals: See requirements in Section 01 77 00 "Closeout Procedures."

C. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.2 ARCHITECT'S ACTION

A. Action Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Architect will review each submittal and will not return it, or will return it if it does not comply with requirements. Architect will forward each submittal to appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Architect without action.

END OF SECTION 01 33 00

SECTION 01 40 00 - QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for quality assurance and quality control.

B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.

1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the Contract Document requirements.
3. Specific test and inspection requirements are not specified in this Section.

1.3 DEFINITIONS

A. Quality-Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.

B. Quality-Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.

C. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.

D. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

E. Source Quality-Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.

F. Field Quality-Control Testing: Tests and inspections that are performed on-site for installation of the Work and for completed Work.

G. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.

H. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform a particular construction operation, including installation, erection, application, and similar operations.

1. Use of trade-specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).

I. Experienced: When used with an entity or individual, "experienced" means having successfully completed a minimum of five previous projects similar in nature, size, and extent to this Project; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

1.4 CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Architect for a decision before proceeding.

1.5 INFORMATIONAL SUBMITTALS

A. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

B. Qualification Data : For Contractor's quality-control personnel.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems:

1. Seismic-force-resisting system, designated seismic system, or component listed in the designated seismic system quality-assurance plan prepared by Architect.
2. Main wind-force-resisting system or a wind-resisting component listed in the wind-force-resisting system quality-assurance plan prepared by Architect.

D. Testing Agency Qualifications: For testing agencies specified in "Quality Assurance" Article to demonstrate their capabilities and experience. Include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

1.6 CONTRACTOR'S QUALITY-CONTROL PLAN

A. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

B. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

1. Project quality-control manager may also serve as Project superintendent.

C. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

D. Testing and Inspection: In quality-control plan, include a comprehensive schedule of Work requiring testing or inspection, including the following:

1. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.

E. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

F. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.7 REPORTS AND DOCUMENTS

A. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of technical representative making report.
2. Statement on condition of substrates and their acceptability for installation of product.
3. Statement that products at Project site comply with requirements.
4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
6. Statement whether conditions, products, and installation will affect warranty.
7. Other required items indicated in individual Specification Sections.

B. Factory-Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory-authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
2. Statement that equipment complies with requirements.
3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
4. Statement whether conditions, products, and installation will affect warranty.
5. Other required items indicated in individual Specification Sections.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.8 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated for this Project.

F. Specialists: Certain Specification Sections require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirements of authorities having jurisdiction shall supersede requirements for specialists.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, as documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.

1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Factory-Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:

1. Contractor responsibilities include the following:

a. Provide test specimens representative of proposed products and construction.
b. Submit specimens in a timely manner with sufficient time for testing and analyzing results to prevent delaying the Work.
c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
d. Build site-assembled test assemblies and mockups using installers who will perform same tasks for Project.
e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
f. When testing is complete, remove test specimens, assemblies, and mockups; do not reuse products on Project.

1.9 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform these services.

1. Owner will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform.
2. Payment for these services will be made from testing and inspecting allowances, as authorized by Change Orders.
3. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor, and the Contract Sum will be adjusted by Change Order.

B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.

1. Unless otherwise indicated, provide quality-control services specified and those required by authorities having jurisdiction. Perform quality-control services required of Contractor by authorities having jurisdiction, whether specified or not.
2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.

    a. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.

3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
4. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections. Report results in writing as specified in Section 01 33 00 "Submittal Procedures."

D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.

E. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Architect and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Do not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

G. Associated Services: Cooperate with agencies performing required tests, inspections, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Delivery of samples to testing agencies.
6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
7. Security and protection for samples and for testing and inspecting equipment at Project site.

H. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities.

1.10 SPECIAL TESTS AND INSPECTIONS

A. Special Tests and Inspections: Conducted by a qualified testing agency as required by authorities having jurisdiction, as indicated in individual Specification Sections, and as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
2. Notifying Architect and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Architect with copy to Contractor and to authorities having jurisdiction.
4. Submitting a final report of special tests and inspections at Substantial Completion, which includes a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Test and Inspection Log: Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the Work tested or inspected.
3. Date test or inspection results were transmitted to Architect.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.2 REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 73 00 "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 01 40 00

SECTION 01 42 00 - REFERENCES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 DEFINITIONS

A. General: Basic Contract definitions are included in the Conditions of the Contract.

B. "Approved": When used to convey Architect's action on Contractor's submittals, applications, and requests, "approved" is limited to Architect's duties and responsibilities as stated in the Conditions of the Contract.

C. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

D. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

E. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

F. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

G. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

H. "Provide": Furnish and install, complete and ready for the intended use.

I. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

1.3 INDUSTRY STANDARDS

A. Applicability of Standards: Unless the Contract Documents include more stringent requirements, applicable construction industry standards have the same force and effect as if bound or copied directly into the Contract Documents to the extent referenced. Such standards are made a part of the Contract Documents by reference.

B. Publication Dates: Comply with standards in effect as of date of the Contract Documents unless otherwise indicated.

C. Copies of Standards: Each entity engaged in construction on Project should be familiar with industry standards applicable to its construction activity. Copies of applicable standards are not bound with the Contract Documents.

1. Where copies of standards are needed to perform a required construction activity, obtain copies directly from publication source.

1.4 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AA	Aluminum Association (The) www.aluminum.org	(703) 358-2960
AABC	Associated Air Balance Council www.aabchq.com	(202) 737-0202
AAMA	American Architectural Manufacturers Association www.aamanet.org	(847) 303-5664
AASHTO	American Association of State Highway and Transportation Officials www.transportation.org	(202) 624-5800
AATCC	American Association of Textile Chemists and Colorists www.aatcc.org	(919) 549-8141
ABAA	Air Barrier Association of America www.airbarrier.org	(866) 956-5888
ABMA	American Bearing Manufacturers Association www.abma-dc.org	(202) 367-1155
ACI	American Concrete Institute www.concrete.org	(248) 848-3700
ACPA	American Concrete Pipe Association www.concrete-pipe.org	(972) 506-7216
AEIC	Association of Edison Illuminating Companies, Inc. (The) www.aeic.org	(205) 257-2530
AF&PA	American Forest & Paper Association www.afandpa.org	(800) 878-8878 (202) 463-2700
AGA	American Gas Association www.aga.org	(202) 824-7000
AHAM	Association of Home Appliance Manufacturers www.aham.org	(202) 872-5955
AHRI	Air-Conditioning, Heating, andRefrigeration Institute, The	(703) 524-8800

	www.ahrinet.org	
AI	Asphalt Institute www.asphaltinstitute.org	(859) 288-4960
AIA	American Institute of Architects (The) www.aia.org	(800) 242-3837 (202) 626-7300
AISC	American Institute of Steel Construction www.aisc.org	(800) 644-2400 (312) 670-2400
AISI	American Iron and Steel Institute www.steel.org	(202) 452-7100
AITC	American Institute of Timber Construction www.aitc-glulam.org	(303) 792-9559
ALSC	American Lumber Standard Committee, Incorporated www.alsc.org	(301) 972-1700
AMCA	Air Movement and Control Association International, Inc. www.amca.org	(847) 394-0150
ANSI	American National Standards Institute www.ansi.org	(202) 293-8020
AOSA	Association of Official Seed Analysts, Inc. www.aosaseed.com	(405) 780-7372
APA	APA - The Engineered Wood Association www.apawood.org	(253) 565-6600
APA	Architectural Precast Association www.archprecast.org	(239) 454-6989
API	American Petroleum Institute www.api.org	(202) 682-8000
ARI	Air-Conditioning & Refrigeration Institute www.ari.org	(703) 524-8800
ARMA	Asphalt Roofing Manufacturers Association www.asphaltroofing.org	(202) 207-0917
ASCE	American Society of Civil Engineers www.asce.org	(800) 548-2723 (703) 295-6300
ASCE/SEI	American Society of Civil Engineers/Structural Engineering Institute (See ASCE)	
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers www.ashrae.org	(800) 527-4723 (404) 636-8400
ASME	ASME International	(800) 843-2763

	(American Society of Mechanical Engineers International) www.asme.org	(973) 882-1170
ASSE	American Society of Sanitary Engineering www.asse-plumbing.org	(440) 835-3040
ASTM	ASTM International (American Society for Testing and Materials International) www.astm.org	(610) 832-9500
ATIS	Alliance for Telecommunications Industry Solutions www.atis.org	(202) 628-6380
AWCMA	American Window Covering Manufacturers Association (Now WCMA)	
AWCI	Association of the Wall and Ceiling Industry www.awci.org	(703) 534-8300
AWI	Architectural Woodwork Institute www.awinet.org	(571) 323-3636
AWPA	American Wood Protection Association (Formerly: American Wood Preservers' Association) www.awpa.com	(205) 733-4077
AWS	American Welding Society www.aws.org	(800) 443-9353 (305) 443-9353
AWWA	American Water Works Association www.awwa.org	(800) 926-7337 (303) 794-7711
BHMA	Builders Hardware Manufacturers Association www.buildershardware.com	(212) 297-2122
BIA	Brick Industry Association (The) www.bia.org	(703) 620-0010
BICSI	BICSI, Inc. www.bicsi.org	(800) 242-7405 (813) 979-1991
BIFMA	BIFMA International (Business and Institutional Furniture Manufacturer's Association International) www.bifma.com	(616) 285-3963
BISSC	Baking Industry Sanitation Standards Committee www.bissc.org	(866) 342-4772
CCC	Carpet Cushion Council www.carpetcushion.org	(610) 527-3880
CDA	Copper Development Association www.copper.org	(800) 232-3282 (212) 251-7200
CEA	Canadian Electricity Association	(613) 230-9263

	www.canelect.ca	
CEA	Consumer Electronics Association www.ce.org	(866) 858-1555 (703) 907-7600
CFFA	Chemical Fabrics & Film Association, Inc. www.chemicalfabricsandfilm.com	(216) 241-7333
CGA	Compressed Gas Association www.cganet.com	(703) 788-2700
CIMA	Cellulose Insulation Manufacturers Association www.cellulose.org	(888) 881-2462 (937) 222-2462
CISCA	Ceilings & Interior Systems Construction Association www.cisca.org	(630) 584-1919
CISPI	Cast Iron Soil Pipe Institute www.cispi.org	(423) 892-0137
CLFMI	Chain Link Fence Manufacturers Institute www.chainlinkinfo.org	(301) 596-2583
CPA	Composite Panel Association www.pbmdf.com	 (703) 724-1128
CRI	Carpet and Rug Institute (The) www.carpet-rug.com	(800) 882-8846 (706) 278-3176
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CRSI	Concrete Reinforcing Steel Institute www.crsi.org	(847) 517-1200 (800) 328-6306
CRRC	Cool Roof Rating Council www.coolroofs.org	(866) 465-2523 (510) 485-7175
CSA	Canadian Standards Association www.csa.ca	(800) 463-6727 (416) 747-4000
CSA	CSA International (Formerly: IAS - International Approval Services) www.csa-international.org	(866) 797-4272 (416) 747-4000
CSI	Construction Specifications Institute (The) www.csinet.org	(800) 689-2900 (703) 684-0300
CSSB	Cedar Shake & Shingle Bureau www.cedarbureau.org	(604) 820-7700
CTI	Cooling Technology Institute (Formerly: Cooling Tower Institute) www.cti.org	(281) 583-4087
DHI	Door and Hardware Institute	(703) 222-2010

	www.dhi.org	
ECA	Electrical Components Association www.ec-central.org	(703)907-8024
EIA	Electronic Industries Alliance www.eia.org	(703) 907-7500
EIMA	EIFS Industry Members Association www.eima.com	(800) 294-3462 (770) 968-7945
EJCDC	Engineers Joint Contract Documents Committee http://content.asce.org/ejcdc/	(703) 295-6000
EJMA	Expansion Joint Manufacturers Association, Inc. www.ejma.org	(914) 332-0040
ESD	ESD Association (Electrostatic Discharge Association) www.esda.org	(315) 339-6937
ETL SEMCO	Intertek ETL SEMCO (Formerly: ITS - Intertek Testing Service NA) www.intertek-etlsemko.com	(800) 967-5352
FIBA	Federation Internationale de Basketball (The International Basketball Federation) www.fiba.com	41 22 545 00 00
FIVB	Federation Internationale de Volleyball (The International Volleyball Federation) www.fivb.ch	41 21 345 35 35
FM Approvals	FM Approvals LLC www.fmglobal.com	(781) 762-4300
FM Global	FM Global (Formerly: FMG - FM Global) www.fmglobal.com	(401) 275-3000
FRSA	Florida Roofing, Sheet Metal & Air Conditioning Contractors Association, Inc. www.floridaroof.com	(407) 671-3772
FSA	Fluid Sealing Association www.fluidsealing.com	(610) 971-4850
FSC	Forest Stewardship Council www.fsc.org	49 228 367 66 0
GA	Gypsum Association www.gypsum.org	(301) 277-8686
GANA	Glass Association of North America www.glasswebsite.com	(785) 271-0208

GRI	(Part of GSI)	
GS	Green Seal www.greenseal.org	(202) 872-6400
GSI	Geosynthetic Institute www.geosynthetic-institute.org	(610) 522-8440
HI	Hydronics Institute www.gamanet.org	(908) 464-8200
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association Division of Air-Conditioning, Heating, and Refrigeration Institute (AHRI) www.ahrinet.org	(908) 464-8200
HMMA	Hollow Metal Manufacturers Association (Part of NAAMM)	
HPVA	Hardwood Plywood & Veneer Association www.hpva.org	(703) 435-2900
HPW	H. P. White Laboratory, Inc. www.hpwhite.com	(410) 838-6550
IAPSC	International Association of Professional Security Consultants www.iapsc.org	(515) 282-8192
ICBO	International Conference of Building Officials www.iccsafe.org	(888) 422-7233
ICEA	Insulated Cable Engineers Association, Inc. www.icea.net	(770) 830-0369
ICRI	International Concrete Repair Institute, Inc. www.icri.org	(847) 827-0830
ICPA	International Cast Polymer Association www.icpa-hq.org	(703) 525-0320
IEC	International Electrotechnical Commission www.iec.ch	41 22 919 02 11
IEEE	Institute of Electrical and Electronics Engineers, Inc. (The) www.ieee.org	(212) 419-7900
IES	Illuminating Engineering Society of North America www.iesna.org	(703) 525-0320
IEST	Institute of Environmental Sciences and Technology www.iest.org	(847) 255-1561
IGMA	Insulating Glass Manufacturers Alliance www.igmaonline.org	(613) 233-1510
ILI	Indiana Limestone Institute of America, Inc.	(812) 275-4426

	www.iliai.com	
ISA	Instrumentation, Systems, and Automation Society, The www.isa.org	(919) 549-8411
ISO	International Organization for Standardization www.iso.ch	41 22 749 01 11
ISSFA	International Solid Surface Fabricators Association www.issfa.net	(877) 464-7732 (801) 341-7360
ITS	Intertek Testing Service NA (Now ETL SEMCO)	
ITU	International Telecommunication Union www.itu.int/home	41 22 730 51 11
KCMA	Kitchen Cabinet Manufacturers Association www.kcma.org	(703) 264-1690
LGSEA	Light Gauge Steel Engineers Association www.arcat.com	(202) 263-4488
LMA	Laminating Materials Association (Now part of CPA)	
LPI	Lightning Protection Institute www.lightning.org	(800) 488-6864
MBMA	Metal Building Manufacturers Association www.mbma.com	(216) 241-7333
MCA	Metal Construction Association www.metalconstruction.org	(847) 375-4718
MFMA	Maple Flooring Manufacturers Association, Inc. www.maplefloor.org	(888) 480-9138
MFMA	Metal Framing Manufacturers Association, Inc. www.metalframingmfg.org	(312) 644-6610
MH	Material Handling (Now MHIA)	
MHIA	Material Handling Industry of America www.mhia.org	(800) 345-1815 (704) 676-1190
MIA	Marble Institute of America www.marble-institute.com	(440) 250-9222
MPI	Master Painters Institute www.paintinfo.com	(888) 674-8937 (604) 298-7578
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc. www.mss-hq.com	(703) 281-6613

NAAMM	National Association of Architectural Metal Manufacturers www.naamm.org	(630) 942-6591
NACE	NACE International (National Association of Corrosion Engineers International) www.nace.org	(800) 797-6223 (281) 228-6200
NADCA	National Air Duct Cleaners Association www.nadca.com	(202) 737-2926
NAGWS	National Association for Girls and Women in Sport www.aahperd.org/nagws/	(800) 213-7193, ext. 453
NAIMA	North American Insulation Manufacturers Association www.naima.org	(703) 684-0084
NBGQA	National Building Granite Quarries Association, Inc. www.nbgqa.com	(800) 557-2848
NCAA	National Collegiate Athletic Association (The) www.ncaa.org	(317) 917-6222
NCMA	National Concrete Masonry Association www.ncma.org	(703) 713-1900
NCTA	National Cable & Telecommunications Association www.ncta.com	(202) 222-2300
NEBB	National Environmental Balancing Bureau www.nebb.org	(301) 977-3698
NECA	National Electrical Contractors Association www.necanet.org	(301) 657-3110
NeLMA	Northeastern Lumber Manufacturers' Association www.nelma.org	(207) 829-6901
NEMA	National Electrical Manufacturers Association www.nema.org	(703) 841-3200
NETA	InterNational Electrical Testing Association www.netaworld.org	(888) 300-6382 (269) 488-6382
NFHS	National Federation of State High School Associations www.nfhs.org	(317) 972-6900
NFPA	NFPA (National Fire Protection Association) www.nfpa.org	(800) 344-3555 (617) 770-3000
NFRC	National Fenestration Rating Council www.nfrc.org	(301) 589-1776
NGA	National Glass Association www.glass.org	(866) 342-5642 (703) 442-4890

NHLA	National Hardwood Lumber Association www.natlhardwood.org	(800) 933-0318 (901) 377-1818
NLGA	National Lumber Grades Authority www.nlga.org	(604) 524-2393
NOFMA	NOFMA: The Wood Flooring Manufacturers Association (Formerly: National Oak Flooring Manufacturers Association) www.nofma.org	(901) 526-5016
NOMMA	National Ornamental & Miscellaneous Metals Association www.nomma.org	(888) 516-8585
NRCA	National Roofing Contractors Association www.nrca.net	(800) 323-9545 (847) 299-9070
NRMCA	National Ready Mixed Concrete Association www.nrmca.org	(888) 846-7622 (301) 587-1400
NSF	NSF International (National Sanitation Foundation International) www.nsf.org	(800) 673-6275 (734) 769-8010
NSSGA	National Stone, Sand & Gravel Association www.nssga.org	(800) 342-1415 (703) 525-8788
NTMA	National Terrazzo & Mosaic Association, Inc. (The) www.ntma.com	(800) 323-9736 (540) 751-0930
NWFA	National Wood Flooring Association www.nwfa.org	(800) 422-4556 (636) 519-9663
PCI	Precast/Prestressed Concrete Institute www.pci.org	(312) 786-0300
PDI	Plumbing & Drainage Institute www.pdionline.org	(800) 589-8956 (978) 557-0720
PGI	PVC Geomembrane Institute http://pgi-tp.cee.uiuc.edu	(217) 333-3929
PTI	Post-Tensioning Institute www.post-tensioning.org	(248) 848-3180
RCSC	Research Council on Structural Connections www.boltcouncil.org	
RFCI	Resilient Floor Covering Institute www.rfci.com	 (706) 882-3833
RIS	Redwood Inspection Service www.redwoodinspection.com	 (925) 935-1499
SAE	SAE International	(877) 606-7323

	www.sae.org	(724) 776-4841
SCAQMD	South Coast Air Quality Management District www.aqmd.com	(909) 396-2000
SCTE	Society of Cable Telecommunications Engineers www.scte.org	(800) 542-5040 (610) 363-6888
SDI	Steel Deck Institute www.sdi.org	(847) 458-4647
SDI	Steel Door Institute www.steeldoor.org	(440) 899-0010
SEFA	Scientific Equipment and Furniture Association www.sefalabs.com	(877) 294-5424 (516) 294-5424
SEI/ASCE	Structural Engineering Institute/American Society of Civil Engineers (See ASCE)	
SIA	Security Industry Association www.siaonline.org	(866) 817-8888 (703) 683-2075
SJI	Steel Joist Institute www.steeljoist.org	(843) 626-1995
SMA	Screen Manufacturers Association www.smacentral.org	(561) 533-0991
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association www.smacna.org	(703) 803-2980
SMPTE	Society of Motion Picture and Television Engineers www.smpte.org	(914) 761-1100
SPFA	Spray Polyurethane Foam Alliance (Formerly: SPI/SPFD - The Society of the Plastics Industry, Inc.; Spray Polyurethane Foam Division) www.sprayfoam.org	(800) 523-6154
SPIB	Southern Pine Inspection Bureau (The) www.spib.org	(850) 434-2611
SPRI	Single Ply Roofing Industry www.spri.org	(781) 647-7026
SSINA	Specialty Steel Industry of North America www.ssina.com	(800) 982-0355 (202) 342-8630
SSPC	SSPC: The Society for Protective Coatings www.sspc.org	(877) 281-7772 (412) 281-2331
STI	Steel Tank Institute www.steeltank.com	(847) 438-8265

SWI	Steel Window Institute www.steelwindows.com	(216) 241-7333
SWPA	Submersible Wastewater Pump Association www.swpa.org	(847) 681-1868
TCA	Tilt-Up Concrete Association www.tilt-up.org	(319) 895-6911
TCNA	Tile Council of North America, Inc. www.tileusa.com	(864) 646-8453
TEMA	Tubular Exchanger Manufacturers Association www.tema.org	(914) 332-0040
TIA/EIA	Telecommunications Industry Association/Electronic Industries Alliance www.tiaonline.org	(703) 907-7700
TMS	The Masonry Society www.masonrysociety.org	(303) 939-9700
TPI	Truss Plate Institute, Inc. www.tpinst.org	(703) 683-1010
TPI	Turfgrass Producers International www.turfgrasssod.org	(800) 405-8873 (847) 649-5555
TRI	Tile Roofing Institute www.tileroofing.org	(312) 670-4177
UL	Underwriters Laboratories Inc. www.ul.com	(877) 854-3577 (847) 272-8800
UNI	Uni-Bell PVC Pipe Association www.uni-bell.org	(972) 243-3902
USAV	USA Volleyball www.usavolleyball.org	(888) 786-5539 (719) 228-6800
USGBC	U.S. Green Building Council www.usgbc.org	(800) 795-1747
USITT	United States Institute for Theatre Technology, Inc. www.usitt.org	(800) 938-7488 (315) 463-6463
WASTEC	Waste Equipment Technology Association www.wastec.org	(800) 424-2869 (202) 244-4700
WCLIB	West Coast Lumber Inspection Bureau www.wclib.org	(800) 283-1486 (503) 639-0651
WCMA	Window Covering Manufacturers Association www.wcmanet.org	(212) 297-2122

WDMA	Window & Door Manufacturers Association (Formerly: NWWDA - National Wood Window and Door Association) www.wdma.com	(800) 223-2301 (312) 321-6802
WI	Woodwork Institute (Formerly: WIC - Woodwork Institute of California) www.wicnet.org	(916) 372-9943
WMMPA	Wood Moulding & Millwork Producers Association www.wmmpa.com	(800) 550-7889 (530) 661-9591
WSRCA	Western States Roofing Contractors Association www.wsrca.com	(800) 725-0333 (650) 570-5441
WWPA	Western Wood Products Association www.wwpa.org	(503) 224-3930

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

DIN	Deutsches Institut fur Normung e.V. www.din.de	49 30 2601-0
IAPMO	International Association of Plumbing and Mechanical Officials www.iapmo.org	(909) 472-4100
ICC	International Code Council www.iccsafe.org	(888) 422-7233
ICC-ES	ICC Evaluation Service, Inc. www.icc-es.org	(800) 423-6587 (562) 699-0543

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

COE	Army Corps of Engineers www.usace.army.mil	(202) 761-0011
CPSC	Consumer Product Safety Commission www.cpsc.gov	(800) 638-2772 (301) 504-7923
DOC	Department of Commerce www.commerce.gov	(202) 482-2000
DOD	Department of Defense http://dodssp.daps.dla.mil	(215) 697-6257
DOE	Department of Energy www.energy.gov	(202) 586-9220

EPA	Environmental Protection Agency www.epa.gov	(202) 272-0167
FAA	Federal Aviation Administration www.faa.gov	(866) 835-5322
FCC	Federal Communications Commission www.fcc.gov	(888) 225-5322
FDA	Food and Drug Administration www.fda.gov	(888) 463-6332
GSA	General Services Administration www.gsa.gov	(800) 488-3111
HUD	Department of Housing and Urban Development www.hud.gov	(202) 708-1112
LBL	Lawrence Berkeley National Laboratory www.lbl.gov	(510) 486-4000
NCHRP	National Cooperative Highway Research Program (See TRB)	
NIST	National Institute of Standards and Technology www.nist.gov	(301) 975-6478
OSHA	Occupational Safety & Health Administration www.osha.gov	(800) 321-6742 (202) 693-1999
PBS	Public Buildings Service (See GSA)	
PHS	Office of Public Health and Science http://www.hhs.gov/ophs/	(202) 690-7694
RUS	Rural Utilities Service (See USDA)	(202) 720-9540
SD	State Department www.state.gov	(202) 647-4000
TRB	Transportation Research Board http://gulliver.trb.org	(202) 334-2934
USDA	Department of Agriculture www.usda.gov	(202) 720-2791
USP	U.S. Pharmacopeia www.usp.org	(800) 227-8772
USPS	Postal Service www.usps.com	(202) 268-2000

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA) Architectural Barriers Act (ABA) Accessibility Guidelines for Buildings and Facilities Available from U.S. Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080
CFR	Code of Federal Regulations Available from Government Printing Office www.gpoaccess.gov/cfr/index.html	(866) 512-1800 (202) 512-1800
DOD	Department of Defense Military Specifications and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
DSCC	Defense Supply Center Columbus (See FS)	
FED-STD	Federal Standard (See FS)	
FS	Federal Specification Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil/	(215) 697-2664
	Available from Defense Standardization Program www.dsp.dla.mil	
	Available from General Services Administration www.gsa.gov	(202) 619-8925
	Available from National Institute of Building Sciences www.wbdg.org/ccb	(202) 289-7800
FTMS	Federal Test Method Standard (See FS)	
MIL	(See MILSPEC)	
MIL-STD	(See MILSPEC)	
MILSPEC	Military Specification and Standards Available from Department of Defense Single Stock Point http://dodssp.daps.dla.mil	(215) 697-2664
UFAS	Uniform Federal Accessibility Standards Available from Access Board www.access-board.gov	(800) 872-2253 (202) 272-0080

E. State Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

CBHF	State of California, Department of Consumer Affairs Bureau of Home Furnishings and Thermal Insulation www.dca.ca.gov/bhfti	(800) 952-5210 (916) 574-2041
CCR	California Code of Regulations www.calregs.com	(916) 323-6815
CDHS	California Department of Health Services www.dhcs.ca.gov	(916) 445-4171
CDPH	California Department of Public Health, Indoor Air Quality Section www.cal-iaq.org	
CPUC	California Public Utilities Commission www.cpuc.ca.gov	(415) 703-2782
TFS	Texas Forest Service Forest Resource Development http://txforestservice.tamu.edu	 (979) 458-6606

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 42 00

SECTION 01 50 00 - TEMPORARY FACILITIES AND CONTROLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes requirements for temporary utilities, support facilities, and security and protection facilities.

B. Related Requirements:

1. Section 01 10 00 "Summary" for work restrictions and limitations on utility interruptions.

1.3 USE CHARGES

A. General: Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.

B. Sewer Service: Owner will pay sewer-service use charges for sewer usage by all entities for construction operations.

C. Water Service: Owner will pay water-service use charges for water used by all entities for construction operations.

D. Electric Power Service: Owner will pay electric-power-service use charges for electricity used by all entities for construction operations.

E. Water and Sewer Service from Existing System: Water from Owner's existing water system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

F. Electric Power Service from Existing System: Electric power from Owner's existing system is available for use without metering and without payment of use charges. Provide connections and extensions of services as required for construction operations.

1.4 INFORMATIONAL SUBMITTALS

A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.

B. Erosion- and Sedimentation-Control Plan: Show compliance with requirements of EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

C. Fire-Safety Program: Show compliance with requirements of NFPA 241 and authorities having jurisdiction. Indicate Contractor personnel responsible for management of fire-prevention program.

D. Moisture-Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.

1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
2. Indicate procedures for discarding water-damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water-damaged Work.
3. Indicate sequencing of work that requires water, such as sprayed fire-resistive materials, plastering, and terrazzo grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.

E. Dust- and HVAC-Control Plan: Submit coordination drawing and narrative that indicates the dust- and HVAC-control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:

1. Locations of dust-control partitions at each phase of work.
2. HVAC system isolation schematic drawing.
3. Location of proposed air-filtration system discharge.
4. Waste handling procedures.
5. Other dust-control measures.

1.5 QUALITY ASSURANCE

A. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.

B. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

C. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board's ADA-ABA Accessibility Guidelines and ICC/ANSI A117.1.

1.6 PROJECT CONDITIONS

A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portable Chain-Link Fencing: Minimum 2-inch, 0.148-inch- thick, galvanized-steel, chain-link fabric fencing with wind screen; minimum 8 feet high with galvanized-steel pipe posts; minimum 2-3/8-inch- OD line posts and 2-7/8-inch- OD corner and pull posts, with 1-5/8-inch- OD top and bottom rails. Provide galvanized-steel bases for supporting posts; provide sandbags as required for support.

B. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10-mil minimum thickness, with flame-spread rating of 15 or less per ASTM E 84 and passing NFPA 701 Test Method 2.

C. Dust-Control Adhesive-Surface Walk-off Mats: Provide mats minimum 36 by 60 inches.

D. Insulation: Unfaced mineral-fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively.

2.2 TEMPORARY FACILITIES

A. Field Offices, General: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading.

B. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations.

1. Store combustible materials apart from building.

2.3 EQUIPMENT

A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.

B. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid-propane-gas or fuel-oil heaters with individual space thermostatic control.

1. Use of gasoline-burning space heaters, open-flame heaters, or salamander-type heating units is prohibited.
2. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
3. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return-air grille in system and remove at end of construction and clean HVAC system as required in Section 01 77 00 "Closeout Procedures".

C. Air-Filtration Units: Primary and secondary HEPA-filter-equipped portable units with four-stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Locate facilities where they will serve Project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.

1. Locate facilities to limit site disturbance as specified in Section 01 10 00 "Summary."

B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

3.2 TEMPORARY UTILITY INSTALLATION

A. General: Install temporary service or connect to existing service.

1. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.

B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.

1. Connect temporary sewers to private system indicated as directed by authorities having jurisdiction.

C. Water Service: Connect to Owner's existing water service facilities. Clean and maintain water service facilities in a condition acceptable to Owner. At Substantial Completion, restore these facilities to condition existing before initial use.

D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.

E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.

F. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.

1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.

G. Electric Power Service: Connect to Owner's existing electric power service. Maintain equipment in a condition acceptable to Owner.

H. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.

1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
2. Install lighting for Project identification sign.

I. Telephone Service: Provide temporary telephone service in common-use facilities for use by all construction personnel. Install one telephone line(s) for each field office.

1. Provide additional telephone lines for the following:

a. Provide a dedicated telephone line for each facsimile machine in each field office.

2. At each telephone, post a list of important telephone numbers.

a. Police and fire departments.
b. Ambulance service.
c. Contractor's home office.
d. Contractor's emergency after-hours telephone number.
e. Architect's office.
f. Engineers' offices.
g. Owner's office.
h. Principal subcontractors' field and home offices.

3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.

3.3 SUPPORT FACILITIES INSTALLATION

A. General: Comply with the following:

1. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
2. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.

B. Temporary Roads and Paved Areas: Construct and maintain temporary roads and paved areas adequate for construction operations. Locate temporary roads and paved areas within construction limits indicated on Drawings.

1. Provide dust-control treatment that is nonpolluting and nontracking. Reapply treatment as required to minimize dust.

C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.

D. Parking: Use designated areas of Owner's existing parking areas for construction personnel.

E. Dewatering Facilities and Drains: Comply with requirements of authorities having jurisdiction. Maintain Project site, excavations, and construction free of water.

1. Dispose of rainwater in a lawful manner that will not result in flooding Project or adjoining properties or endanger permanent Work or temporary facilities.
2. Remove snow and ice as required to minimize accumulations.

F. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.

1. Identification Signs: Provide Project identification signs as indicated on Drawings.

a. Location on Campus to be determined by Owner.

2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.

a. Provide temporary, directional signs for construction personnel and visitors.

3. Maintain and touchup signs so they are legible at all times.

G. Waste Disposal Facilities: Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

H. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.

1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.

I. Temporary Elevator Use: See Section 14 21 00 "Electric Traction Elevators," Section 14 21 13 "Electric Traction Freight Elevators," Section 14 24 00 "Hydraulic Elevators," Section 14 24 13 "Hydraulic Freight Elevators," and Section 14 26 00 "Limited-Use/Limited-Application Elevators" for temporary use of new elevators.

J. Existing Elevator Use: Use of Owner's existing elevators will be permitted, provided elevators are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore elevators to condition existing before initial use, including replacing worn cables, guide shoes, and similar items of limited life.

1. Do not load elevators beyond their rated weight capacity.
2. Provide protective coverings, barriers, devices, signs, or other procedures to protect elevator car and entrance doors and frame. If, despite such protection, elevators become damaged, engage elevator Installer to restore damaged work so no evidence remains of correction work. Return items that cannot be refinished in field to the shop, make required repairs and refinish entire unit, or provide new units as required.

K. Temporary Stairs: Until permanent stairs are available, provide temporary stairs where ladders are not adequate.

L. Existing Stair Usage: Use of Owner's existing stairs will be permitted, provided stairs are cleaned and maintained in a condition acceptable to Owner. At Substantial Completion, restore stairs to condition existing before initial use.

1. Provide protective coverings, barriers, devices, signs, or other procedures to protect stairs and to maintain means of egress. If stairs become damaged, restore damaged areas so no evidence remains of correction work.

M. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION

A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities.

B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.

1. Comply with work restrictions specified in Section 01 10 00 "Summary."

C. Temporary Erosion and Sedimentation Control: Provide measures to prevent soil erosion and discharge of soil-bearing water runoff and airborne dust to undisturbed areas and to adjacent properties and walkways, according to requirements of 2003 EPA Construction General Permit or authorities having jurisdiction, whichever is more stringent.

1. Verify that flows of water redirected from construction areas or generated by construction activity do not enter or cross tree- or plant- protection zones.
2. Inspect, repair, and maintain erosion- and sedimentation-control measures during construction until permanent vegetation has been established.
3. Clean, repair, and restore adjoining properties and roads affected by erosion and sedimentation from Project site during the course of Project.
4. Remove erosion and sedimentation controls and restore and stabilize areas disturbed during removal.

D. Stormwater Control: Comply with requirements of authorities having jurisdiction. Provide barriers in and around excavations and subgrade construction to prevent flooding by runoff of stormwater from heavy rains.

E. Tree and Plant Protection: Install temporary fencing located as indicated or outside the drip line of trees to protect vegetation from damage from construction operations. Protect tree root systems from damage, flooding, and erosion.

F. Pest Control: Engage pest-control service to recommend practices to minimize attraction and harboring of rodents, roaches, and other pests and to perform extermination and control procedures at regular intervals so Project will be free of pests and their residues at Substantial Completion. Perform control operations lawfully, using environmentally safe materials.

G. Site Enclosure Fence: Prior to commencing earthwork, furnish and install site enclosure fence in a manner that will prevent people and animals from easily entering site except by entrance gates.

1. Extent of Fence: As required to enclose entire Project site or portion determined sufficient to accommodate construction operations.
2. Maintain security by limiting number of keys and restricting distribution to authorized personnel. Furnish one set of keys to Owner.

H. Security Enclosure and Lockup: Install temporary enclosure around partially completed areas of construction. Provide lockable entrances to prevent unauthorized entrance, vandalism, theft, and similar violations of security. Lock entrances at end of each work day.

I. Barricades, Warning Signs, and Lights: Comply with requirements of authorities having jurisdiction for erecting structurally adequate barricades, including warning signs and lighting.

J. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.

K. Covered Walkway: Erect protective, covered walkway for passage of individuals through or adjacent to Project site. Coordinate with entrance gates, other facilities, and obstructions. Comply with regulations of authorities having jurisdiction.

1. Construct covered walkways using scaffold or shoring framing.
2. Provide overhead decking, protective enclosure walls, handrails, barricades, warning signs, exit signs, lights, safe and well-drained walkways, and similar provisions for protection and safe passage.
3. Paint and maintain appearance of walkway for duration of the Work.

L. Temporary Enclosures: Provide temporary enclosures for protection of construction, in progress and completed, from exposure, foul weather, other construction operations, and similar activities. Provide temporary weathertight enclosure for building exterior.

1. Where heating or cooling is needed and permanent enclosure is incomplete, insulate temporary enclosures.

M. Temporary Partitions: Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas occupied by Owner from fumes and noise.

1. Construct dustproof partitions with two layers of 6-mil polyethylene sheet on each side. Cover floor with two layers of 6-mil polyethylene sheet, extending sheets 18 inches up the sidewalls. Overlap and tape full length of joints. Cover floor with fire-retardant-treated plywood.

    a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches between doors. Maintain water-dampened foot mats in vestibule.

2. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
3. Insulate partitions to control noise transmission to occupied areas.
4. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
5. Protect air-handling equipment.
6. Provide walk-off mats at each entrance through temporary partition.

N. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.

1. Prohibit smoking in construction areas.
2. Supervise welding operations, combustion-type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.

3. Develop and supervise an overall fire-prevention and -protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire-protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

3.5 MOISTURE AND MOLD CONTROL

A. Contractor's Moisture-Protection Plan: Avoid trapping water in finished work. Document visible signs of mold that may appear during construction.

B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:

1. Protect porous materials from water damage.
2. Protect stored and installed material from flowing or standing water.
3. Keep porous and organic materials from coming into prolonged contact with concrete.
4. Remove standing water from decks.
5. Keep deck openings covered or dammed.

C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:

1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
2. Keep interior spaces reasonably clean and protected from water damage.
3. Periodically collect and remove waste containing cellulose or other organic matter.
4. Discard or replace water-damaged material.
5. Do not install material that is wet.
6. Discard, replace, or clean stored or installed material that begins to grow mold.
7. Perform work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.

D. Controlled Construction Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:

1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
2. Use permanent HVAC system to control humidity.
3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits.

    a. Hygroscopic materials that may support mold growth, including wood and gypsum-based products, that become wet during the course of construction and remain wet for 48 hours are considered defective.
    b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.

c. Remove materials that can not be completely restored to their manufactured moisture level within 48 hours.

3.6 OPERATION, TERMINATION, AND REMOVAL

A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.

B. Maintenance: Maintain facilities in good operating condition until removal.

1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24-hour basis where required to achieve indicated results and to avoid possibility of damage.

C. Operate Project-identification-sign lighting daily from dusk until 12:00 midnight.

D. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion.

E. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.

1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.
3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00 "Closeout Procedures."

END OF SECTION 01 50 00

SECTION 01 55 00 – VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Access roads.

B. Parking.

C. Existing pavements and parking areas.

D. Permanent pavements and parking facilities.

E. Construction parking controls.

F. Maintenance.

G. Removal, repair.

H. Mud from site vehicles.

1.2 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: access to site, work sequence, and occupancy.

B. Section 31 22 00 - Grading: Specifications for earthwork and paving bases.

PART 2 PRODUCTS

2.1 MATERIALS

A. Materials for Permanent Construction: As specified in product specification sections, including earthwork, paving base, and topping.

PART 3 EXECUTION

3.1 PREPARATION

A. Clear areas, provide surface and storm drainage of road, parking, area premises, and adjacent areas.

3.2 ACCESS ROADS

A. Tracked vehicles not allowed on paved areas.

B. Location as approved by Architect and/or Owner.

C. Provide unimpeded access for emergency vehicles. Maintain 20 foot width driveways with turning space between and around combustible materials.

D. Provide and maintain access to fire hydrants free of obstructions.

3.3 PARKING

A. Locate as approved by Architect and/or Owner.

3.4 PERMANENT PAVEMENTS AND PARKING FACILITIES

A. Avoid traffic loading beyond paving design capacity. Tracked vehicles not allowed.

3.5 CONSTRUCTION PARKING CONTROL

A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.

B. Monitor parking of construction personnel's vehicles in existing facilities. Maintain vehicular access to and through parking areas.

3.6 MAINTENANCE

A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, Products, mud, snow, and ice.

B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.7 REMOVAL, REPAIR

A. Repair existing facilities damaged by use, to original condition.

B. Repair damage caused by installation.

3.8 MUD FROM SITE VEHICLES

A. Provide means of removing mud from vehicle wheels before entering streets.

END OF SECTION 01 55 00

SECTION 01 55 26 – TRAFFIC CONTROL AND PROTECTION

PART 1 – GENERAL

1.01 SUMMARY

A. This Section includes warning signs and devices, temporary traffic signals, guardrails, handrails, temporary fencing, flag persons, and other equipment and materials required to protect vehicular and pedestrian traffic from construction activities.

B. The Contractor shall be responsible for the installation and maintenance of adequate signs, traffic control devices, and warning devices to inform and protect the public during all phases of construction.

1.02 SUBMITTALS

A. Traffic Control Schedule:

1. Schedule of lane closures, street closures, parking lot closures, and sidewalk closings, partial closings, and detours.

2. Include procedures for pedestrian and vehicular traffic routing and protection in immediate construction area and surrounding area during working and non-working hours.

3. Update as necessary to keep Owner and Maintaining Agency informed of traffic routing.

4. Owners and Maintaining Agency review and acceptance shall not be construed as confirming adequacy of protection measures proposed.

5. Contractor will notify Owner of construction schedules and traffic plans. Contractor shall be solely responsible for full protection of public and Contractor's own forces.

1.03 TRAFFIC CONTROL CONDITIONS

A. Keep Work areas open to pedestrian and vehicular traffic to maximum extent practical.

B. Provide minimum of 4-day notice before implementation of traffic restrictions.

C. Provide safe passage to vehicular and pedestrian traffic at all times when traffic is allowed.

D. Provide continuous access for emergency vehicles.

PART 2 – PRODUCTS

2.01 MATERIALS

A. Traffic control materials shall conform to following reference documents:

1. Illinois Manual on Uniform Traffic Control Devices for Streets and Highways

2. Section 701 -TRAFFIC CONTROL AND PROTECTION of the IDOT SSRBC

2.02 PERSONNEL

A. Flag persons (if applicable) shall be trained in accordance with State of Illinois regulations.

PART 3 – EXECUTION

3.01 GENERAL VEHICULAR TRAFFIC CONTROL REQUIREMENTS

A. At a minimum, provide traffic control in following general locations:

1. Streets, parking lots, or highways along or in which construction is occurring.

2. Areas where construction vehicles are entering or leaving streets or highways.

3. Roadways temporarily restricted to one-way travel.

4. Unpaved trenches and other disturbed areas in pavement.

5 When work is occurring adjacent to a traveled roadway.

B. Provide traffic control devices in accordance with following general conditions:

1. Flashing light barricades, Type I or Type II, to channel traffic to undisturbed pavement. Lights with barricades shall be provided for over night traffic control and protection.

2. Flashing light barricades, Type III, to screen off disturbed areas and trenches from oncoming traffic.

C. Placement of signs and barricades shall proceed in direction of flow of traffic. Remove signs and barricades at end of construction area and proceed toward oncoming traffic.

3.02 SPECIFIC TRAFFIC CONTROL REQUIREMENTS

A. Streets

1. One (1) lane open with flag persons.

2. Detours must be approved by the Owner prior to implementation.

3. The Contractor shall make every effort to keep construction traffic from delaying traffic entering/existing the College to U.S. Route 14.

3.03 PEDESTRIAN TRAFFIC CONTROL

A. Protect pedestrians and students/faculty from construction operations and vehicular traffic traveling through construction area.

B. Stockpiled materials shall not block streets, driveways, sidewalks, or crosswalks.

C. Grade backfilled trenches uniformly and install temporary pavements as required to permit safe crossing by vehicles and pedestrians.

PART 4 – EXECUTION

4.01 TRAFFIC CONTROL AND PROTECTION is included as a Lump Sum unit price. A percentage of the Lump Sum shall be paid on each payment application in proportion total work completed as determined by the Engineer.

END OF SECTION 01 55 26

SECTION 01 57 13 – TEMPORARY EROSION AND SEDIMENT CONTROL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Prevention of erosion due to construction activities.

B. Prevention of sedimentation of open drainage ways, and storm and sanitary sewers due to construction activities.

C. Restoration of areas eroded due to insufficient preventive measures.

D. Compensation of Owner for fines levied by authorities having jurisdiction due to non-compliance by Contractor.

1.2 RELATED REQUIREMENTS

A. Section 31 10 00 - Site Clearing: Limits on clearing; disposition of vegetative clearing debris.

B. Section 31 22 00 - Grading: Temporary and permanent grade changes for erosion control.

C. Section 32 11 23 - Aggregate Base Courses: Temporary and permanent roadways.

D. Section 32 92 23 - Sodding: Permanent turf for erosion control.

E. Section 32 93 00 - Plants: Permanent plantings for erosion control.

F. Section 03 30 00 - Cast-in-Place Concrete: Concrete for temporary and permanent erosion control structures indicated on drawings.

1.3 REFERENCE STANDARDS

A. ASTM D4355/D4355M - Standard Test Method for Deterioration of Geotextiles by Exposure to Light, Moisture, and Heat in a Xenon Arc Type Apparatus ; 2014.

B. ASTM D4491 - Standard Test Methods for Water Permeability of Geotextiles by Permittivity ; 1999a (Reapproved 2014).

C. ASTM D4533 - Standard Test Method for Trapezoid Tearing Strength of Geotextiles ; 2011.

D. ASTM D4632/D4632M - Standard Test Method for Grab Breaking Load and Elongation of Geotextiles ; 2015a.

E. ASTM D4751 - Standard Test Method for Determining Apparent Opening Size of a Geotextile ; 2012.

F. ASTM D4873 - Standard Guide for Identification, Storage, and Handling of Geosynthetic Rolls and Samples ; 2002 (Reapproved 2009).

G. EPA (NPDES) - National Pollutant Discharge Elimination System (NPDES), Construction General Permit ; current edition.

1.4 PERFORMANCE REQUIREMENTS

A. Comply with requirements of EPA (NPDES) for erosion and sedimentation control, as specified by the NPDES, for Phases I and II, and in compliance with requirements of Construction General Permit (CGP) , whether the project is required by law to comply or not.

B. Also comply with all more stringent requirements of State of Illinois Erosion and Sedimentation Control Manual.

C. Follow Grading and Erosion Control Plan in engineering plans and the Storm Water Pollution Prevention Plan (SWPPP) document and submit periodic inspection reports as specified in the SWPPP.

D. Do not begin clearing, grading, or other work involving disturbance of ground surface cover until applicable permits have been obtained; furnish all documentation required to obtain applicable permits.
   1. Owner will obtain permits and pay for securities required by authority having jurisdiction.

E. Provide to Owner a Performance Bond covering erosion and sedimentation preventive measures only, in an amount equal to 100 percent of the cost of erosion and sedimentation control work.

F. Timing: Put preventive measures in place as soon as possible after disturbance of surface cover and before precipitation occurs.

G. Storm Water Runoff: Control increased storm water runoff due to disturbance of surface cover due to construction activities for this project.
   1. Prevent runoff into storm and sanitary sewer systems, including open drainage channels, in excess of actual capacity or amount allowed by authorities having jurisdiction, whichever is less.
   2. Anticipate runoff volume due to the most extreme short term and 24-hour rainfall events that might occur in 25 years.

H. Erosion On Site: Minimize wind, water, and vehicular erosion of soil on project site due to construction activities for this project.
   1. Control movement of sediment and soil from temporary stockpiles of soil.
   2. Prevent development of ruts due to equipment and vehicular traffic.
   3. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

I. Erosion Off Site: Prevent erosion of soil and deposition of sediment on other properties caused by water leaving the project site due to construction activities for this project.
   1. Prevent windblown soil from leaving the project site.
   2. Prevent tracking of mud onto public roads outside site.
   3. Prevent mud and sediment from flowing onto sidewalks and pavements.
   4. If erosion occurs due to non-compliance with these requirements, restore eroded areas at no cost to Owner.

J. Sedimentation of Waterways On Site: Prevent sedimentation of waterways on the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.
   2. If sediment basins are used as temporary preventive measures, pump dry and remove deposited sediment after each storm.

K. Sedimentation of Waterways Off Site: Prevent sedimentation of waterways off the project site, including rivers, streams, lakes, ponds, open drainage ways, storm sewers, and sanitary sewers.
   1. If sedimentation occurs, install or correct preventive measures immediately at no cost to Owner; remove deposited sediments; comply with requirements of authorities having jurisdiction.

L. Open Water: Prevent standing water that could become stagnant.

M. Maintenance: Maintain temporary preventive measures until permanent measures have been established.

1.5 SUBMITTALS

A. Inspection Reports: Submit report of each inspection; identify each preventive measure, indicate condition, and specify maintenance or repair required and accomplished.

PART 2 PRODUCTS

2.1 MATERIALS

A. See Grading and Erosion Control Plan, Erosion Control Specifications and Notes and Erosion Control Details located in the engineering plan set and also the SWPPP for additional information.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine site and identify existing features that contribute to erosion resistance; maintain such existing features to greatest extent possible.

3.2 PREPARATION

A. Schedule work so that soil surfaces are left exposed for the minimum amount of time.

3.3 SCOPE OF PREVENTIVE MEASURES

A. Construction Entrances: Traffic-bearing aggregate surface.
   1. Dimensions are shown on engineering drawings.

B. Linear Sediment Barriers: Made of silt fences.
   1. Provide linear sediment barriers:

C. Storm Drain Drop Inlet Sediment Traps: As detailed on drawings.

D. Soil Stockpiles: Protect using one of the following measures:
   1. Cover with mulch at least 4 inches thickness of pine needles, sawdust, bark, wood chips, or shredded leaves, or 6 inches of straw or hay.

E. Concrete Washout Area: As detailed on drawings.

F. Temporary Seeding: Use where temporary vegetated cover is required.

3.4 INSTALLATION

A. See engineering drawings for details and notes related to the installation of the sediment and erosion control devices.

3.5 MAINTENANCE

A. Inspect preventive measures weekly, and as detailed in the SWPPP.

B. Repair deficiencies immediately.

C. Silt Fences:
   1. Promptly replace fabric that deteriorates unless need for fence has passed.
   2. Remove silt deposits that exceed one-third of the height of the fence.

D. Clean out temporary sediment control structures weekly and relocate soil on site.

E. Place sediment in appropriate locations on site; do not remove from site.

3.6 CLEAN UP

A. Remove temporary measures after permanent measures have been installed, unless permitted to remain by Owner.

B. Clean out temporary sediment control structures that are to remain as permanent measures.

C. Where removal of temporary measures would leave exposed soil, shape surface to an acceptable grade and finish to match adjacent ground surfaces.

END OF SECTION 01 57 13

SECTION 01 60 00 - PRODUCT REQUIREMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for selection of products for use in Project; product delivery, storage, and handling; manufacturers' standard warranties on products; special warranties; and comparable products.

B. Related Requirements:

1. Section 01 23 00 "Alternates" for products selected under an alternate.
2. Section 01 25 00 "Substitution Procedures" for requests for substitutions.
3. Section 01 42 00 "References" for applicable industry standards for products specified.

1.3 DEFINITIONS

A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature, that is current as of date of the Contract Documents.
2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.

B. Basis-of-Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words "basis-of-design product," including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

1.4 ACTION SUBMITTALS

A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.

1. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.

B. Basis-of-Design Product Specification Submittal: Comply with requirements in Section 01 33 00 "Submittal Procedures." Show compliance with requirements.

1.5 QUALITY ASSURANCE

A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.7 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submittal Time: Comply with requirements in Section 01 77 00 "Closeout Procedures."

PART 2 - PRODUCTS

2.1 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
4. Where products are accompanied by the term "as selected," Architect will make selection.
5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products" Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:

    a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.

4. Manufacturers:

    a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
    b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.

5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.

1. If no product available within specified category matches and complies with other specified requirements, comply with requirements in Section 01 25 00 "Substitution Procedures" for proposal of product.

D. Visual Selection Specification: Where Specifications include the phrase "as selected by Architect from manufacturer's full range" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.2 COMPARABLE PRODUCTS

A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
3. Evidence that proposed product provides specified warranty.
4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
5. Samples, if requested.

PART 3 - EXECUTION (Not Used)

END OF SECTION 01 60 00

SECTION 01 73 00 - EXECUTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes general administrative and procedural requirements governing execution of the Work including, but not limited to, the following:

1. Construction layout.
2. Installation of the Work.
3. Cutting and patching.
4. Coordination of Owner-installed products.
5. Progress cleaning.
6. Starting and adjusting.
7. Protection of installed construction.
8. Correction of the Work.

B. Related Requirements:

1. Section 01 10 00 "Summary" for limits on use of Project site.
2. Section 01 33 00 "Submittal Procedures" for submitting surveys.
3. Section 01 77 00 "Closeout Procedures" for submitting final property survey with Project Record Documents, recording of Owner-accepted deviations from indicated lines and levels, and final cleaning.
4. Section 02 41 19 "Selective Structure Demolition" for demolition and removal of selected portions of the building.

1.3 DEFINITIONS

A. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

B. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.4 INFORMATIONAL SUBMITTALS

A. Certificates: Submit certificate signed by professional engineer certifying that location and elevation of improvements comply with requirements.

B. Cutting and Patching Plan: Submit plan describing procedures at least 10 days prior to the time cutting and patching will be performed. Include the following information:

1. Extent: Describe reason for and extent of each occurrence of cutting and patching.
2. Changes to In-Place Construction: Describe anticipated results. Include changes to structural elements and operating components as well as changes in building appearance and other significant visual elements.
3. Products: List products to be used for patching and firms or entities that will perform patching work.
4. Dates: Indicate when cutting and patching will be performed.
5. Utilities and Mechanical and Electrical Systems: List services and systems that cutting and patching procedures will disturb or affect. List services and systems that will be relocated and those that will be temporarily out of service. Indicate length of time permanent services and systems will be disrupted.

    a. Include description of provisions for temporary services and systems during interruption of permanent services and systems.

C. Landfill Receipts: Submit copy of receipts issued by a landfill facility, licensed to accept hazardous materials, for hazardous waste disposal.

1.5 QUALITY ASSURANCE

A. Cutting and Patching: Comply with requirements for and limitations on cutting and patching of construction elements.

1. Structural Elements: When cutting and patching structural elements, notify Architect of locations and details of cutting and await directions from Architect before proceeding. Shore, brace, and support structural elements during cutting and patching. Do not cut and patch structural elements in a manner that could change their load-carrying capacity or increase deflection.
2. Operational Elements: Do not cut and patch operating elements and related components in a manner that results in reducing their capacity to perform as intended or that results in increased maintenance or decreased operational life or safety. Operational elements include the following:

    a. Primary operational systems and equipment.
    b. Fire separation assemblies.
    c. Air or smoke barriers.
    d. Fire-suppression systems.
    e. Mechanical systems piping and ducts.
    f. Control systems.
    g. Communication systems.
    h. Fire-detection and -alarm systems.
    i. Conveying systems.
    j. Electrical wiring systems.
    k. Operating systems of special construction.

3. Other Construction Elements: Do not cut and patch other construction elements or components in a manner that could change their load-carrying capacity, that results in reducing their capacity to perform as intended, or that results in increased maintenance or decreased operational life or safety. Other construction elements include but are not limited to the following:

    a. Water, moisture, or vapor barriers.
    b. Membranes and flashings.

c. Exterior curtain-wall construction.
d. Sprayed fire-resistive material.
e. Equipment supports.
f. Piping, ductwork, vessels, and equipment.
g. Noise- and vibration-control elements and systems.

4. Visual Elements: Do not cut and patch construction in a manner that results in visual evidence of cutting and patching. Do not cut and patch exposed construction in a manner that would, in Architect's opinion, reduce the building's aesthetic qualities. Remove and replace construction that has been cut and patched in a visually unsatisfactory manner.

B. Cutting and Patching Conference: Before proceeding, meet at Project site with parties involved in cutting and patching, including mechanical and electrical trades. Review areas of potential interference and conflict. Coordinate procedures and resolve potential conflicts before proceeding.

C. Manufacturer's Installation Instructions: Obtain and maintain on-site manufacturer's written recommendations and instructions for installation of products and equipment.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Comply with requirements specified in other Sections.

B. In-Place Materials: Use materials for patching identical to in-place materials. For exposed surfaces, use materials that visually match in-place adjacent surfaces to the fullest extent possible.

1. If identical materials are unavailable or cannot be used, use materials that, when installed, will provide a match acceptable to Architect for the visual and functional performance of in-place materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Existing Conditions: The existence and location of underground and other utilities and construction indicated as existing are not guaranteed. Before beginning sitework, investigate and verify the existence and location of underground utilities, mechanical and electrical systems, and other construction affecting the Work.

1. Before construction, verify the location and invert elevation at points of connection of sanitary sewer, storm sewer, and water-service piping; underground electrical services, and other utilities.
2. Furnish location data for work related to Project that must be performed by public utilities serving Project site.

B. Examination and Acceptance of Conditions: Before proceeding with each component of the Work, examine substrates, areas, and conditions, with Installer or Applicator present where indicated, for compliance with requirements for installation tolerances and other conditions affecting performance. Record observations.

1. Examine roughing-in for mechanical and electrical systems to verify actual locations of connections before equipment and fixture installation.
2. Examine walls, floors, and roofs for suitable conditions where products and systems are to be installed.
3. Verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Written Report: Where a written report listing conditions detrimental to performance of the Work is required by other Sections, include the following:

1. Description of the Work.
2. List of detrimental conditions, including substrates.
3. List of unacceptable installation tolerances.
4. Recommended corrections.

D. Proceed with installation only after unsatisfactory conditions have been corrected. Proceeding with the Work indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Existing Utility Information: Furnish information to Owner that is necessary to adjust, move, or relocate existing utility structures, utility poles, lines, services, or other utility appurtenances located in or affected by construction. Coordinate with authorities having jurisdiction.

B. Field Measurements: Take field measurements as required to fit the Work properly. Recheck measurements before installing each product. Where portions of the Work are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

C. Space Requirements: Verify space requirements and dimensions of items shown diagrammatically on Drawings.

D. Review of Contract Documents and Field Conditions: Immediately on discovery of the need for clarification of the Contract Documents caused by differing field conditions outside the control of Contractor, submit a request for information to Architect according to requirements in Section 01 31 00 "Project Management and Coordination."

3.3 CONSTRUCTION LAYOUT

A. General: Engage a land surveyor to lay out the Work using accepted surveying practices.

1. Establish benchmarks and control points to set lines and levels at each story of construction and elsewhere as needed to locate each element of Project.
2. Establish limits on use of Project site.

3. Establish dimensions within tolerances indicated. Do not scale Drawings to obtain required dimensions.
4. Inform installers of lines and levels to which they must comply.
5. Check the location, level and plumb, of every major element as the Work progresses.
6. Close site surveys with an error of closure equal to or less than the standard established by authorities having jurisdiction.

B. Building Lines and Levels: Locate and lay out control lines and levels for structures, building foundations, column grids, and floor levels, including those required for mechanical and electrical work. Transfer survey markings and elevations for use with control lines and levels. Level foundations and piers from two or more locations.

3.4 INSTALLATION

A. General: Locate the Work and components of the Work accurately, in correct alignment and elevation, as indicated.

1. Make vertical work plumb and make horizontal work level.
2. Where space is limited, install components to maximize space available for maintenance and ease of removal for replacement.
3. Conceal pipes, ducts, and wiring in finished areas unless otherwise indicated.
4. Maintain minimum headroom clearance of 96 inches in occupied spaces and 90 inches in unoccupied spaces.

B. Comply with manufacturer's written instructions and recommendations for installing products in applications indicated.

C. Install products at the time and under conditions that will ensure the best possible results. Maintain conditions required for product performance until Substantial Completion.

D. Conduct construction operations so no part of the Work is subjected to damaging operations or loading in excess of that expected during normal conditions of occupancy.

E. Sequence the Work and allow adequate clearances to accommodate movement of construction items on site and placement in permanent locations.

F. Tools and Equipment: Do not use tools or equipment that produce harmful noise levels.

G. Templates: Obtain and distribute to the parties involved templates for work specified to be factory prepared and field installed. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing products to comply with indicated requirements.

H. Attachment: Provide blocking and attachment plates and anchors and fasteners of adequate size and number to securely anchor each component in place, accurately located and aligned with other portions of the Work. Where size and type of attachments are not indicated, verify size and type required for load conditions.

1. Mounting Heights: Where mounting heights are not indicated, mount components at heights directed by Architect.
2. Allow for building movement, including thermal expansion and contraction.

3. Coordinate installation of anchorages. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors, that are to be embedded in concrete or masonry. Deliver such items to Project site in time for installation.

I. Joints: Make joints of uniform width. Where joint locations in exposed work are not indicated, arrange joints for the best visual effect. Fit exposed connections together to form hairline joints.

J. Hazardous Materials: Use products, cleaners, and installation materials that are not considered hazardous.

3.5 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements in Section 01 10 00 "Summary."

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.

4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.

a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
b. Restore damaged pipe covering to its original condition.

3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.

a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.6 OWNER-INSTALLED PRODUCTS

A. Site Access: Provide access to Project site for Owner's construction personnel.

B. Coordination: Coordinate construction and operations of the Work with work performed by Owner's construction personnel.

1. Construction Schedule: Inform Owner of Contractor's preferred construction schedule for Owner's portion of the Work. Adjust construction schedule based on a mutually agreeable timetable. Notify Owner if changes to schedule are required due to differences in actual construction progress.
2. Preinstallation Conferences: Include Owner's construction personnel at preinstallation conferences covering portions of the Work that are to receive Owner's work. Attend preinstallation conferences conducted by Owner's construction personnel if portions of the Work depend on Owner's construction.

3.7 PROGRESS CLEANING

A. General: Clean Project site and work areas daily, including common areas. Enforce requirements strictly. Dispose of materials lawfully.

1. Comply with requirements in NFPA 241 for removal of combustible waste materials and debris.
2. Do not hold waste materials more than seven days during normal weather or three days if the temperature is expected to rise above 80 deg F.
3. Containerize hazardous and unsanitary waste materials separately from other waste. Mark containers appropriately and dispose of legally, according to regulations.

    a. Use containers intended for holding waste materials of type to be stored.

4. Coordinate progress cleaning for joint-use areas where Contractor and other contractors are working concurrently.

B. Site: Maintain Project site free of waste materials and debris.

C. Work Areas: Clean areas where work is in progress to the level of cleanliness necessary for proper execution of the Work.

1. Remove liquid spills promptly.
2. Where dust would impair proper execution of the Work, broom-clean or vacuum the entire work area, as appropriate.

D. Installed Work: Keep installed work clean. Clean installed surfaces according to written instructions of manufacturer or fabricator of product installed, using only cleaning materials specifically recommended. If specific cleaning materials are not recommended, use cleaning materials that are not hazardous to health or property and that will not damage exposed surfaces.

E. Concealed Spaces: Remove debris from concealed spaces before enclosing the space.

F. Exposed Surfaces in Finished Areas: Clean exposed surfaces and protect as necessary to ensure freedom from damage and deterioration at time of Substantial Completion.

G. Waste Disposal: Do not bury or burn waste materials on-site. Do not wash waste materials down sewers or into waterways. Comply with waste disposal requirements in Section 01 50 00 "Temporary Facilities and Controls."

H. During handling and installation, clean and protect construction in progress and adjoining materials already in place. Apply protective covering where required to ensure protection from damage or deterioration at Substantial Completion.

I. Clean and provide maintenance on completed construction as frequently as necessary through the remainder of the construction period. Adjust and lubricate operable components to ensure operability without damaging effects.

J. Limiting Exposures: Supervise construction operations to assure that no part of the construction, completed or in progress, is subject to harmful, dangerous, damaging, or otherwise deleterious exposure during the construction period.

3.8 STARTING AND ADJUSTING

A. Coordinate startup and adjusting of equipment and operating components with requirements in Section 01 91 13 "General Commissioning Requirements."

B. Start equipment and operating components to confirm proper operation. Remove malfunctioning units, replace with new units, and retest.

C. Adjust equipment for proper operation. Adjust operating components for proper operation without binding.

D. Test each piece of equipment to verify proper operation. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

E. Manufacturer's Field Service: Comply with qualification requirements in Section 01 40 00 "Quality Requirements."

3.9 PROTECTION OF INSTALLED CONSTRUCTION

A. Provide final protection and maintain conditions that ensure installed Work is without damage or deterioration at time of Substantial Completion.

B. Comply with manufacturer's written instructions for temperature and relative humidity.

END OF SECTION 01 73 00

SECTION 01 77 00 - CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Substantial Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

B. Related Requirements:

1. Section 01 73 00 "Execution" for progress cleaning of Project site.
2. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.
3. Section 01 78 39 "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.
4. Section 01 79 00 "Demonstration and Training" for requirements for instructing Owner's personnel.

1.3 ACTION SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Substantial Completion.

1.4 CLOSEOUT SUBMITTALS

A. Certificates of Release: From authorities having jurisdiction.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.6 SUBSTANTIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from authorities having jurisdiction permitting Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.
2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by . Label with manufacturer's name and model number where applicable.
5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Substantial Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Substantial Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Substantial Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 01 79 00 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Substantial Completion a minimum of days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architectwill either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Substantial Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.7 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 01 29 00 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architectwill either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.8 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas firstand proceeding from lowest floor to highest floor.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

    a. Project name.
    b. Date.
    c. Name of Architect.

d. Name of Contractor.
e. Page number.

4. Submit list of incomplete items in the following format:

a. MS Excel electronic file.

1.9 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Substantial Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.

C. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive 8-1/2-by-11-inch paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

D. Provide additional copies of each warranty to include in operation and maintenance manuals.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

1. Use cleaning products that comply with Green Seal's GS-37, or if GS-37 is not applicable, use products that comply with the California Code of Regulations maximum allowable VOC levels.

PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Remove snow and ice to provide safe access to building.
f. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
h. Sweep concrete floors broom clean in unoccupied spaces.
i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
j. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
k. Remove labels that are not permanent.
l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
q. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 01 50 00 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 74 19 "Construction Waste Management and Disposal."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Substantial Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

    a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 01 77 00

SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for preparing operation and maintenance manuals, including the following:

1. Operation and maintenance documentation directory.
2. Emergency manuals.
3. Operation manuals for systems, subsystems, and equipment.
4. Product maintenance manuals.
5. Systems and equipment maintenance manuals.

B. Related Requirements:

1. Section "General Commissioning Requirements" for verification and compilation of data into operation and maintenance manuals.

1.3 DEFINITIONS

A. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

B. Subsystem: A portion of a system with characteristics similar to a system.

1.4 CLOSEOUT SUBMITTALS

A. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.

1. Architect and Commissioning Authority will comment on whether content of operations and maintenance submittals are acceptable.
2. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

B. Format: Submit operations and maintenance manuals in the following format:

1. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Architect.

a. Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
b. Enable inserted reviewer comments on draft submittals.

C. Initial Manual Submittal: Submit draft copy of each manual at least 30 days before commencing demonstration and training. Architect and Commissioning Authority will comment on whether general scope and content of manual are acceptable.

D. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 15 days before commencing demonstration and training. Architect and Commissioning Authority will return copy with comments.

1. Correct or revise each manual to comply with Architect's and Commissioning Authority's comments. Submit copies of each corrected manual within 15 days of receipt of Architect's and Commissioning Authority's comments and prior to commencing demonstration and training.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

2.2 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Organization: Unless otherwise indicated, organize each manual into a separate section for each system and subsystem, and a separate section for each piece of equipment not part of a system. Each manual shall contain the following materials, in the order listed:

1. Title page.
2. Table of contents.
3. Manual contents.

B. Title Page: Include the following information:

1. Subject matter included in manual.
2. Name and address of Project.
3. Name and address of Owner.
4. Date of submittal.
5. Name and contact information for Contractor.
6. Name and contact information for Construction Manager.
7. Name and contact information for Architect.
8. Name and contact information for Commissioning Authority.
9. Names and contact information for major consultants to the Architect that designed the systems contained in the manuals.
10. Cross-reference to related systems in other operation and maintenance manuals.

C. Table of Contents: List each product included in manual, identified by product name, indexed to the content of the volume, and cross-referenced to Specification Section number in Project Manual.

1. If operation or maintenance documentation requires more than one volume to accommodate data, include comprehensive table of contents for all volumes in each volume of the set.

D. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

E. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

2.3 EMERGENCY MANUALS

A. Content: Organize manual into a separate section for each of the following:

1. Type of emergency.
2. Emergency instructions.
3. Emergency procedures.

B. Type of Emergency: Where applicable for each type of emergency indicated below, include instructions and procedures for each system, subsystem, piece of equipment, and component:

1. Fire.
2. Flood.
3. Gas leak.
4. Water leak.
5. Power failure.
6. Water outage.
7. System, subsystem, or equipment failure.
8. Chemical release or spill.

C. Emergency Instructions: Describe and explain warnings, trouble indications, error messages, and similar codes and signals. Include responsibilities of Owner's operating personnel for notification of Installer, supplier, and manufacturer to maintain warranties.

D. Emergency Procedures: Include the following, as applicable:

1. Instructions on stopping.
2. Shutdown instructions for each type of emergency.
3. Operating instructions for conditions outside normal operating limits.
4. Required sequences for electric or electronic systems.
5. Special operating instructions and procedures.

2.4 OPERATION MANUALS

A. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:

1. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
2. Performance and design criteria if Contractor has delegated design responsibility.
3. Operating standards.
4. Operating procedures.
5. Operating logs.
6. Wiring diagrams.
7. Control diagrams.
8. Piped system diagrams.
9. Precautions against improper use.
10. License requirements including inspection and renewal dates.

B. Descriptions: Include the following:

1. Product name and model number. Use designations for products indicated on Contract Documents.
2. Manufacturer's name.
3. Equipment identification with serial number of each component.
4. Equipment function.
5. Operating characteristics.
6. Limiting conditions.
7. Performance curves.
8. Engineering data and tests.

9. Complete nomenclature and number of replacement parts.

C. Operating Procedures: Include the following, as applicable:

1. Startup procedures.
2. Equipment or system break-in procedures.
3. Routine and normal operating instructions.
4. Regulation and control procedures.
5. Instructions on stopping.
6. Normal shutdown instructions.
7. Seasonal and weekend operating instructions.
8. Required sequences for electric or electronic systems.
9. Special operating instructions and procedures.

D. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.

E. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

2.5 PRODUCT MAINTENANCE MANUALS

A. Content: Organize manual into a separate section for each product, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.

B. Source Information: List each product included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Product Information: Include the following, as applicable:

1. Product name and model number.
2. Manufacturer's name.
3. Color, pattern, and texture.
4. Material and chemical composition.
5. Reordering information for specially manufactured products.

D. Maintenance Procedures: Include manufacturer's written recommendations and the following:

1. Inspection procedures.
2. Types of cleaning agents to be used and methods of cleaning.
3. List of cleaning agents and methods of cleaning detrimental to product.
4. Schedule for routine cleaning and maintenance.
5. Repair instructions.

E. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

F. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

2.6 SYSTEMS AND EQUIPMENT MAINTENANCE MANUALS

A. Content: For each system, subsystem, and piece of equipment not part of a system, include source information, manufacturers' maintenance documentation, maintenance procedures, maintenance and service schedules, spare parts list and source information, maintenance service contracts, and warranty and bond information, as described below.

B. Source Information: List each system, subsystem, and piece of equipment included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.

C. Manufacturers' Maintenance Documentation: Manufacturers' maintenance documentation including the following information for each component part or piece of equipment:

1. Standard maintenance instructions and bulletins.
2. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
3. Identification and nomenclature of parts and components.
4. List of items recommended to be stocked as spare parts.

D. Maintenance Procedures: Include the following information and items that detail essential maintenance procedures:

1. Test and inspection instructions.
2. Troubleshooting guide.
3. Precautions against improper maintenance.
4. Disassembly; component removal, repair, and replacement; and reassembly instructions.
5. Aligning, adjusting, and checking instructions.
6. Demonstration and training video recording, if available.

E. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.

1. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
2. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.

F. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.

G. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.

H. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.

1. Include procedures to follow and required notifications for warranty claims.

PART 3 - EXECUTION

3.1 MANUAL PREPARATION

A. Operation and Maintenance Documentation Directory: Prepare a separate manual that provides an organized reference to emergency, operation, and maintenance manuals.

B. Emergency Manual: Assemble a complete set of emergency information indicating procedures for use by emergency personnel and by Owner's operating personnel for types of emergencies indicated.

C. Product Maintenance Manual: Assemble a complete set of maintenance data indicating care and maintenance of each product, material, and finish incorporated into the Work.

D. Operation and Maintenance Manuals: Assemble a complete set of operation and maintenance data indicating operation and maintenance of each system, subsystem, and piece of equipment not part of a system.

1. Engage a factory-authorized service representative to assemble and prepare information for each system, subsystem, and piece of equipment not part of a system.
2. Prepare a separate manual for each system and subsystem, in the form of an instructional manual for use by Owner's operating personnel.

E. Manufacturers' Data: Where manuals contain manufacturers' standard printed data, include only sheets pertinent to product or component installed. Mark each sheet to identify each product or component incorporated into the Work. If data include more than one item in a tabular format, identify each item using appropriate references from the Contract Documents. Identify data applicable to the Work and delete references to information not applicable.

1. Prepare supplementary text if manufacturers' standard printed data are not available and where the information is necessary for proper operation and maintenance of equipment or systems.

F. Drawings: Prepare drawings supplementing manufacturers' printed data to illustrate the relationship of component parts of equipment and systems and to illustrate control sequence and flow diagrams. Coordinate these drawings with information contained in record Drawings to ensure correct illustration of completed installation.

1. Do not use original project record documents as part of operation and maintenance manuals.
2. Comply with requirements of newly prepared record Drawings in Section 01 78 39 "Project Record Documents."

G. Comply with Section 01 77 00 "Closeout Procedures" for schedule for submitting operation and maintenance documentation.

END OF SECTION 01 78 23

SECTION 01 78 39 - PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section includes administrative and procedural requirements for project record documents, including the following:

1. Record Drawings.
2. Record Specifications.
3. Record Product Data.
4. Miscellaneous record submittals.

B. Related Requirements:

1. Section 01 77 00 "Closeout Procedures" for general closeout procedures.
2. Section 01 78 23 "Operation and Maintenance Data" for operation and maintenance manual requirements.

1.3 CLOSEOUT SUBMITTALS

A. Record Drawings: Comply with the following:

1. Number of Copies: Submit copies of record Drawings as follows:

a. Initial Submittal:

1) Submit PDF electronic files of scanned record prints and one of file prints.
2) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.

b. Final Submittal:

1) Submit PDF electronic files of scanned record prints and set(s) of prints.
2) Print each drawing, whether or not changes and additional information were recorded.

B. Record Specifications: Submit annotated PDF electronic files of Project's Specifications, including addenda and contract modifications.

C. Record Product Data: Submit annotated PDF electronic files and directories of each submittal.

1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked-up Product Data as a component of manual.

D. Miscellaneous Record Submittals: See other Specification Sections for miscellaneous record-keeping requirements and submittals in connection with various construction activities. Submit annotated PDF electronic files and directories of each submittal.

E. Reports: Submit written report monthly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

1.4 ELECTRONIC CLOSEOUT DOCUMENTATION

A. General: Provide a complete project closeout documentation package in electronic format. This package shall include:
1. Issued for Construction Plans, Specs
2. Project Record Documents.
3. Approved Submittals.
4. Operation and Maintenance Manuals.
5. Warranties.
6. Owner training Videos (.WMV or .MP4 Format)
7. Project Contact Directory.

B. The Electronic Closeout Documentation shall be prepared by BHFX Imaging. GCs / CMs are responsible for the Closeout Fee. Please contact Sarah Jacobs at 847-593-3161 x. 206 or sarah.jacobs@bhfx.net for Pricing and Closeout Organization Information.

C. In order to facilitate the Electronic Closeout Documentation process, comply with the following procedures:
1. Contact BHFX Imaging for a Project Order Form a minimum of three months prior to the date of Substantial Completion to schedule a pre-closeout meeting. Review the following:
    a. Format of documents: PDF electronic format for all documents.
    b. Folder structure for storage and transfer of files.
    c. Schedule for collection and turn-over of closeout documentation.
    d. Record Document format procedures: Provide clean and accurate paper copies of the marked-up Record Documents (Drawings and Specifications) for scanning.
    e. Provide contact information for the individual responsible for the collection and transfer of the Electronic Closeout Documentation Package contents.
    f. Review a complete listing of Electronic Closeout Documentation Package contents.
2. Provide all documentation to BHFX Imaging for processing no later than 30 days after the date of Substantial Completion.
3. Schedule a training conference with the Owner's Representative, Architect, Construction Manager and BHFX Imaging to present the completed Electronic Closeout Documentation Package.

PART 2 - PRODUCTS

2.1 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.

a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
b. Accurately record information in an acceptable drawing technique.
c. Record data as soon as possible after obtaining it.
d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:

a. Dimensional changes to Drawings.
b. Revisions to details shown on Drawings.
c. Depths of foundations below first floor.
d. Locations and depths of underground utilities.
e. Revisions to routing of piping and conduits.
f. Revisions to electrical circuitry.
g. Actual equipment locations.
h. Duct size and routing.
i. Locations of concealed internal utilities.
j. Changes made by Change Order or Construction Change Directive.
k. Changes made following Architect's written orders.
l. Details not on the original Contract Drawings.
m. Field records for variable and concealed conditions.
n. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark record sets with erasable, red-colored pencil. Use other colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Architect. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Architect for resolution.

4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.

    a. See Section 01 33 00 "Submittal Procedures" for requirements related to use of Architect's digital data files.
    b. Architect will provide data file layer information. Record markups in separate layers.

C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.

1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or other modification.

D. Format: Identify and date each record Drawing; include the designation "PROJECT RECORD DRAWING" in a prominent location.

1. Format: Annotated PDF electronic file with comment function enabled.
2. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
3. Identification: As follows:

    a. Project name.
    b. Date.
    c. Designation "PROJECT RECORD DRAWINGS."
    d. Name of Contractor.

2.2 RECORD SPECIFICATIONS

A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
5. Note related Change Orders, record Product Data, and record Drawings where applicable.

B. Format: Submit record Specifications as annotated PDF electronic file.

2.3 RECORD PRODUCT DATA

A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.

1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
3. Note related Change Orders, record Specifications, and record Drawings where applicable.

B. Format: Submit record Product Data as annotated PDF electronic file.

1. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

2.4 MISCELLANEOUS RECORD SUBMITTALS

A. Assemble miscellaneous records required by other Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference.

B. Format: Submit miscellaneous record submittals as PDF electronic file.

1. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

PART 3 - EXECUTION

3.1 RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction purposes. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

END OF SECTION 01 78 39

SECTION 02 41 19 - SELECTIVE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. The Work of this Section Includes:

1. Demolition and removal of selected portions of exterior or interior of building or structure and site elements.
2. Abandonment and Removal of existing Utilities and Utility Structures.

B. Related Requirements:

1. Section 01 10 00 "Summary" for restrictions on use of the premises, Owner-occupancy requirements, and phasing requirements.
2. Section 01 50 00 "Temporary Facilities and Controls": Site fences, security, protective barriers, and waste removal.
3. Section 01 57 13 "Temporary Erosion and Sediment Control.
4. Section 01 60 00 "Product Requirements" Handling and storage of items removed for salvage and relocation.
5. Section 01 73 00 "Execution" for cutting and patching procedures.
6. Section 31 10 00 "Site Clearing" Vegetation and existing deris removal.
7. Section 31 22 00 "Grading" Topsoil Removal and fill material for filling holes, pits, and excavations generated as a result of removal operations.
8. Section 31 23 23 "Fill" Fill material for filling holes, pits, and excavations generated as a result of removal operations.
9. Section 33 05 00 "Common Work Results for Utilities" for removal of site utility systems piping, equipment, and components.

1.2 DEFINITIONS

A. Remove: Detach items from existing construction and legally dispose of off-site unless indicated to be removed and salvaged or removed and reinstalled.

B. Remove and Salvage: Detach items from existing construction, in a manner to prevent damage, and deliver to Owner as indicated.

C. Remove and Reinstall: Detach items from existing construction, in a manner to prevent damage; prepare for reuse; and reinstall where indicated.

D. Existing to Remain: Existing items of construction that are not to be removed.

1.3 MATERIALS OWNERSHIP

A. Unless otherwise indicated, demolition waste becomes property of Contractor.

B. Historic items, relics, antiques, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, and other items of interest or value to Owner that may be uncovered during demolition remain the property of Owner.

1. Carefully salvage in a manner to prevent damage and promptly return to Owner.

1.4 COORDINATION

A. Arrange selective demolition schedule so as not to interfere with Owner's operations.

1.5 PREINSTALLATION MEETINGS

A. Predemolition Conference: Conduct conference at Project site.

1.6 INFORMATIONAL SUBMITTALS

A. Survey of Existing Conditions: Submit survey.

B. Proposed Protection Measures: Submit report, including Drawings, that indicates the measures proposed for protecting individuals and property, for environmental protection , for dust control and , for noise control. Indicate proposed locations and construction of barriers.

C. Schedule of Selective Demolition Activities: Indicate the following:

1. Detailed sequence of selective demolition and removal work, with starting and ending dates for each activity. Ensure Owner's on-site operations are uninterrupted.
2. Temporary interruption of utility services. Indicate how long utility services will be interrupted.
3. Coordination for shutoff, capping, and continuation of utility services.
4. Use of elevator and stairs.
5. Coordination of Owner's continuing occupancy of portions of existing building and of Owner's partial occupancy of completed Work.

D. Predemolition Photograph or Video: Submit before work begins.

E. Statement of Refrigerant Recovery: Signed by refrigerant recovery technician responsible for recovering refrigerant, stating that all refrigerant that was present was recovered and that recovery was performed in accordance with EPA regulations. Include name and address of technician and date refrigerant was recovered.

F. Warranties: Documentation indicating that existing warranties are still in effect after completion of selective demolition.

1.7 CLOSEOUT SUBMITTALS

A. Inventory: Submit a list of items that have been removed and salvaged.

1.8 QUALITY ASSURANCE

A. Refrigerant Recovery Technician Qualifications: Universal certified by an EPA-approved certification program.

1.9 FIELD CONDITIONS

A. Owner will occupy portions of building immediately adjacent to selective demolition area. Conduct selective demolition so Owner's operations will not be disrupted.

B. Conditions existing at time of inspection for bidding purpose will be maintained by Owner as far as practical.

1. Before selective demolition, Owner will remove the following items:

a. Loose furniture, fixtures, and equipment.
b. Artwork and wall decor the Owner would like to salvage.
c. Computers and Office Furniture.

C. Notify Architect of discrepancies between existing conditions and Drawings before proceeding with selective demolition.

D. Hazardous Materials:

1. It is not expected that hazardous materials will be encountered in the Work.

a. If materials suspected of containing hazardous materials are encountered, do not disturb; immediately notify Architect and Owner. Hazardous materials will be removed by Owner under a separate contract.

E. On-site sale of removed items or materials is not permitted.

1.10 WARRANTY

A. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during selective demolition, by methods and with materials and using approved contractors so as not to void existing warranties. Notify warrantor before proceeding. Existing warranties include the following:

1. Owner to confirm if any existing warranties are applicable prior to construction commencement.

B. Notify warrantor on completion of selective demolition, and obtain documentation verifying that existing system has been inspected and warranty remains in effect. Submit documentation at Project closeout.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Regulatory Requirements: Comply with governing EPA notification regulations before beginning selective demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

B. Standards: Comply with ANSI/ASSP A10.6 and NFPA 241.

C. Sustainable Design Requirements for Building Reuse:

1. Maintain the existing interior ceilings, interior partitions, and/or demountable walls where indicated to remain. Do not demolish such existing construction beyond indicated limits.

2.2 MATERIALS

A. Fill Materials: As specified in Section 31 23 23 Fill.

2.3 SCOPE FOR SITEWORK

A. Remove paving and curbs as required to accomplish new work.

B. Remove concrete slabs on grade withing site boundaries.

C. Remove manholes and manhole covers, curb inlets, and basins.

D. Remove fences and gates.

E. Remove other items indicated, for salvage, relocation, and recycling.

F. Fill excavations, open pits, and holes in ground areas generated as a result of removals using specified fill, compact as specified in Section 31 22 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that utilities have been disconnected and capped before starting selective demolition operations.

B. Review Project Record Documents of existing construction or other existing condition and hazardous material information provided by Owner. Owner does not guarantee that existing conditions are same as those indicated in Project Record Documents.

C. Perform an engineering survey of condition of building to determine whether removing any element might result in structural deficiency or unplanned collapse of any portion of structure or adjacent structures during selective building demolition operations.

D. Verify that hazardous materials have been remediated before proceeding with building demolition operations.

E. Survey of Existing Conditions: Record existing conditions by use of preconstruction photographs or video, measured drawings and templates.

1. Inventory and record the condition of items to be removed for salvage or reinstallation. Photograph or video conditions that might be misconstrued as damage caused by removal.
2. Photograph or video existing conditions of adjoining construction including finish surfaces, that might be misconstrued as damage caused by selective demolition operations or removal of items for salvage or reinstallation.

3.2 PREPARATION

A. Temporary Shoring: Design, provide, and maintain shoring, bracing, and structural supports as required to preserve stability and prevent movement, settlement, or collapse of construction and finishes to remain, and to prevent unexpected or uncontrolled movement or collapse of construction being demolished.

1. Strengthen or add new supports when required during progress of selective demolition.

B. Temporary Protection: Provide temporary barricades and other protection required to prevent injury to people and damage to adjacent buildings and facilities to remain.

1. Provide protection to ensure safe passage of people around selective demolition area and to and from occupied portions of building.
2. Provide temporary weather protection, during interval between selective demolition of existing construction on exterior surfaces and new construction, to prevent water leakage and damage to structure and interior areas.
3. Protect walls, ceilings, floors, and other existing finish work that are to remain or that are exposed during selective demolition operations.
4. Cover and protect furniture, furnishings, and equipment that have not been removed.
5. Comply with requirements for temporary enclosures, dust control, heating, and cooling specified in Section 01 50 00 "Temporary Facilities and Controls."

C. Existing Items to Remain: Protect construction indicated to remain against damage and soiling during selective demolition. When permitted by Architect, items may be removed to a suitable, protected storage location and cleaned and reinstalled in their original locations after selective demolition operations are complete.

D. Refrigerant: Before starting demolition, remove refrigerant from mechanical equipment in accordance with 40 CFR 82 and regulations of authorities having jurisdiction.

3.3 UTILITY SERVICES AND BUILDING SYSTEMS

A. Existing Services/Systems to Remain: Maintain utilities and building systems and equipment to remain and protect against damage during selective demolition operations.

1. Maintain fire-protection facilities in service during selective demolition operations.

B. Existing Services/Systems to Be Removed, Relocated, or Abandoned: Locate, identify, disconnect, and seal or cap off utilities and building systems serving areas to be selectively demolished.

1. Arrange to shut off utilities with utility companies.
2. If disconnection of utilities and building systems will affect adjacent occupied parts of the building, provide temporary services/systems that bypass area of selective demolition and that maintain continuity of services/systems to those parts of the building.
3. Demolish and remove existing building systems, equipment, and components indicated on Drawings to be removed.

    a. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
    b. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material.
    c. Equipment to Be Removed: Disconnect and cap services and remove equipment and components.

4. Abandon existing building systems, equipment, and components indicated on Drawings to be abandoned in place.

    a. Piping to Be Abandoned in Place: Drain piping and cap or plug piping with same or compatible piping material and leave in place.
    b. Ducts to Be Abandoned in Place: Cap or plug ducts with same or compatible ductwork material and leave in place.

5. Remove and reinstall/salvage existing building systems, equipment, and components indicated on drawings to be removed and reinstalled or removed and salvaged:

    a. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment and components; when appropriate, reinstall, reconnect, and make equipment operational.
    b. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and components and deliver to Owner.

3.4 SALVAGE/REINSTALL

A. Removed and Salvaged Items:

1. Clean salvaged items.

2. Pack or crate items after cleaning. Identify contents of containers with label indicating elements, date of removal, quantity, and location where removed.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area on-site designated by Owner.
5. Protect items from damage during transport and storage.

B. Removed and Reinstalled Items:

1. Clean and repair items to functional condition adequate for intended reuse.
2. Pack or crate items after cleaning and repairing. Identify contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment. Provide connections, supports, and miscellaneous materials necessary to make item functional for use indicated.

3.5 SELECTIVE DEMOLITION, GENERAL

A. General: Demolish and remove existing construction only to extent required by new construction and as indicated. Use methods required to complete the Work within limitations of governing regulations and as follows:

1. Proceed with selective demolition systematically, from higher to lower level. Complete selective demolition operations above each floor or tier before disturbing supporting members on the next lower level.
2. Neatly cut openings and holes plumb, square, and true to dimensions required. Use cutting methods least likely to damage construction to remain or adjoining construction. Use hand tools or small power tools designed for sawing or grinding, not hammering and chopping. Temporarily cover openings to remain.
3. Cut or drill from the exposed or finished side into concealed surfaces to avoid marring existing finished surfaces.
4. Do not use cutting torches until work area is cleared of flammable materials. At concealed spaces, such as duct and pipe interiors, verify condition and contents of hidden space before starting flame-cutting operations. Maintain portable fire-suppression devices during flame-cutting operations.
5. Maintain fire watch during and for at least 2 hours after flame-cutting operations.
6. Maintain adequate ventilation when using cutting torches.
7. Remove decayed, vermin-infested, or otherwise dangerous or unsuitable materials and promptly dispose of off-site.
8. Remove structural framing members and lower to ground by method suitable to avoid free fall and to prevent ground impact or dust generation.
9. Locate selective demolition equipment and remove debris and materials so as not to impose excessive loads on supporting walls, floors, or framing.

B. Site Access and Temporary Controls: Conduct selective demolition and debris-removal operations to ensure minimum interference with roads, streets, walks, walkways, and other adjacent occupied and used facilities.

1. Do not close or obstruct streets, walks, walkways, or other adjacent occupied or used facilities without permission from Owner and authorities having jurisdiction. Provide alternate routes around closed or obstructed trafficways if required by authorities having jurisdiction.

2. Use water mist and other suitable methods to limit spread of dust and dirt. Comply with governing environmental-protection regulations. Do not use water when it may damage adjacent construction or create hazardous or objectionable conditions, such as ice, flooding, and pollution.

3.6 SELECTIVE DEMOLITION PROCEDURES FOR SPECIFIC MATERIALS

A. Concrete:

1. Demolish in sections. Cut concrete full depth at junctures with construction to remain and at regular intervals using power-driven saw, and then remove concrete between saw cuts.

B. Masonry: Demolish in small sections. Cut masonry at junctures with construction to remain, using power-driven saw, and then remove masonry between saw cuts.

C. Concrete Slabs-on-Grade: Saw-cut perimeter of area to be demolished, and then break up and remove.

D. Resilient Floor Coverings: Remove floor coverings and adhesive in accordance with recommendations in RFCI's "Recommended Work Practices for the Removal of Resilient Floor Coverings." Do not use methods requiring solvent-based adhesive strippers.

E. Roofing: Remove no more existing roofing than what can be covered in one day by new roofing and so that building interior remains watertight and weathertight. See Section 07 53 23 EPDM Roofing for new roofing requirements.

3.7 DISPOSAL OF DEMOLISHED MATERIALS

A. Remove demolition waste materials from Project site and dispose of them in an EPA-approved construction and demolition waste landfill acceptable to authorities having jurisdiction.

1. Do not allow demolished materials to accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Remove debris from elevated portions of building by chute, hoist, or other device that will convey debris to grade level in a controlled descent.
4. Comply with requirements specified in Section 01 74 19 "Construction Waste Management and Disposal."

B. Burning: Do not burn demolished materials.

3.8 CLEANING

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by selective demolition operations. Return adjacent areas to condition existing before selective demolition operations began.

END OF SECTION 02 41 19

SECTION 03 10 00 - CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Design, construction and treatment of formwork and related accessories to confine and shape concrete to the required dimensions.

B. Installation of embedded items such as waterstops, shelf angles, and PVC weeps.
C. Structural notes indicated on the drawings regarding concrete formwork shall be considered a part of this specification.

1.2 RELATED WORK

A. Pertinent Sections of Division 01.

B. Section 03 20 00 - Concrete Reinforcement.
C. Section 03 30 00 - Cast-in-Place Concrete.

1.3 REFERENCES

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified. Where provisions of the pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI 347 - Guide to Formwork for Concrete.
5. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
6. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
7. NIST - PS 1: Structural Plywood

1.4 DESIGN REQUIREMENTS

A. Design and engineering of formwork is the responsibility of the Contractor. Design, engineer and construct formwork, shoring, and bracing to conform to Contract Documents and in accordance with . Formwork design shall be under direct supervision of a Structural engineer experienced in the design of this work and licensed in the State where the project is located. Design for construction loads, lateral pressure, and requirements of the applicable building code to conform to the required shape, line, and dimensions. Contractor is responsible for formwork camber calculations.

B. Drawings show the design requirements and dimensions for structural strength, but structural drawings do not show all detail dimensions to fit intricate architectural and mechanical detail. Contractor shall construct the concrete work so that it will conform to the clearance required by the architectural, mechanical, and electrical design.
C. Maximum deflection of facing materials forming concrete surfaces exposed to view shall be 1/240 of the center-to-center span between structural members of the formwork.
D. Carry vertical and lateral loads to the ground by a formwork system and in-place construction that has attained adequate strength for that purpose. Where adequate foundations for shores and struts cannot be secured, provide trussed supports.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data, installation instructions and specifications for each of the following:

1. Waterstop profiles
2. Form sealer
3. Form release agent(s), including certification that agent is compatible with finish
4. Form ties and spreaders

B. Testing for Formwork Removal: When methods other than cylinder tests are proposed for determining time for formwork removal, submit data on methods for approval.

1.6 COORDINATION

A. Coordinate with other sections of work that require attachment of components to formwork.

B. If formwork is placed after reinforcement, resulting in insufficient concrete cover to reinforcement, request instructions from the Owner's Representative or Architect or Structural Engineer before proceeding.

PART 2 - PRODUCTS

2.1 MATERIALS AND ACCESSORIES

A. Formwork Accessories: Use commercially manufactured accessories for formwork accessories partially or completely embedded in concrete, including ties and hangers.

B. Sealer: Clear, penetrating, synthetic resin sealer.
C. Formwork Release Agent: Use commercially manufactured form release agents that will prevent formwork absorption of moisture, prevent bond with concrete, and will not stain the concrete surface. Reapply to cleaned forms before each reuse. Formwork release agent shall be compatible with paint or any other finish applied to the concrete; submit data indicating compatibility.
D. Waterstops: Waterstops shall be a flexible butyl rubber and bentonite clay compound that swells upon contact with water.

1. Manufacturers:

a. CETCO - Waterstop RX
b. Greenstreak - Swellstop
c. J.P. Specialties - Earth Shield (Type 20 & 23) Waterstop
d. <Insert>

2.2 FORM FINISHES

A. Rough Form Finish:

1. Concrete surfaces not exposed to view in the finished work shall have a rough-form finish. No form-facing material is specified for rough-form finish.
2. Set and maintain forms so finished concrete dimensions shall conform to the tolerances. Rough form finish is Designated Surface Finish-1.0 from ACI 301, except that surface tolerance Class C is required as specified in ACI 117.

B. Smooth Form Finish:

1. Concrete surfaces exposed to view in the finished work or surfaces to receive finishes of any type (paint, textured paint, etc.) shall have a smooth form finish. Form-facing material shall be plywood, tempered concrete-form-grade hardboard, metal, plastic, paper, or other acceptable material capable of producing the desired finish. Form-facing material shall produce a smooth, uniform texture on the concrete. Do not use form facing material with raised grain, torn surfaces, worn edges, patches, dents, or other defects that might impair the texture of the concrete surfaces.
2. Set and maintain forms so finished concrete dimensions shall conform to the tolerances. Smooth form finish is Designated Surface Finish-3.0 from ACI 301, including surface tolerance Class A as specified in ACI 117.

C. Patching and repairing concrete finishes are specified under Section 03 30 00.

2.3 FABRICATION AND MANUFACTURE

A. Form Ties and Spreaders: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms, hold inner and outer forms for vertical concrete together, and to prevent spalling of concrete on removal.

1. Furnish units that will leave no corrodible metal closer than 1-1/2 inch to the plane of the exposed concrete surface.
2. Furnish ties that, when removed, will leave holes not larger than 1 inch in diameter in the concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.
4. At horizontal pour lines, locate ties not more than 6" below the pour lines. Tighten after concrete has set and before the next pour is made.
5. For exposed concrete surfaces, provide form ties of removable type with permanent plugs and a system approved by the Architect for fixing the plugs in place.

B. Waterstops: Fabricate pieces of premolded waterstop with a maximum practicable length to hold the number of end joints to a minimum. Fabricate joints in waterstops in accordance with the manufacturer's recommendations.

PART 3 - EXECUTION

3.1 CONSTRUCTION OF TEMPORARY FORMWORK

A. In accordance with ACI 301, construct formwork:

1. Design, erect, shore, brace, and maintain formwork to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until the concrete structure can support such loads.
2. Obtain approval before framing openings in structural members not indicated on the drawings.

B. Fabricate forms for easy removal without hammering or prying against concrete surfaces.

1. Provide crush or wrecking plates where stripping may damage cast concrete surfaces.
2. Provide top forms for inclined surfaces where slope is too steep to place concrete with bottom forms only.
3. Chamfer wood inserts for forming keyways, reglets, recesses, and the like to allow wood to swell without spalling concrete and to ensure easy removal.

C. Falsework:

1. Provide positive means of adjustment (wedges or jacks) of shores and struts. Do not adjust formwork after concrete has taken its initial set. Brace formwork securely against lateral deflection and lateral instability.
2. To maintain specified tolerances, camber formwork to compensate for anticipated deflections in formwork prior to hardening of concrete. Formwork camber calculations are the responsibility of the formwork designer. Set formwork and intermediate screed strips for slabs accurately to produce designated elevations and contours of the finished surface prior to removal of formwork. Ensure edge forms and screed strips are sufficiently strong to support vibrating screeds or roller pipe screeds when the finish specified requires the use of such equipment.
3. When formwork is cambered, set screeds to a like camber to maintain required concrete thickness.
4. Verify lines, levels, and centers before proceeding with formwork. Ensure dimensions agree with the drawings.
5. Fasten form wedges in place after final adjustment of forms and prior to concrete placement.
6. Anchor formwork to shores, supporting surfaces, or members to prevent upward or lateral movement of the formwork system during concrete placement.
7. Securely brace and shore forms to prevent displacement and to safely support construction loads.
8. Construct forms plumb and straight to conform to slopes, lines, and dimensions shown.
9. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.
10. Provide runways for moving equipment and support runways directly on formwork or structural member without resting on the reinforcing steel.

D. Where end-of-work sequence requires a joint in the concrete, provide adequately designed additional formwork. Extend reinforcement through formwork as indicated on the drawings. Location of the construction joint is subject to approval by the Architect and the Structural Engineer.

E. Construct formwork for wall openings to facilitate removal and to counteract swelling of wood formwork. Keep wood forms wet as necessary to prevent shrinkage.

F. Do not use rust-stained steel form-facing material.
G. Provide temporary openings at the base of column and wall formwork and at other points where necessary to facilitate cleaning and inspection.
H. Unless noted otherwise, all footings shall be centered under walls, piers, or columns.
I. Provisions for Other Trades:

1. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for support of adjoining work prior to concrete placement.
2. Position and support expansion joint material and other embedded items to prevent displacement. Fill voids in sleeves, inserts, and anchor slots temporarily with readily removable material to prevent entry of concrete into voids.

J. Cleaning:

1. Clean surfaces of formwork and embedded materials of mortar, grout, and foreign material before concrete is placed.
2. Cover surfaces of formwork with acceptable formwork release agent. Apply form release agent before placing reinforcing steel and concrete according to manufacturer's written instructions. Do not allow formwork release agent to puddle in forms. Do not allow formwork release agent to contact reinforcing steel or hardened concrete against which fresh concrete is to be placed. Do not apply form release agent to concrete surfaces receiving special finishes or applied coverings affected by the agent.
3. Clean and inspect formwork immediately before concrete is placed.

K. Provide forms for concrete work adjacent to earth banks including sides of footings, except where footing excavation is vertical rock cut.

L. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

3.2 COORDINATION

A. Install all required pipe sleeves, cavities or slots. Notify appropriate trades in due time so they may furnish information and make necessary installations. Check sizes, location and alignment of all openings, frames and other work, which are to be built-in including electrical boxes and conduit.

B. Layout the run of partitions and establish location of openings so other trades may properly locate their work.
C. Core drilling concrete is not permitted unless noted otherwise or approved in writing by the Architect. Notify the Architect in advance of conditions not shown on the drawings.

3.3 INSTALLATION OF EMBEDDED ITEMS

A. Built-In Items:

1. Confirm with Architect that all materials to be embedded are suitable for embedment in concrete.
2. Build in anchors, inserts, and other devices indicated or required for various portions of work.
3. Build in sleeves, thimbles, and other items furnished or set in place by other trades.
4. Accurately position and support all embedded items prior to concrete placement. Secure embedded items against displacement during concrete placement operations.
5. Fill voids with readily removable material to prevent entry of concrete into voids.
6. Mechanical and Electrical shall provide and set required sleeves.
7. Coordinate setting of all embedded items.

B. Waterstops:

1. Locate waterstops in joints where indicated on the drawings.
2. Build in waterstops using longest unbroken lengths possible to hold the number of end splices to a minimum.
3. Form splices and intersections strictly according to the manufacturer's instructions so waterstops are continuous and develop an effective watertight joint.
4. In general, waterstops should be located just behind outermost layer of reinforcing. Do not place waterstops closer than 2" from face of concrete.

3.4 TOLERANCES

A. Construction formwork to maintain tolerances required by ACI 301 and ACI 117.

3.5 REMOVAL OF FORMS

A. When removal of formwork is based on concrete reaching a specified compressive strength, concrete will be presumed to have reached this strength when either of the following requirements has been met:

1. Test cylinders, molded and cured under the same conditions for moisture and temperature as used for the concrete they represent, have reached the specified compressive strength.
2. Concrete has been cured in accordance with the specifications for the same length of time as laboratory-cured cylinders, which have reached the specified strength. Determine the length of time concrete has been cured in the structure by the cumulative number of days or fractions thereof, not necessarily consecutive, during which the temperature of the air in contact with the concrete is above 50F and the concrete has been damp or thoroughly sealed from evaporation and loss of moisture.

B. Forms shall remain in place for the following periods of time. These periods represent cumulative number days or hours, not necessarily consecutive, during which the temperature of the air surrounding the concrete is above 50F:

1. Walls, Grade Beams, Columns, Sides of Beams, Girders and Footings: 67% specified compressive strength or minimum 24 hours.

C. When finishing is required, remove forms as soon as removal operations will not damage concrete.

D. Loosen wood formwork for wall openings when this can be accomplished without causing damage to concrete.

E. Do not allow removal of formwork to damage the fresh concrete for columns, walls, sides of beams, and other parts supporting the weight of the concrete. Perform needed repair and treatment required on vertical surfaces at once and follow immediately with specified curing.

3.6 FASTENER REMOVAL

A. Remove all protruding fasteners left as a result of securing inserts to forms by Contractor responsible for insert.

B. Cutting flush with surface is not acceptable.
C. Patch exposed concrete surfaces if damaged during fastener removal process.

3.7 REMOVING AND REUSING FORMS

A. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material will not be acceptable for exposed surfaces. Apply new form-release agent.

B. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by the Architect.

END OF SECTION

SECTION 03 20 00 - CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fabrication and placement of reinforcing steel for concrete and all related accessories.

B. Reinforcing steel for use in bond beams, masonry columns, and lintels is specified in Division 4 and is not a part of the work in this section.

C. Structural notes indicated on the drawings regarding concrete reinforcement shall be considered a part of this specification.

1.2 RELATED WORK

A. Pertinent Sections of Division 01.

B. Section 03 10 00 - Concrete Formwork.

C. Section 03 30 00 - Cast-in-Place Concrete.

1.3 REFERENCES

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified. Where provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 318 - Building Code Requirements for Structural Concrete.
4. ACI SP-066 - ACI Detailing Manual.
5. ASTM A615 - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
6. ASTM A706 - Standard Specification for Deformed and Plain Low-Alloy Steel Bars for Concrete Reinforcement.
7. ASTM A1064 - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete.
8. Concrete Reinforcing Steel Institute (CRSI) - Manual of Standard Practice.

1.4 SUBMITTALS

A. Placing Drawings: Submit placing drawings showing fabrication dimensions and locations for placement of reinforcement and reinforcement accessories. Indicate bar sizes, spacing, locations, and quantities of reinforcing steel, bending and cutting diagrams, anchors, and supporting and spacing devices. Dowels shall be shown in placing drawings for the element that is to be placed first. Reinforcing steel descriptions or shop drawings shall be inch-pound sizes.

B. Product Data: Submit product data sheets for all specified products.

1.5 COORDINATION

A. Coordinate reinforcement installation with the placement of formwork and other embedded items such as inserts, conduit, pipe sleeves, drains, metal supports, anchor rods, etc.

1.6 DELIVERY, STORAGE AND HANDLING

A. Deliver reinforcement to the jobsite in bundles sorted and labeled with durable tags indicating bar size, length, and shop drawing mark. Bundles shall also bear testing laboratory tags indicating identified steel.

B. Store elevated clear of ground and protect at all times from contamination and deterioration.
C. Prevent bending, coating with earth, oil, or other material, or otherwise damaging the reinforcement.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing Steel: Reinforcing steel shall conform to the ASTM standard and grade indicated in the General Notes on the drawings.

B. Welded Wire Reinforcement: Welded wire reinforcement shall conform to the ASTM standard indicated in the General Notes on the drawings.
C. Joint Dowel Bars: Plain-steel bars. Cut bars true to length with square ends and free of burrs.
D. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded wire reinforcement in place. Manufacture bar supports according to CRSI's "Manual of Standard Practice" from steel wire, plastic, precast concrete, or fiber-reinforced concrete of greater compressive strength than concrete, and as follows:

1. For concrete surfaces exposed to view where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected or CRSI Class 2 stainless-steel bar supports.
2. Concrete cast against earth: Bars may be supported by precast concrete bricks or approved prefabricated wire bar supports complying with CRSI recommendations with footpads large enough to support the weight of the bars and construction traffic without being pushed into underlying grade. Precast concrete blocks shall have a minimum compressive strength of 6,000 psi.

2.2 FABRICATION

A. Fabrication Tolerances: Reinforcing steel shall be shop fabricated within tolerances according to ACI 117 and other applicable codes, and shall conform in size, shape, quantity, dimensions, etc. to the construction drawings and approved shop drawings.

B. Bar Condition: Bars shall be free from mill scale, excessive rust, and other coatings, which would reduce or destroy the bond with the concrete. Wipe oil from forms before reinforcement is placed on or adjacent to so that oil will not be tracked over or in any way come into contact with the reinforcement.

C. Bars Bending: Bars shall be bent cold, and no method of fabrication shall be used which would be injurious to the material. Heating of bars for bending is not permitted.
D. Identification: After fabrication, bars shall be sorted, bundled, and tagged with metal tags bearing the bar mark before delivery to the jobsite.
E. Splicing:

1. Continuous reinforcing in beams and grade beams shall be lapped as follows unless noted otherwise:

a. Top bars: Midspan
b. Bottom bars: Directly over support

2. Column splice reinforcing bars shall have shop fabricated offset bends at splices. Column lap splices shall be 30 bar diameters unless noted otherwise.
3. Locate reinforcing splices not indicated on drawings at point of minimum stress. Review location of splices with the Structural Engineer and obtain written approval prior to proceeding.

F. Where beams and grade beams are simple span, top bars shall be continuous for full length and hooked down at each end.

G. Reinforcing for continuous footings shall extend into spread footings a minimum of 2'-0".
H. Dowels between footings and walls or columns shall be the same grade, size and spacing or number as the vertical reinforcing respectively, unless noted otherwise.

2.3 SUSTAINABILITY MEASURES

A. Provide steel products made using an Electric Arc Furnace having a minimum recycled content of 80%, including at least 40% post-consumer recycled content and 30% post-industrial recycled content.

1. Concrete reinforcement must be made using an Electric Arc Furnace.

B. Steel products shall be manufactured within 500 miles of project site. Recycled steel products shall be procured from within 500 miles of the project site.

PART 3 - EXECUTION

3.1 PLACING

A. Reinforcement Relocation: When necessary to move reinforcement beyond the specified spacing to avoid interference with other reinforcement, or embedded items, submit resulting arrangement of reinforcement to Structural Engineer for approval.

B. Reinforcement Cutting: Cutting of reinforcement which conflicts with embedded objects is not acceptable.

C. Welded Wire Reinforcement: Extend welded wire reinforcement to within 1 inch of the concrete edge. Lap edges and ends of fabric sheets a minimum of two full mesh squares. Lace edges with 16-gauge tie wire. Support welded wire reinforcement during placing of concrete to assure required positioning in the slab. Do not place wire reinforcement on grade or metal deck and raise into position in freshly-placed concrete.

D. Wire Tie Orientation: Set wire ties so ends are directed away from the concrete surface.

E. Slab on Grade Reinforcement Placement: Place shrinkage and temperature reinforcement 1/3 of the slab thickness from the top surface of the slabs on grade unless noted otherwise on the drawings.

F. Do not cut, displace, or puncture vapor retarder. Repair damage and reseal vapor retarder before placing concrete.

G. Support for Reinforcement: Unless noted otherwise, supports for reinforcement shall have Class 2 protection as defined in the CRSI Manual of Standard Practice. Submit data on supports indicating class of protection at all different locations for approval. Supports shall not be used as bases for runways for concrete-conveying equipment and similar construction loads. Do not place reinforcing bars more than 2" beyond last leg of any continuous bar support.

H. Support for Bars in Concrete Cast on Ground: Bar supports for slabs on grade, grade beams, footings, and all other concrete cast directly onto grade shall be supported at an average spacing of 4 feet or less in each direction.

I. Securing Reinforcing Bars: All bars must be placed, spaced, secured, and supported prior to casting concrete. Bars embedded in hardened or partially hardened concrete shall not be bent unless approved in writing prior to placement by the Structural Engineer.

J. Foot Traffic: Restrict foot traffic over the slab on grade reinforcing after it has been properly positioned.

K. Reinforcement at Expansion Joints: Do not continue reinforcement or other embedded metal items bonded to concrete through expansion joints. Dowels bonded on only one side of a joint and waterstops may extend through joint.

L. Pumping Concrete: When using a pump to place concrete, pump hose shall be supported directly on forms. Do not allow hose to rest on reinforcing bars if doing so could cause displacement of bars.

END OF SECTION

SECTION 03 30 00 - CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. All items required for executing and completing the cast-in-place concrete work and related work shown on the drawings or specified herein. Work shall include installation of items furnished in other sections of these specifications.

B. Concrete paving, walks, and curbs are specified in Division 3 or 32.

C. Structural notes indicated on the drawings regarding cast-in-place concrete shall be considered a part of this specification.

1.2 RELATED WORK

A. Pertinent Sections of Division 01.

B. Section 03 10 00 - Concrete Formwork.

C. Section 03 20 00 - Concrete Reinforcement.

D. Section 03 38 10 - Unbonded Post-Tensioned Concrete.

E. Section 05 31 00 - Steel Deck.

1.3 REFERENCES

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified. Where any provision of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

B. SPECIFIER: Edit References to suit project.

1. ACI 117 - Specification for Tolerances for Concrete Construction and Materials.
2. ACI 301 - Specifications for Structural Concrete.
3. ACI 302.1R - Guide to Concrete Floor and Slab Construction.
4. ACI 302.2R - Guide for Concrete Slabs that Received Moisture-Sensitive Flooring Materials.
5. ACI 304R - Guide to Measuring, Mixing, Transporting, and Placing Concrete.
6. ACI 305.1 - Specification for Hot Weather Concreting.
7. ACI 306.1 - Guide to Cold Weather Concreting.
8. ACI 308R - Guide to External Curing of Concrete.
9. ACI 309R - Guide for Consolidation of Concrete.
10. ACI 318 - Building Code Requirements for Structural Concrete.
11. ACI 347R - Guide to Formwork for Concrete.
12. ASTM C31 - Standard Practice for Making and Curing Concrete Test Specimens in the Field.
13. ASTM C33 - Standard Specification for Concrete Aggregates.

14. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.
15. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.
16. ASTM C88 - Standard Test Method for Soundness of Aggregates by Use of Sodium Sulfate or Magnesium Sulfate.
17. ASTM C94 - Standard Specification for Ready-Mixed Concrete.
18. ASTM C131 - Standard Test Method for Resistance to Degradation of Small-Size Coarse Aggregate by Abrasion and Impact in the Los Angeles Machine.
19. ASTM C138 - Standard Test Method for Density (Unit Weight), Yield, and Air Content (Gravimetric) of Concrete.
20. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.
21. ASTM C150 - Standard Specification for Portland Cement.
22. ASTM C157 - Standard Test Method for Length Change of Hardened Hydraulic-Cement Mortar and Concrete
23. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.
24. ASTM C172 - Standard Practice for Sampling Freshly Mixed Concrete.
25. ASTM C173 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method.
26. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.
27. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.
28. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.
29. ASTM C494 - Standard Specification for Chemical Admixtures for Concrete.
30. ASTM C595 - Standard Specification for Blended Hydraulic Cements.
31. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.
32. ASTM C1017 - Standard Specification for Chemical Admixtures for Use in Producing Flowing Concrete.
33. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Hydraulic Cement Concrete.
34. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation.
35. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Non-shrink).
36. ASTM D1751 - Standard Specification for Preformed Expansion Joint Filler for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).
37. ASTM D2103 - Standard Specification for Polyethylene Film and Sheeting.
38. ASTM E154 - Standard Test Methods for Water Vapor Retarders Used in Contact with Earth Under Concrete Slabs, on Walls, or as Ground Cover.
39. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection.
40. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs.
41. Concrete Reinforcing Steel Institute (CRSI) - Manual of Standard Practice.
42. IDOT SSRBC, latest edition.

1.4 SAMPLING AND TESTING REQUIREMENTS

A. Maintain records verifying materials used are of the specified and accepted types and sizes and are in conformance with the requirements of the Contract Documents.

B. Use of testing services will not relieve the Contractor of the responsibility to furnish materials and construction in full compliance with the Contract Documents.

C. Take samples of fresh concrete at the job site for each mix design placed each day. Sampling and testing shall be done after the final addition and proper mixing of any water or admixtures that are added on site.

1. Personnel and testing equipment shall meet the requirements of ASTM E329.
2. Testing Frequency: Obtain at least one composite sample for each 150 cu. yd. or 5,000 sq. ft. of surface area, whichever is less or fraction thereof of each concrete mixture placed each day.

    a. On a given project, if the total volume of concrete is such that the frequency of testing required above would provide less than five strength tests for a given class of concrete, tests shall be made from at least five randomly selected batches or from each batch if fewer than five batches are used.

3. A strength test shall be the average of the strengths of two 6x12 inch or three 4x8 inch cylinders made from the same sample of concrete and tested at 28 days.

D. For each sample of fresh concrete, perform the following duties:

1. Measure and record slump in accordance with ASTM C143.
2. Measure and record temperature in accordance with ASTM C1064.

    a. Provide one test hourly when air temperature is 40F and below and when 80F and above, and one test for each composite sample.

3. Measure and record air content by volume in accordance with either ASTM C231 or ASTM C173.
4. Mold two 6x12 inch or three 4x8 inch cylinders (laboratory cylinders) in accordance with ASTM C31 to be laboratory-cured. Protect from moisture loss and maintain at 60F to 80F for 24 to 48 hours before moving. Deliver cylinders to testing laboratory for curing and testing.
5. Mold one cylinder (field cylinder) in accordance with ASTM C31 to be field-cured. Field cylinder shall be placed as near as possible to the in-place concrete from which it was taken, protected, and cured in the same manner. Deliver field-cured cylinder to testing laboratory, and measure and record compressive strength in accordance with ASTM C39. Field cylinder shall be used to determine if concrete footings, walls, or piers have reached the required compressive strength for steel erection to begin.

E. Measure and record compressive strength in accordance with ASTM C39 for laboratory cylinders. Test one laboratory cylinder at 7 days and all other cylinders at 28 days. Acceptance is based on the average of the two 6x12 inch or three 4x8 inch laboratory cured 28-day tests. Notify Architect in the event strength levels do not meet the acceptance requirements of ACI 318.

1. Any additional cylinders molded for Contractor to have a compressive strength test done before seven days shall be at the Contractor's expense.

F. Prepare and submit test reports to the Architect, Engineer, Contractor and Supplier. Reports shall be completed and furnished within 48 hours of testing. Refer to description in Submittals.

G. When strength of field-cured cylinders is less than 85 percent of companion laboratory-cured cylinders, Contractor shall evaluate operations and provide corrective procedures for protecting and curing in-place concrete.

H. Should the strength of any grade of concrete for any portion of work, as indicated by molded test cylinders, fall below the minimum 28-day compressive strength specified on the drawings, upon approval of the Structural Engineer, the concrete supplier shall adjust the concrete mix for remaining portion of construction so that the resulting concrete meets the minimum strength requirements.

1.5 SUBMITTALS

A. Concrete Materials: Submit information on concrete materials as listed below.

1. Cementitious Materials: Submit type, class, producer name, and certification not more than 90 days old of compliance with applicable ASTM standard.
2. Aggregates: Submit type, pit or quarry location, producer name, gradations, specific gravity, water content, and certification not more than 90 days old.
3. Admixtures: Submit product data sheet. Product data shall include: dosages and performance data, brand names, producers, chloride ion concentrations, and certifications of compliance with applicable ASTM standard. Certifications shall not be more than 90 days old.
4. Water: Submit name of source.
5. Environmental Product Declaration (EPD): Submit a product-specific EPD for each mix design including Product Category Rule (PCR), declared product, date of issue, period of validity, and third-party verification.

B. Product Data: Prepare and submit product and performance data for materials and accessories, including patching compounds, joint systems, curing compounds, finish materials, and other concrete related items.

C. Testing Agency Qualifications: When requested, the proposed testing agencies shall submit data on qualifications for acceptance.

D. Concrete Mix Design:

1. Concrete mix design submittals shall be submitted to the Structural Engineer[and HCAI] for review and approval at least 14 days prior to placing concrete.
2. Obtain Structural Engineer[and HCAI] approval for each mix design prior to use, including new mix designs required to be prepared should there be a change in materials being used.
3. Submit concrete mixture proportions and characteristics for each concrete mix. Include standard deviation analysis or trial batch data with mix design. Submit historical field test data to demonstrate the average compressive strength for approval. Concrete mix proportions, materials, and handling methods for field test data or trial batches shall be the same as used for the work. Include the following information for each mix design:

    a. Water/cementitious materials ratio.
    b. Slump per ASTM C143
    c. Air content per ASTM C231 or ASTM C173
    d. Unit weight of concrete per ASTM C138
    e. Compressive strength at 28 days per ASTM C39
    f. Embodied Carbon in kg CO2e/yd3 per ISO 21930:2017.

4. If trial batches are used, submit representative samples of each proposed ingredient to independent testing laboratory for use in preparation of mix design.
5. Include alternate mix designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments. Indicate amounts of mix water to be withheld for later addition at Project site.

6. Provide a record copy of the final mix designs and test results to the testing agency prior to commencement of the concrete work.

E. Cold Weather Procedure Submittal: Refer to Cold Weather Concreting article in Part 3 for more information.

F. Record Documents: Accurately record actual locations of embedded utilities and components that are concealed from view.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Cementitious Materials: Store cementitious materials in dry weather tight buildings, bins, or silos that exclude contaminants.

B. Aggregates: Store and handle aggregate in a manner that will avoid segregation and prevent contamination with other materials or other sizes of aggregates. Store aggregates so as to drain freely.

C. Admixtures: Protect stored admixtures against contamination, evaporation, or damage. Protect liquid admixtures from freezing and temperature changes, which would adversely affect their performance. Handle chemical admixtures in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.1 CONCRETE MATERIALS

A. Portland Limestone Cement: Portland limestone cement (PLC) shall conform to ASTM C595, Type IL. Use one brand of PLC throughout project, unless approved in writing by the Engineer. PLC used in concrete shall be the same as used in the concrete represented by the submitted field test data or used in the trial mixtures. Maintain consistent PLC color throughout project unless directed otherwise by architectural requirements.

1. Total replacement of Portland limestone cement by supplementary cementitious materials in design mixture shall not exceed 50% (by weight).

B. Portland Cement: Portland cement shall conform to ASTM C150, Type I Normal, and be a standard brand of Portland cement. Use one brand of cement throughout project, unless approved in writing by the Engineer. Cement, which conforms to ASTM C150 Type II, may be used if it also meets the requirements of ASTM C150 Type I. Cement used in concrete shall be of the same brand and type as the cement used in the concrete represented by the submitted field test data or used in the trial mixtures. Maintain consistent cement color throughout project unless directed otherwise by architectural requirements.

C. Supplementary Cementitious Materials

1. Fly Ash: Fly ash shall conform to ASTM C618, Class C or Class F. Replacement of Portland cement by fly ash shall not exceed the following (percentages are by weight):

a. Concrete Flatwork: 20 percent.
b. Mass Concrete (more than two feet thick): 50 percent.
c. All other concrete: 25 percent.

d. Concrete to be placed in cold weather as defined herein: No fly ash allowed unless the cold weather procedure submitted has compensated for the increased setting time and decreased rate of strength gain due to cold weather and fly ash.

2. Slag Cement: ASTM C989, Grade 100 or 120.

a. Ground Granulated Blast-Furnace Slag Limit: 50% by weight of total cementitious materials.
b. In mass concrete more than 2 feet thick, the usage rate may be 80% by weight of total cementitious materials.

3. Combined Fly Ash and Ground Granulated Blast-Furnace Slag:

a. Supplementary Cementitious Materials Limit: 50% with fly ash not exceeding 25% by weight of total cementitious materials.
b. In mass concrete more than 2 feet thick: 80% with fly ash not exceeding 50% by weight of total cementitious materials.

D. Coarse Aggregate for Normal Weight Concrete: Comply with ASTM C33. Provide coarse aggregate from a single source for exposed concrete. Gradations shall be similar to that described in the following table:

COARSE AGGREGATE GRADATIONS							
SIEVE SIZE - PERCENT PASSING							
Grade No.	1-1/2"	1"	3/4"	1/2"	3/8"	No. 4	No. 16
4	90-100 Note 1	20-55	0-15	---	0-5	---	---
57	100	95-100	---	25-60	0-10	0-10	---
67	---	100	90-100	---	20-55	0-10	---
89	---	---	---	100	90-100	20-55	0-10

1. Shall be 100 percent passing the 2" sieve.
2. A maximum of 30% of coarse aggregate may be recycled aggregate for footing and grade beam concrete.

E. Fine Aggregate for Normal Weight Concrete: Comply with ASTM C33. Provide fine aggregate from a single source for exposed concrete. Fine aggregate shall consist of washed sand. Gradations shall be similar to that described in the following table:

FINE AGGREGATE GRADATIONS							
SIEVE SIZE - PERCENT PASSING							
Grade No.	3/8	No. 4	No. 8	No. 16	No. 50	No. 80	No. 100
FA	100	95-100	80-100	50-85	5-30	---	0-10

1. A maximum of 10% of fine aggregate may be recycled aggregate for footing and grade beam concrete.

F. Do not use aggregates containing deleterious substances that could cause spalling on any exterior exposed surface. These include, but are not limited to the following:

1. Organic impurities.
2. Ferrous metals.
3. Soluble salts.
4. Coal, lignite, or other lightweight materials.
5. Soft particles.
6. Clay lumps and friable particles.
7. Cherts of less than 2.40 specific gravity.

G. Water: Mixing water for concrete shall meet the requirements of ASTM C94. Water shall be clean and free from injurious amounts of acids, alkalis, organic materials, chloride ions and oils deleterious to concrete or reinforcing steel.

H. Testing agency shall be given access to plants and stockpiles to obtain samples for testing for compliance with the Contract Documents.

2.2 ADMIXTURES

A. Chemical Admixtures: Provide admixtures certified by manufacturer to be compatible with other admixtures. Calcium chloride thiocyanates or admixtures containing intentionally added chlorides are not permitted.

B. Water Reducing Admixture: Material shall comply with ASTM C494, Type A.

1. Acceptable:

a. Master Builders Solutions - MasterPozzolith Series or MasterPolyheed Series.
b. Chemical Company - Eucon WR Series.
c. Sika Chemical Corp. - Plastocrete 161.
d. GRT - Polychem 400 NC.
e. Grace Construction Products - WRDA 82.
f. .

C. High Range Water Reducing Admixture (superplasticizer): Material shall comply with ASTM C494, Type F or Type G.

1. Acceptable:

a. Master Builders Solutions - MasterRheobuild 1000 or MasterGlenium Series.
b. Euclid Chemical Company - Eucon 37 or Plastol Series.
c. Sika - ViscoCrete 2100.
d. GRT - Melchem.
e. Grace Construction Products - Mira 110.
f. .

D. High Range Water Reducing, Slump Retaining Admixture: Material shall comply with ASTM C494, Type F or Type G.

1. Acceptable:

a. Master Builders Solutions - MasterGlenium 7700.
b. Euclid Chemical Company - Eucon 537, Eucon 1037, or Plastol Series.
c. Sika - Sikament 686.
d. GRT - Melchem - M.
e. Grace Construction Products - ADVA FLEX.

E. Non-Chloride Accelerator: Material shall comply with ASTM C494, Type C or Type E, and not contain a higher chloride ion concentration than municipal drinking water.

1. Acceptable:

a. Master Builders Solutions - MasterSet FP 20 or MasterSet AC 534.
b. Euclid Chemical Company - Accelguard Series.
c. Sika Chemical Corp. - Sika Rapid-1.
d. GRT - Polychem HE.
e. Grace Construction Products - Lubricon NCA.

F. Air Entraining Admixture: Air entraining admixture shall comply with ASTM C260, and be certified by the manufacturer to be compatible with other admixtures to be used.

1. Acceptable:

a. Master Builders Solutions - MasterAir Series.
b. Euclid Chemical Company - Air-Mix or AEA Series.
c. Sika Chemical Corporation - Sika-Aer.
d. GRT - Polychem VR.
e. Grace Construction Products - Darex II or Daravair 1000.

G. Water Reducing and Retarding Admixture: Material shall comply with ASTM C494, Types B and D.

1. Acceptable:

a. Master Builders Solutions - MasterSet R Series or MasterSet DELVO Series.
b. Euclid Chemical Company - Eucon Retarder Series.
c. Sika Chemical Corporation - Plastiment.
d. GRT - Polychem - R.
e. Grace Construction Products - Daratard 17 or Recover.

H. Set Accelerating Corrosion-Inhibiting Admixture: Admixture shall contain at least 30% calcium nitrite, while meeting the requirements of ASTM C494 as a Type C admixture.

1. Acceptable:

a. Master Builders Solutions - MasterLife CI 30.
b. Euclid Chemical Company - Eucon CIA.
c. Grace Construction Products - DCI.

I. Shrinkage Reducing and/or Shrinkage Compensating Admixture: Admixture used for the compensation and reduction of shrinkage in Portland cement concrete.

1. Acceptable:

a. Euclid Chemical Company - Conex.
b. Grace Construction Products - Eclipse Floor 200.
c. Master Builders Solutions - MasterLife SRA Series or MasterLife CRA 007 MasterSure Z60 MasterLife 300D.

J. CO2 mineralized concrete is preferred where available, provided concrete performance criteria are met. Supply CO2 mineralized concrete, such that post-industrial carbon dioxide (CO2) is injected into the concrete like an admixture and chemically converted into a mineral. The concrete may undergo mix optimization whereby the strength enhancement property of the mineralized CO2 is utilized to adjust cementitious content, provided the optimized concrete mix meets concrete performance requirements as outlined in this specification document.

1. Acceptable:

a. CarbonCure Ready Mix Concrete Technology

K. Admixtures used in concrete shall be the same brand, type, and dosage used in concrete represented by field test data or used in trial mixes.

2.3 CURING PRODUCTS

A. Moisture Retaining Cover

1. Plastic Film: Use 6 mil polyethylene film sheet materials that meet the requirements of ASTM C171.
2. White burlap-polyethylene sheet meeting ASTM C171.
3. Reinforced curing paper complying with ASTM C171.
4. Moisture Retaining Fabric: A naturally colored, non-woven, polypropylene fabric with a 4-mil, non-perforated reflective (white) polyethylene coating containing stabilizers to resist degradation from ultraviolet light. Fabric shall exhibit low permeability and high moisture retention. Acceptable manufacturers and products include:

a. PNA Construction Technologies, Inc.: Hydracure S16.
b. PNA Construction Technologies, Inc.: Hydracure M5.
c. Reef Industries Incorporated: Transguard 4000.

B. Dissipating Resin Curing Compound: Clear, waterborne, membrane-forming curing compound complying with ASTM C309, Type 1, Class B shall be composed of hydrocarbon resins and dissipating agents that begin to break down upon exposure to ultraviolet light and traffic approximately 4 to 6 weeks after application, providing a film that is removable with standard degreasing agents and mechanized scrubbing actions so as to not impair the later addition of applied finishes.

1. Curing compounds used on interior enclosed environments shall be a water-borne product and VOC compliant as required by the U.S. EPA Architectural Coating Rule.

C. Non-dissipating Curing Compound: Clear, membrane-forming curing compound complying with ASTM C309, Type 1, Class B.

1. Curing compounds used on interior enclosed environments shall be a water-borne product and VOC compliant as required by the U.S. EPA Architectural Coating Rule.

D. Curing and Sealing Compound: Clear, membrane-forming curing and sealing compound complying with ASTM C309, Type 1, and ASTM C1315, Type 1, Class A. Compound shall dry to a clear finish, resist yellowing due to ultraviolet degradation and provide a long-lasting finish that has high resistance to chemicals, oil, grease, deicing salts, and abrasion.

1. Curing and sealing compounds used on interior enclosed environments shall be a water-borne product and VOC compliant as required by the U.S. EPA Architectural Coating Rule.

2.4 MISCELLANEOUS MATERIALS

A. Patching Mortar: Non-shrink, non-slump, non-metallic, quick setting.

1. Acceptable manufacturers and products:

a. Euclid Chemical Company - Eucospeed.
b. Master Builders Solutions - MasterEmaco N 424.
c. Adhesive Technologies. - Hard Rok Vertipatch.
d. W.R. Meadows - Speed Crete (Red Line).
e. Dayton Superior - Re-Crete 20 minute.
f. SpecChem - Precast Patch.

B. Cement Grout: Mix 1 part Portland limestone cement, 2-1/2 to 3 parts fine aggregate, and enough water for required consistency. Depending on use, consistency may range from mortar consistency to a mixture that will flow under its own weight. Do not mix more than the amount that can be used within 30 minutes. Retempering is not permitted. Use for leveling, preparing setting pads, beds, construction joints (with liquid bonding admixture) and similar uses. Do not use for grouting under bearing plates or structural members in place.

C. Dry-Pack: Mix 1 part Portland limestone cement, 2 parts fine aggregate, and enough water to hydrate cement and provide a mixture that can be molded with the hands into a stable ball (a stiff mix). Do not mix more than the amount that can be used within 30 minutes.

D. Expansion Joint Material: Preformed, resilient, non-extruding asphalt-impregnated fiber conforming to ASTM D1751. Thickness of expansion joint material shall be 1/2" unless noted otherwise on the drawings.

E. Vapor Barrier: ASTM E 1745, Class A, not less than 15 mils thick.

1. Acceptable:

a. Stego Industries, LLC - Stego Wrap.
b. W.R. Meadows, Inc. - Perminator.
c. Raven Industries - Vapor Block.
d. Insulation Solutions - Viper VaporCheck II.

F. Bonding Agent: "Weld-Crete" manufactured by the Larsen Products Corporation or "Nitobond Acrylic" manufactured by Fosroc Inc. or approved equivalent.

G. Anti-Bonding Agent: "Thompson's Water Seal" as manufactured by A. E. Thompson, Inc., California or approved equivalent.

2.5 STRENGTH AND PROPERTIES

A. Concrete Mix Designs: Refer to the drawings for specified compressive strength and other performance criteria. Proportion concrete mixes to meet design and performance requirements. The concrete supplier may produce a mix at a lower water-cement ratio to allow for adjustment of slump at the site by adding water. The addition of site water shall be in accordance with ASTM C94.

B. Slump of Super-plasticized Concrete: Concrete containing high-range water reducing admixtures (superplasticizer) shall have 8" maximum slump, unless otherwise approved by Structural Engineer.

C. Accelerators: Add non-chloride accelerator to all concrete slabs placed at air temperatures below 50F only when approved in the mix design. Use of admixtures will not relax cold weather placement requirements.

D. Water Reducer: Add water reducing admixture or high range water reducing admixtures (superplasticizers) as follows:

1. All pumped concrete.
2. Fiber reinforced concrete.
3. As required for placement or workability.
4. As required by high temperatures, low humidity, or other adverse placement conditions.
5. Concrete with water-cementitious materials ratio below 0.50.

E. No other admixtures shall be used unless approved by Structural Engineer.

F. Chlorides: Admixtures or other ingredients including aggregates containing calcium chloride or more than 0.05% chloride ions by weight shall not be used.

G. Workability: Concrete shall have a workability such that it will fill the forms without voids, honeycombs, or rock pockets with proper vibration without permitting materials to separate or excess water to collect on the surface.

H. Concrete Temperatures: Minimum concrete temperature of fresh concrete varies in relation to average air temperature over a 24-hour period as follows:

1. Air temperature below 0F — Concrete temperature 70F min.
2. Air temperature 0F to 30F — Concrete temperature 65F min.
3. Air temperature 30F to 50F — Concrete temperature 50F min.
4. Air temperature above 50F — No minimum temperature
5. The maximum temperature of concrete at the time of delivery shall be 95F. When concrete temperature exceeds 95F, concrete supplier shall attempt to reduce temperature by shading aggregates and cement and cooling mix water. When these methods fail to reduce the concrete temperature below 95F, supplier shall use ice in the water to reduce the concrete temperature. Use set retarding admixtures only when approved in the mix design.

PART 3 - EXECUTION

3.1 PREPARATION

A. Verify requirements for concrete cover over reinforcement.

B. Verify anchors, seats, plates, reinforcement, and other items to be cast into concrete are accurately placed, positioned securely, and will not cause hardship in placing concrete.

C. Do not place concrete until data on materials and mix designs have been approved, Architect has been notified, and all other affected trades have coordinated their work.

D. Remove snow, ice, frost, water, mud, and other foreign material from surfaces, reinforcing bars and embedded items against which concrete will be placed.

E. Prepare previously placed concrete by cleaning with sandblasting, steel brush, or water blast to expose aggregate to minimum 1/4" amplitude.

F. Sandblast all existing concrete surfaces older than 28 days against which concrete is to be placed, unless directed otherwise in writing by Architect/Engineer.

3.2 SLABS

A. Slab on Grade:

1. All interior slabs on grade shall have a polyethylene vapor retarder conforming to ASTM E1745. Lap all joints minimum 6" and seal edges with adhesive tape. Fit vapor retarder around utilities and seal with adhesive tape as required. Place, protect, and repair vapor-retarder sheets according to ASTM E 1643 and manufacturer's written instructions.
2. Refer to drawings and Section 31 23 00 for required sub-grade preparation beneath slabs on grade.
3. Where vapor retarder is not used below the slab on grade, wet sub-grade below slab prior to placing concrete. Subgrade shall be moist with no free water and no muddy or soft spots.
4. Saw cut control joints: Cut with power saws equipped with shatterproof abrasive or diamond-rimmed blades. Cut joints into concrete when cutting action will not tear, abrade, or otherwise damage surface and before concrete develops random contraction cracks. Control joints shall be located along column lines, with intermediate joints spaced at a maximum distance indicated on the drawings, unless noted otherwise. Control joints shall be continuous, not staggered or offset. Slab panels shall have a maximum length to width ratio of 1.5 to 1. Provide additional control joints at all reentrant or isolated corners formed in the slab on grade. Refer to the drawings for typical control joint detailing.
5. Provide isolation joints[around each column,][against grade beams,][and][along foundation walls]. Form isolation joints with 1/2" expansion joint material. Extend isolation joint material full width and depth of joint, terminating flush with finished concrete surface, unless otherwise indicated.
6. Depress slabs as required for mats, architectural finishes, pits, and kitchen equipment. Obtain layout and locations from Architect.
7. Verify completion of all under slab work with mechanical and electrical trades before placing slabs.
8. Slope slabs as indicated on the drawings and to provide positive drainage. Slope slab keeping bottom level and varying top. Maintain minimum thickness of concrete as indicated on the drawings. Refer to floor finishes for tolerances.

B. Embedded Items:

1. The outside diameter of embedded conduit or pipe shall not exceed one-third of the slab thickness in structural slabs, including at crossovers, and shall be placed between the top and bottom reinforcing with a minimum 3" clear cover. Conduit or pipe running parallel to each other shall be spaced at least 8" apart and no more than 2 runs stacked vertically in the slab. Conduit or pipe shall not be embedded in any supported slab less than 6" thick. No embedded conduit or pipe is allowed in any concrete slab-on-steel deck.

3.3 CONSTRUCTION JOINTS

A. Vertical: Locate vertical construction joints in walls not farther than a maximum of 100 feet on center. Coordinate joint locations with architectural design.

B. Reinforcing: Stop all welded wire reinforcement and/or reinforcing at construction joints in slabs on grade and provide dowel bars as detailed. Provide reinforcement at other construction joints as detailed. Roughen and thoroughly clean the surface of the concrete, remove all laitance, and wet the surface before placing new concrete against the joint.

3.4 CONCRETE PLACEMENT

A. Place concrete as continuously as possible until placement is complete. Do not place against concrete that has attained initial set, except at authorized joints. If, for any reason, concrete pour is delayed for more than 45 minutes, bulkhead off pour at last acceptable construction joint. Immediately remove excess concrete and clean forms.

B. Do not begin to place concrete during periods of rain, sleet, or snow unless adequate protection is provided.

C. No concrete shall be cast onto or against sub-grades containing free water, frost, ice, or snow. If earth at bottom of forms has dried out, rewet so the soil is moist, but free of standing water and mud.

D. Notify the Architect in advance if concrete is to be pumped.

E. Do not place concrete until all reinforcement is in place, forms have been thoroughly cleaned and approval has been given.

F. Do not accept concrete delivered to the job site more than 90 minutes after initial mixing.

G. Concrete from its point of release to mixers, hoppers, or conveyances, shall not be permitted to drop more than 5 feet (10 feet for concrete containing high-range water reducers). Deposit concrete directly into conveyances and directly from conveyances to final points of deposit. Sufficient transportation equipment in good working order shall be on hand before work begins. All conveying equipment must be clean and kept clean during concreting operations. Take every possible precaution to prevent segregation or loss of ingredients.

H. Regulate rate of placement so concrete surface is kept level throughout; a minimum being permitted to flow from one area to another. Use tremie heads spaced at approximately 10-foot intervals for placing concrete in walls. Control rate of placement consistent with form design.

I. Deposit concrete in one continuous operation until section being placed has been completed. For slab thicknesses greater than 12 inches, prevent excessive segregation of aggregate and high temperatures in accordance with ACI 304 and ACI 308. Place concrete in wall forms in layers not greater than 12 inches in depth, each layer being compacted by internal vibration before succeeding layer is placed.

J. Place concrete as near as possible to its final position to prevent segregation or loss of materials. Do not use vibrators to transport concrete within forms. Consolidate concrete in walls, columns, beams, and slabs or joist construction thicker than 8" with internal vibrators (8,000 to 12,000 VPM). Slabs less than 8" thick may be consolidated with internal vibrators (9,000 to 13,500 VPM) or vibrating screeds supported on forms, boards, or rails, approved by the Structural Engineer, supplement vibration by forking or spading by hand along surfaces adjacent to forms and construction joints. Be sure an adequate number of operating vibrator units are on hand to properly consolidate quantity of concrete to be placed, including spares for emergency use.

1. Vertically insert and remove handheld vibrators at constant intervals 18 to 30 inches apart. Vibrate concrete the maximum amount and time required for complete consolidation, without segregation, and release of entrapped air bubbles, but in no instance exceed 15 seconds per square foot of exposed surface.

K. Re-tempering of concrete shall not be permitted. Concrete that has stood more than 15 minutes after leaving the mixer shall be discarded.

L. Exercise care in placing concrete over waterproof membranes, rigid insulation, and/or protection boards to avoid damaging those materials. Report damage immediately, and do not proceed until damage is repaired.

M. Remove loose debris from hardened surfaces of previous pours by sandblasting surfaces and expose clean coarse aggregate firmly embedded in cement matrix.

N. Protect existing concrete work to be exposed to view and other finished materials from damage and staining resulting from concreting operations. Handle concrete carefully to avoid dripping and spillage. Remove spilled concrete from existing surfaces immediately. Covering sills, ledges, and other surfaces with protective coverings may be necessary to protect the work.

O. Filling In: Fill in holes and openings left in concrete structures, unless otherwise indicated, after work of other trades is in place. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete Work.

P. Equipment Bases and Foundations: Provide machine and equipment bases and foundations as shown on drawings. Set anchor rods for machines and equipment at correct elevations, complying with diagrams or templates from manufacturer furnishing machines and equipment.

Q. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on the drawings. Screed, tamp, and trowel-finish concrete surfaces.

3.5 CONCRETE FINISHES AND TOLERANCES

A. Exposed Smooth Formed Surfaces: Remove forms and perform necessary repairs and patch to produce surface finish-3.0 as specified in ACI 301. Apply the following to smooth-formed finished concrete exposed to view in the finished work. Confirm finishes with the Architect prior to concrete placement by submitting shop drawings indicating locations of all types of finishes.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces, unless otherwise indicated.

3.6 CONCRETE SLAB FINISHES AND TOLERANCES

A. Trowel Finish:

1. Screed concrete to an even plane, float, then power trowel the surface.
2. Hand trowel the surface smooth and free of trowel marks. Continue hand troweling until a ringing sound is produced as the floor is troweled.
3. Provide trowel finish as indicated on the drawings and at the following locations:

    a. Concrete floors exposed in finished work unless otherwise indicated.
    b. Slabs to receive curing compounds and sealers.
    c. Slabs to receive resilient flooring or carpet.

B. Fine Broom Finish:

1. Screed concrete to an even plane, float, then power trowel the surface. Provide fine hair broom finish perpendicular to slope, free of loose particles, ridges, projections, voids, and concrete droppings.
2. Provide fine broom finish as indicated on the drawings and at the following locations:

    a. Stoop slabs.
    b. Raised curbs and walkway areas.
    c. Slabs to receive thin set ceramic tile.

C. Broom Finish:

1. Screed concrete to an even plane and then float. Immediately after concrete has received a floated finish, give the concrete surface a coarse transverse scored texture by drawing a coarse broom across the surface.
2. Provide as indicated on the drawings and at the following locations:

    a. ADA ramp slabs.
    b. Exterior walkway slabs.

D. Float Finish:

1. Screed concrete to an even plane then float.
2. Provide as indicated on the drawings and at the following locations:

    a. Slabs to directly receive concrete topping.
    b. Roof slabs to receive loose laid roof insulation.

E. Floor Finish Tolerances: Floor finish tolerances shall be measured by placing a freestanding (unleveled) 10-foot straightedge anywhere on the slab and allowing it to rest upon two high spots within 72 hours after placement of slab and removal of shoring (if present). The gap at any point between the straightedge and the floor (and between the high spots) shall not exceed:

1. Slab on Grade (Office, School): 1/4"

F. Slab Drainage: Finish all concrete slabs to proper elevations to ensure that all surface moisture will drain freely to floor drains, and that no puddle areas exist. Contractor shall bear the cost of corrections to provide positive drainage.

G. Special Tolerances for Concrete Slabs: No abrupt change in vertical elevation of 1/4" or more is acceptable at the interface between slabs and within areas where pedestrian traffic is expected.

3.7 CONCRETE CURING

A. Freshly placed concrete shall be protected from premature drying and excessively hot temperatures.

B. Concrete other than high-early strength shall be maintained above 50F and in a moist condition for at least the first 7 days after placement, except when special curing is used. Special curing procedures shall not be used without written permission from the Structural Engineer.

C. Formed surfaces shall be cured by leaving the formwork in place during the curing period.

D. Protect concrete from excessive changes in temperature during the curing period and at the termination of the curing process. Changes in the temperature of the concrete shall be as uniform as possible and shall not exceed 5F in any one hour or 50F in any 24-hour period.

E. Protect concrete from injury from the elements until full strength is developed. Protect from mechanical injury.

F. During cold weather construction, all [footings]<Insert> shall be protected from frost penetration until the building is enclosed and temporary heat is provided.

3.8 SLAB CURING

A. Begin curing after finishing concrete, but not before free water has disappeared from concrete surface. Use one of the methods described below.

B. Moisture-Retaining-Cover Curing for Concrete Floors Not Exposed in Final Condition: Cover concrete surface with waterproof sheet material as soon as finishing operations are complete and the concrete is sufficiently hard to be undamaged by covering. The cover shall be placed flat on the concrete surface, avoiding wrinkles. Sprinkle concrete with water as necessary during application of covering. Place in widest practicable width, with sides and ends lapped at least 12 inches, and seal with waterproof tape or adhesive. Verify the concrete is continuously wet under the sheets; otherwise, add water through soaker hoses under the sheets. Weight down covering to prevent displacement. Immediately repair any holes or tears during the curing period using polyethylene sheet and waterproof tape. Curing process shall be maintained for a minimum of 7 days.

C. Moisture-Retaining-Fabric Curing for Concrete Floors to Remain Exposed: Cover concrete surface with moisture retaining fabric as soon as finishing operations are complete and the concrete is sufficiently hard to be undamaged by covering. The cover shall be installed in accordance with the manufacturer's written recommendations, in largest practical widths. Wet the slab to rejection, then thoroughly wet fabric side of cover and install with poly side up. Lap over adjacent covers a minimum of 18". Wet all laps and outside edges to prevent displacement and to ensure intimate contact with concrete and adjacent covers. Rewet as necessary and protect covers from damage during curing process.

1. After minimum 7-day cure, remove moisture retaining fabric in sections.
2. A maximum of 3,500 square feet of concrete curing cover may be removed at any one time. At no time shall the exposed area be permitted to dry prior to completion of the floor scrubbing process.
3. Using a high-powered floor scrubber capable of a minimum 80 pounds head pressure, and a mild citrus-based detergent that does not damage or mar the surface in any way, scrub the floor to remove any minerals or soluble salts that may have accumulated at the floor surface. Rinse area thoroughly with clean fresh water. Remove water and allow floor to dry. If whitening occurs during drying, repeat scrubbing process before floor dries until no whitening occurs during drying.
4. All areas of the floor shall remain wet during floor scrubbing process. Expose only the amount of floor surface that can be cleaned before any drying occurs without exceeding the maximum allowable exposed area.

D. Curing Compound: Apply uniformly in continuous operation by low pressure spray equipment or roller as soon as finishing operations are complete, free water on the surface has disappeared, and no water sheen can be seen. Follow the manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period. Verify compatibility of the curing compound with paint, finishes, or toppings that require positive bond to the concrete. If curing compound is not compatible with paint finishes or toppings, utilize a dissipating curing compound and remove in accordance with the manufacturer's recommendations.

3.9 APPLICATION OF FLOOR SEALER - FINISH COAT

A. Give concrete floors, as indicated in the Room Finish Schedule and where exposed in finished Work, a second coat of curing and sealing compound immediately prior to Substantial Completion.

B. Clean floors and apply sealer strictly according to manufacturer's instructions. Dilution and coverage shall be as recommended by the manufacturer. Apply sealer evenly.

3.10 COLD WEATHER CONCRETING

A. Definition: Cold weather shall be defined as a period when for more than three successive days the average daily outdoor temperature drops below 40F. The average daily temperature is the average of the highest and lowest temperature during the period from midnight to midnight. When temperatures above 50F occur during more than half of any 24-hour duration, the period shall not be regarded as cold weather.

B. All cast-in-place concrete work occurring during cold weather shall conform to all requirements of ACI 306.1, "Standard Specification for Cold Weather Concreting", published by the American Concrete Institute, Detroit, Michigan, except as modified by the contract documents or this specification.

C. Planning: The General Contractor, concrete contractor, concrete supplier, and Architect shall have a pre-construction conference to outline the cold weather concreting operations concerning the placing, finishing, curing and protection of the concrete during cold weather. Pre-construction conference shall occur before cold weather is expected to occur.

D. Detailed procedure submittal: Concrete contractor shall prepare and submit for review detailed procedures for the production, transportation placement, protection, curing and temperature monitoring of concrete during cold weather. Include procedures to be implemented upon abrupt changes in weather conditions. Do not begin cold weather concreting until these procedures have been reviewed and approved.

E. Mixing: Concrete flatwork poured in cold weather shall be proportioned to obtain a lower slump to minimize the amount of bleed water during finishing. All bleed water should be skimmed off flatwork prior to troweling. Concrete that will be exposed to cycles of freezing and thawing while saturated should be properly air entrained as outlined in this specification.

F. Protection of Concrete: Cure and protect concrete against damage from freezing for a minimum period of 72 hours, unless approved by the Structural Engineer. The protection period may be reduced according to ACI 306.1 requirements. Concrete contractor shall submit a letter of request to reduce the protection period, by outlining the method used to achieve the reduction per ACI 306.1.

1. When practical for the construction schedule, formwork shall be insulated and remain in place for at least the required protection period.

G. Concrete Temperatures: The minimum temperature of concrete immediately after placement shall be as specified in the following table.

			Mixing Temperatures		
Section Size	Minimum temperature of concrete as placed and maintained during the protection period	Maximum gradual decrease in surface temperature during any 24 hours after the end of the protection.	Above 30F	0 to 30F	Below 0F
Less than 12 in	55F	50F	60F	65F	70F
12-36 in	50F	40F	55F	60F	65F
36-72 in	50F	30F	50F	55F	60F
Greater than 72 in	50F	20F	45F	50F	55F

H. Mixing Temperatures: As the ambient air temperature decreases, the concrete mixing temperature shall be increased to compensate for the heat lost in the period between mixing and placement. The concrete supplier shall use one or both of the following methods for increasing the concrete temperature.

1. Heating the mixing water to a temperature necessary to offset the temperature losses during transport. Supplier shall not heat water to temperatures in excess of 140F, without taking special precautions as outlined in ACI 306.
2. Heating the aggregate with a circulated steam piping system.

I. Temperature Measurements: The Contractor shall be responsible for monitoring and recording the concrete temperatures during placement and throughout the protection period.

1. Inspection personnel shall keep a record of the date, time, outside air temperature, temperature of concrete as placed, and weather conditions.
2. Temperature of the concrete and the outside air shall be recorded at regular intervals but not less than twice in a 24-hour period. The record shall include temperatures at several points within the enclosure and on the concrete surface of sufficient frequency to determine a range of temperatures.
3. Inspection agency shall submit the temperature logs to the Architect for permanent job records.

3.11 HOT WEATHER PROTECTION

A. Definition: Hot weather shall be defined as any combination of high ambient temperature, low relative humidity, high winds, and intense solar radiation that leads to higher than usual evaporation. The table below defines low relative humidity based on air temperature. For a given air temperature, if the relative humidity is equal to or less than the specified minimum, provisions for hot weather concreting shall be as follows:

Air Temperature	Minimum Relative Humidity
105F	90%
100F	80%
95F	70%
90F	60%
85F	50%
80F	40%
75F	30%

B. Scheduling: When hot weather is expected, adjust concrete placement schedules to avoid placing or finishing during the period from noon until 3:00 pm. When possible, slab pours should be delayed until the building is enclosed to protect the concrete from wind and direct sunlight. The construction schedule shall account for 7-day moist curing period.

C. Mixing: Concrete supplier shall adjust mix designs and admixtures to minimize slump loss. Concrete shall be mixed at a water-cement ratio, which is lower than the specified maximum, to allow for the adjustment of slump by addition of water in the field. Water reduction shall be accomplished without reducing initial slump by increasing dosage of a water reducing admixture.

D. Preparation: Do not order concrete earlier than is required to avoid delays. Cool forms, subgrades and reinforcing bars with water spray from fog nozzle prior to concrete placement.

E. Delivery: Site traffic shall be coordinated, and delivery times scheduled to minimize waiting times for concrete trucks.

F. Placement: Preparations shall be made to place and consolidate the concrete at the fastest possible rate. Maintain a continuous flow of concrete to the job site to avoid development of cold joints, during placement of slabs, apply fog spray to prevent moisture loss without causing surplus water to stand on concrete surface.

G. Finishing: Finish concrete as fast as practical. Continue fogging concrete during finishing. Where fogging is not possible, apply sprayable moisture-retaining film between finishing passes.

H. Curing: Formed concrete shall be covered with a waterproof material to retain moisture. Flat work shall be moisture cured as described in this specification. Moist curing shall continue for at least 7 days.

3.12 FIELD QUALITY ASSURANCE

A. Independent Testing Agency and Special Inspector shall each perform their prescribed inspection, sampling, and testing services as described in Part 1 of this specification section.

B. In cases where samples have not been taken or tests conducted as specified or strength of laboratory test cylinders for a particular portion of the structure fails to meet requirements of ACI 301, for evaluation of concrete strength, Structural Engineer shall have the right to order compressive or flexural test specimens or both be taken from the hardened concrete according to ASTM C42, load tests according to ACI 318, or such other tests as may be necessary to clearly establish the strength of the in situ concrete, and such tests shall be paid for by the Contractor. Where cores have been cut from the Work, Contractor shall fill voids with dry-pack and patch the finish to match the adjacent existing surfaces.

3.13 REPAIR OF DEFECTIVE AREAS

A. All repair of defective areas shall be made, with prior approval of Architect and Structural Engineer as to method and procedure, in accordance with Section 5 of ACI 301, except specified bonding compound must be used. Cosmetic repairs of minor defects in exposed concrete surfaces shall be in a manner acceptable to the Architect. Defective areas shall be deemed when:

1. Tests on core or prism specimens fail to show specified strengths.
2. Not formed as indicated or detailed.
3. Not plumb or level where so indicated or required to receive subsequent work.
4. Not true to intended grades and levels.
5. Cut, filled, or resurfaced, unless under direction of the Structural Engineer.
6. Debris is embedded therein.
7. Not fully in conformance with provisions of the drawings.
8. Damaged by hot or cold weather conditions.
9. Mixing time exceeds 90 minutes from ready-mix plant to the time of deposit.

B. Patch form tie holes at the following locations:

1. Unfinished exposed concrete (not scheduled for painting, plus at board formed concrete finish).
2. All other areas: Prime voids with bonding compound and fill with patching mortar. Strike flush without overlap, float to uniform texture to match adjacent surfaces.
3. Exposed areas scheduled for spray texture:

    a. Remove projections and protrusions: 1/16" or larger.
    b. Remove continuous ridges 1/32" or larger.
    c. Fill voids and pin holes.

4. Exposed areas scheduled for painting or epoxy:

    a. Remove projections, ridges, and other protrusions 1/32" or larger.
    b. Fill voids and pin holes 1/16" or larger.

5. Exposed areas not scheduled for painting or other finishes:

    a. Remove projections, ridges and other protrusions not conforming to requirements specified under Section 03 10 00.
    b. Fill voids and pin holes not conforming to requirements specified under Section 03 10 00.

C. All structural repairs shall be made, with prior approval of the Architect/Engineer, as to method and procedure, using the specified epoxy adhesive and/or epoxy mortar.

D. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins, and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.

1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
2. Repair defects on surfaces exposed to view by blending white Ordinary Portland cement. Portland limestone cement and standard Ordinary Portland cement. Portland limestone cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

E. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finishing and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.

1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
2. After concrete has cured at least 14 days, correct high areas by grinding.
3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing them with patching mortar. Finish repaired areas to blend into adjacent concrete.
4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mix as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

3.14 CEMENT GROUT AND DRY-PACK

A. Cement Grout: Thoroughly mix sufficient quantities to avoid combining different batches of grout mix. Ensure that grout completely fills all spaces and voids. Level, screed, or cut flush excess grout to produce smooth, neat, even exposed surfaces.

B. Dry-Pack: Thoroughly blend dry ingredients prior to mixing with water. Forcibly pack mixture to completely fill voids and spaces.

3.15 CLEANING

A. Clean exposed concrete to remove laitance, efflorescence and stains.

END OF SECTION

SECTION 03 49 00 - GLASS-FIBER-REINFORCED CONCRETE (GFRC)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass-fiber-reinforced concrete (GFRC) panels without panel frames.

a. GFRC panels include wall units and as indicated on drawings.

1.2 DEFINITIONS

A. Design Reference Sample: Sample of GFRC color, finish, and texture, preapproved by Architect.

B. GFRC Panels: GFRC components, including panel frames, anchors, connections, and integral ribs, as applicable.

1.3 COORDINATION

A. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction without delaying the Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Show fabrication and installation details for GFRC panels including the following:

1. Panel elevations, sections, and dimensions.
2. Thickness of facing mix, GFRC backing, and bonding pads for typical panels.
3. Finishes.
4. Joint and connection details.
5. Panel corner details.
6. Erection details.
7. Panel frame details for typical panels including sizes, spacings, thicknesses, and yield strengths of various members.
8. Locations and details of connection hardware attached to structure.

9. Sizes, locations, and details of flex, gravity, and seismic anchors for typical panels.
10. Other items sprayed into panels.
11. Erection sequence for special conditions.
12. Relationship to adjacent materials.
13. Description of loose, cast-in, and field hardware.

C. Samples for Verification: Actual sample of finished products representative of GFRC finish, color, and texture variations.

1. Size: PLUS - 2500mm x 250mm.
2. Thickness: 13mm

D. Delegated Design Submittals: For GFRC panels, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.6 INFORMATIONAL SUBMITTALS

A. Certificates:

B. Source Quality-Control Submittals:

1. Source Quality-Control Programs: For GFRC manufacturer.

C. Field Quality-Control Submittals:

1. Field quality-control reports.

D. Qualification Statements: For GFRC manufacturer.

E. Delegated Design Engineer Qualifications: Include the following:

1. Experience providing delegated design engineering services of the type indicated.
2. Documentation that delegated design engineer is licensed in state where Project is located.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturers: Designated a PCI-certified plant for Group G - Glass Fiber Reinforced Concrete, and who employs on Project experienced PCI-certified GFRC testing and inspection personnel, or designated an APA-certified plant for GFRC production.
2. Delegated Design Engineer: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.

1.8 MOCKUPS

A. Sample Panels: After sample approval and before fabricating GFRC units, produce a minimum of two sample panels approximately 16 sq. ft. in area for review by Architect to verify selections made under Sample submittals. Incorporate full-scale details of architectural features, finishes, textures, and transitions in sample panels.

1. Locate panels where indicated or, if not indicated, as directed by Architect.

B. Range Samples: After sample panel approval and before fabricating GFRC units, produce a minimum of three sets of range samples, approximately 16 sq. ft. in area, representing anticipated range of each color and texture on Project's units. Maintain one set of range samples at Project site and remaining range sample sets at manufacturer's plant as color and texture approval reference.

C. Build mockups to demonstrate aesthetic effects and to set quality standards for fabrication and installation.

1. Build mockup .

a. Include typical components, attachments to building structure, and methods of installation.
b. Include window opening with GFRC returns.
c. Include sealant-filled joint complying with requirements in Section 07 92 00 "Joint Sealants."

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Handle and transport GFRC panels supported on nonstaining material and with nonstaining resilient spacers between panels.

B. Store GFRC panels off of ground on firm, level, and smooth surfaces supported on nonstaining material and with nonstaining resilient spacers between panels. Place stored panels so identification marks are clearly visible.

1.10 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace components of GFRC panels that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including cracking.

b. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. GFRC Panels:

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Rieder: Oko Skin with Hidden Fix fastening system.

2.2 SOURCE LIMITATIONS

A. Obtain GFRC panels from single manufacturer.

2.3 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design GFRC panels.

B. Structural Performance: GFRC panels to withstand the following design loads as well as the effects of thermal- and moisture-induced dimensional changes within limits and under conditions indicated:

1. Loads: As indicated on Drawings.
2. Deflection Limits: Design panel frames to withstand design loads without lateral deflections greater than L/240 of wall span.
3. Thermal Movements: Provide for thermal movements resulting from annual ambient temperature changes of 80 deg F .
4. Design panel frames and connections to accommodate deflections and other building movements.
5. Design panel frames to transfer window loads to building structure.

C. Quality-Control Standard: Comply with requirements and recommendations in PCI MNL 130, "Manual for Quality Control for Plants and Production of Glass Fiber Reinforced Concrete Products," unless more stringent requirements are indicated.

D. AISI Specifications: Comply with AISI S100, "North American Specification for the Design of Cold-Formed Steel Structural Members."

E. AISC Specifications: Comply with AISC 360, "Specification for Structural Steel Buildings."

2.4 MOLD MATERIALS

A. Molds: Rigid, dimensionally stable, non-absorptive material, warp and buckle free, that provides continuous GFRC surfaces within tolerances; nonreactive with GFRC and capable of producing required finish surfaces.

1. Mold-Release Agent: Commercially produced liquid-release agent that does not bond with, stain, or adversely affect GFRC surfaces and does not impair subsequent surface or joint treatments of GFRC.

B. Form Liners: Units of face design, texture, arrangement, and configuration to match GFRC design reference sample. Provide solid backing and form supports to ensure that form liners remain in place during GFRC application. Use with manufacturer's recommended liquid-release agent that does not bond with, stain, or adversely affect GFRC surfaces and does not impair subsequent surface or joint treatments of GFRC.

C. Surface Retarder: Chemical liquid-set retarder capable of temporarily delaying hardening of newly placed GFRC face mix to depth of reveal specified.

2.5 GFRC MATERIALS

A. Obtain each GFRC material of same type, brand, and color from single source or producer.

B. Portland Cement: ASTM C150/C150M; Type I, or III.

1. For surfaces exposed to view in finished structure, use [gray] [white] cement.

C. Metakaolin: ASTM C618, Class N.

D. Glass Fibers: Alkali resistant, with a minimum zirconia content of 16 percent, 1 to 2 inches long, specifically produced for use in GFRC, and complying with ASTM C1666/C1666M.

E. Backing Sand: Washed and dried silica, complying with composition requirements in ASTM C144; passing a No. 20 sieve with a maximum of 2 percent passing a No. 100 sieve.

F. Facing Aggregate: ASTM C33/C33M, except for gradation, and PCI MNL 130, 1/4-inch maximum size.

1. Aggregates: Selected, hard, and durable; free of material that reacts with cement or causes staining; to match sample.
2. Fine Aggregate: Natural or manufactured sand with a maximum of 5 percent passing a No. 100 sieve and a maximum of 3 percent passing a No. 200 sieve.

G. Coloring Admixture: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures, temperature stable, nonfading, and alkali resistant.

H. Water: Potable; free from deleterious material that may affect color stability, setting, or strength of GFRC and complying with ASTM C1602/C1602M and chemical limits in PCI MNL 130 for nonpotable mixing water.

I. Polymer-Curing Admixture: Acrylic thermoplastic copolymer dispersion complying with PCI MNL 130.

J. Air-Entraining Admixture: ASTM C260/C260M, containing not more than 0.1 percent chloride ions.

K. Chemical Admixtures: ASTM C494/C494M, containing not more than 0.1 percent chloride ions.

2.6 ANCHORS, CONNECTORS, AND MISCELLANEOUS MATERIALS

A. Stainless Steel Plates: ASTM A666, Type 304, Type 316, or Type 201.

B. Stainless Steel Bars and Shapes: ASTM A276/A276M, Type 304.

C. High-Strength Bolts, Nuts, and Washers: ASTM F3125/F3125M, Grade A325, Type 1, heavy-hex steel structural bolts; ASTM A563, Grade DH heavy-hex carbon-steel nuts; and ASTM F436/F436M, Type 1, hardened carbon-steel washers, finished as follows:

1. Finish: Zinc coated by hot-dip process in accordance with ASTM A 123/A 123M, after fabrication, and ASTM A 153/A 153M, as applicable.

D. Welding Electrodes: Comply with AWS standards.

E. Galvanizing Repair Paint: ASTM A 780/A 780M.

2.7 GFRC MIXES

A. Mist Coat: Slurry of portland cement, sand, water, and admixtures; of same proportions as backing mix without glass fibers.

B. Air Content: 3 to 7-1/2 percent; ASTM C185.

2.8 MOLD FABRICATION

A. Construct molds that result in finished GFRC complying with profiles, dimensions, and tolerances indicated, without damaging GFRC during stripping. Construct molds to prevent water leakage and loss of cement paste.

1. Coat contact surfaces of molds with form-release agent.
2. Coat contact surfaces of molds with surface retarder.

B. Place form liners accurately to provide finished surface texture indicated. Provide solid backing and supports to maintain stability of liners during GFRC application. Coat form liner with form-release agent.

2.9 GFRC FABRICATION

A. Proportioning and Mixing: For backing mix, meter sand/cement slurry and glass fibers to spray head at rates to achieve design mix proportions and glass-fiber content in accordance with PCI MNL 130 procedures.

B. Spray Application: Comply with spray-up method procedures in accordance with PCI MNL 130.

C. Hand form and consolidate intricate details, incorporate formers or infill materials, and overspray before material reaches initial set to ensure complete bonding.

D. Attach panel frame to GFRC before initial set of GFRC backing, maintaining a minimum clearance of 1/2 inch from GFRC backing, and without anchors protruding into GFRC backing.

E. Build up homogeneous GFRC bonding pads over anchor feet, maintaining a minimum thickness of 1/2 inch over tops of anchor feet, before initial set of GFRC backing. Measure bonding pad thickness at 25 percent of anchor locations.

F. Integral Ribs: Build up homogeneous GFRC integral ribs over expanded polystyrene or polyurethane foam rib formers to comply with design requirements.

G. Inserts and Embedments: Build up homogeneous GFRC bosses or bonding pads over inserts and embedments to provide enough anchorage and embedment to comply with design requirements.

H. Curing: Employ initial curing method that ensures sufficient strength for removing units from mold. Comply with PCI MNL 130 procedures.

1. Keep moisture off the surfaces of mixes with polymer curing admixtures during the first three hours of curing. Maintain temperature between 60 and 120 deg F during the first 16 hours.
2. Prevent drying of moist curing mixes during the first 24 hours. Maintain units in surface-damp condition at a temperature above 60 deg F and 95 percent relative humidity for seven days.

I. Panel Identification: Mark each GFRC panel to correspond with identification mark on Shop Drawings. Mark each panel with its casting date.

2.10 FABRICATION TOLERANCES

A. Manufacturing Tolerances: Manufacture GFRC panels so each finished unit complies with the following dimensional tolerances:

1. Overall Height and Width of Units, Measured at the Face Adjacent to Mold:

a. 10 ft. or less, plus or minus 1/8 inch.
b. More than 10 ft., plus or minus 1/8 inch per 10 ft.; 1/4 inch maximum.

2. Edge Return: Plus 1/2 inch, minus 0 inch.
3. Architectural Facing Thickness: Plus 1/8 inch, minus 0 inch.
4. Backing Thickness: Plus 1/4 inch, minus 0 inch.
5. Panel Depth from Face of Skin to Back of Panel Frame or Integral Rib: Plus 3/8 inch, minus 1/4 inch.
6. Angular Variation of Plane of Side Mold: Plus or minus 1/32 inch per 3 inches of depth, or plus or minus 1/16 inch total, whichever is greater.
7. Variation from Square or Designated Skew (Difference in Length of Two Diagonal Measurements): Plus or minus 1/8 inch per 72 inches or 1/4 inch total, whichever is greater.
8. Local Smoothness: 1/4 inch per 10 ft..
9. Bowing: Not to exceed L/240 unless panel complies with erection tolerances using connection adjustments.
10. Length and Width of Block Outs and Openings within One Panel: Plus or minus 1/4 inch.
11. Location of Window Opening within Panel: Plus or minus 1/4 inch.
12. Maximum Permissible Warpage of One Corner out of the Plane of the Other Three: 1/16 inch per 12 inches of distance from nearest adjacent corner, unless panel complies with erection tolerances using connection adjustments.

B. Position Tolerances: Measured from datum line locations, as indicated on Shop Drawings.

1. Panel Frame and Track: Plus or minus 1/4 inch.
2. Inserts: Plus or minus 1/2 inch.
3. Special Handling Devices: Plus or minus 3 inches.
4. Location of Bearing Devices: Plus or minus 1/4 inch.
5. Block Outs: Plus or minus 3/8 inch.

C. Panel Frame Tolerances: As follows:

1. Vertical and Horizontal Alignment: 1/4 inch per 10 ft..
2. Spacing of Framing Member: Plus or minus 3/8 inch.
3. Squareness of Frame: Difference in length of diagonals of 3/8 inch.
4. Overall Size of Frame: Plus or minus 3/8 inch.

2.11 FINISHES

A. Exposed faces to be free of joint marks, grain, and other obvious defects. Corners, including false joints, to be uniform, straight, and sharp.

B. Finish exposed-face surfaces of GFRC to match approved design reference sample and as follows:

1. Color: Off-White

2. Texture: FL Ferro Light as indicated on drawings.

2.12 SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to evaluate GFRC fabricator's quality-control and testing methods.

1. Allow testing agency access to material storage areas, concrete production equipment, concrete placement, and curing facilities. Cooperate with testing agency and provide samples of materials and GFRC mixes as may be requested for additional testing and evaluation.

B. Quality-Control Testing: Establish and maintain a quality-control program for manufacturing GFRC panels in accordance with PCI MNL 130.

1. Test materials and inspect production techniques.
2. Quality-control program monitors glass-fiber content, spray rate, unit weight, product physical properties, anchor pull-off and shear strength, and curing period and conditions.
3. Prepare test specimens and test in accordance with ASTM C1228 and PCI MNL 130procedures.
4. Test GFRC inserts and anchors in accordance with ASTM C1230 to validate design values.
5. Produce test boards at a rate of no fewer than one per work shift per operator for each spray machine and for each mix design.

a. For each test board, determine glass-fiber content in accordance with ASTM C1229 and flexural yield and ultimate strength in accordance with ASTM C947.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine structure and conditions for compliance with requirements for installation tolerances, bearing surfaces, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Install clips, hangers, and other accessories required for connecting GFRC panels to supporting members and backup materials.

B. Install GFRC panels level, plumb, square, and in alignment. Provide temporary supports and bracing as required to maintain position, stability, and alignment of panels until permanent connections are completed.

1. Maintain horizontal and vertical joint alignment and uniform joint width.
2. Remove projecting hoisting devices.

C. Connect GFRC panels in position by bolting or welding, or both, as indicated on Shop Drawings. Remove temporary shims, wedges, and spacers as soon as possible after connecting is completed.

D. Welding: Comply with applicable AWS D1.1/D1.1M and AWS D1.3/D1.3M requirements for welding, appearance, quality of welds, and methods used in correcting welding work.

1. Protect GFRC panels from damage by field welding or cutting operations, and provide noncombustible shields as required.

E. At bolted connections, use lock washers or other acceptable means to prevent loosening of nuts.

3.3 ERECTION TOLERANCES

A. Erect GFRC panels to comply with the following noncumulative tolerances. For erection tolerances not listed below, comply with PCI MNL 130.

1. Plan Location from Building Grid Datum: Plus or minus 1/2 inch.
2. Top Elevation from Nominal Top Elevation:

    a. Exposed Individual Panel: Plus or minus 1/4 inch.
    b. Nonexposed Individual Panel: Plus or minus 1/2 inch.
    c. Exposed Panel Relative to Adjacent Panel: 1/4 inch.
    d. Nonexposed Panel Relative to Adjacent Panel: 1/2 inch.

3. Support Elevation from Nominal Elevation:

    a. Maximum Low: 1/2 inch.
    b. Maximum High: 1/4 inch.

4. Maximum Plumb Variation over the Lesser of Height of Structure or 100 Ft.: 1 inch.
5. Plumb in Any 10 Ft. of Element Height: 1/4 inch.
6. Maximum Offset in Alignment of Matching Edges: 1/4 inch.
7. Face Width of Joint (Governs over Joint Taper):

    a. Panel Dimension 20 Ft. or Less: Plus or minus 1/4 inch.
    b. Panel Dimension More Than 20 Ft.: Plus or minus 3/8 inch.

8. Maximum Joint Taper: 3/8 inch.
9. Maximum Joint Taper in 10 Ft.: 1/4 inch.
10. Maximum Offset in Alignment of Matching Faces: 1/4 inch.
11. Differential Bowing, as Erected, between Adjacent Members of Same Design: 1/4 inch.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections and prepare test reports.

B. Visually inspect field welds and test in accordance with ASTM E165/E165M or with ASTM E709 and ASTM E1444/E1444M. High-strength bolted connections are subject to inspections.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Repair or remove and replace work where tests and inspections indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, to be performed to determine compliance of replaced or additional work with specified requirements.

3.5 REPAIRS

A. Repairs are permitted provided structural adequacy of GFRC panel and appearance are not impaired, as approved by Architect.

B. Mix patching materials and repair GFRC so cured patches blend with color, texture, and uniformity of adjacent exposed surfaces.

C. Prepare and repair accessible damaged galvanized coatings with galvanizing repair paint in accordance with ASTM A780/A780M.

D. Wire brush and clean accessible weld areas on prime-painted components and paint with same type of shop primer.

E. Remove and replace damaged GFRC panels when repairs do not comply with requirements.

3.6 CLEANING AND PROTECTION

A. Perform cleaning procedures, if necessary, in accordance with GFRC manufacturer's written instructions. Clean soiled GFRC surfaces with detergent and water, using soft fiber brushes and sponges, and rinse with clean water. Prevent damage to GFRC surfaces and staining of adjacent materials.

END OF SECTION 03 49 00

SECTION 04 72 00 - CAST STONE MASONRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Trim units.
2. Decorative elements.
3. Mortar materials.
4. Accessories.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. For cast stone units, include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for cast stone units. Include dimensions, details of reinforcement and anchorages if any, and indication of finished faces.

1. Include building elevations showing layout of units and locations of joints and anchors.

C. Samples for Initial Selection: For colored mortar.

D. Samples for Verification:

1. For each color and texture of cast stone required, 4 inches square in size.
2. For each trim shape required, 4 inches in length.
3. For colored mortar, make Samples using same sand and mortar ingredients to be used on Project. Label Samples to indicate types and amounts of pigments used.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer of cast stone units similar to those indicated for this Project, that has sufficient production capacity to manufacture required units, and is a plant certified by CSI.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Coordinate delivery of cast stone with unit masonry work to avoid delaying the Work and to minimize the need for on-site storage.

B. Pack, handle, and ship cast stone units in suitable packs or pallets.

1. Lift with wide-belt slings; do not use wire rope or ropes that might cause staining. Move cast stone units if required, using dollies with wood supports.
2. Store cast stone units on wood skids or pallets with nonstaining, waterproof covers, securely tied. Arrange to distribute weight evenly and to prevent damage to units. Ventilate under covers to prevent condensation.

C. Store cementitious materials on elevated platforms, under cover, and in a dry location. Do not use cementitious materials that have become damp.

D. Store mortar aggregates where grading and other required characteristics can be maintained and contamination can be avoided.

1.6 PROJECT CONDITIONS

A. Cold-Weather Requirements: Do not use frozen materials or materials mixed or coated with ice or frost. Do not build on frozen substrates. Comply with cold-weather construction requirements in TMS 602.

1. Cold-Weather Cleaning: Use liquid cleaning methods only when air temperature is 40 deg F and above and will remain so until cast stone has dried, but no fewer than seven days after completing cleaning.

B. Hot-Weather Requirements: Comply with hot-weather construction requirements in TMS 602.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Cast Stone: Obtain cast stone units from single source from single manufacturer.

B. Source Limitations for Mortar Materials: Obtain mortar ingredients of a uniform quality, including color, from one manufacturer for each cementitious component and from one source or producer for each aggregate.

2.2 CAST STONE MATERIALS

A. General: Comply with ASTM C1364.

B. Color Pigment: ASTM C979/C979M, synthetic mineral-oxide pigments or colored water-reducing admixtures; color stable, free of carbon black, nonfading, and resistant to lime and other alkalis.

C. Admixtures: Use only admixtures specified or approved in writing by Architect.

1. Do not use admixtures that contain more than 0.1 percent water-soluble chloride ions by mass of cementitious materials. Do not use admixtures containing calcium chloride.
2. Use only admixtures that are certified by manufacturer to be compatible with cement and other admixtures used.
3. Air-Entraining Admixture: ASTM C260/C260M.[Add to mixes for units exposed to the exterior at manufacturer's prescribed rate to result in an air content of 4 to 6 percent, except do not add to zero-slump concrete mixes.]

D. Reinforcement:

1. Deformed steel bars complying with ASTM A615/A615M, Grade 40. Use galvanized or epoxy-coated reinforcement when covered with less than 1-1/2 inches of cast stone material.

E. Embedded Anchors and Other Inserts: Fabricated from stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666, Type 304.

2.3 CAST STONE UNITS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Arriscraft - Basis of Design: Nutmeg Renaissance.
2. Reading Rock

B. Cast Stone Units: Comply with ASTM C1364.

1. Units are manufactured using the manufacturer's selected method.
2. Trim units including wall caps.
3. Decorative elements including items as indicated on Drawings.

C. Fabricate units with sharp arris and accurately reproduced details, with indicated texture on all exposed surfaces unless otherwise indicated.

1. Slope exposed horizontal surfaces 1:12 to drain unless otherwise indicated.
2. Provide drips on projecting elements unless otherwise indicated.

D. Fabrication Tolerances:

1. Variation in Cross Section: Do not vary from indicated dimensions by more than 1/8 inch.
2. Variation in Length: Do not vary from indicated dimensions by more than 1/360 of the length of unit or 1/8 inch, whichever is greater, but in no case by more than 1/4 inch.

3. Warp, Bow, and Twist: Not to exceed 1/360 of the length of unit or 1/8 inch, whichever is greater.
4. Location of Grooves, False Joints, Holes, Anchorages, and Similar Features: Do not vary from indicated position by more than 1/8 inch on formed surfaces of units and 3/8 inch on unformed surfaces.

E. Cure Units as Follows:

1. Cure units in enclosed, moist curing room at 95 percent relative humidity and temperature of 100 deg F for 12 hours or 70 deg F for 16 hours.
2. Keep units damp and continue curing to comply with one of the following:

a. No fewer than five days at mean daily temperature of 70 deg F or above.
b. No fewer than seven days at mean daily temperature of 50 deg F or above.

F. Colors and Textures: Match Architect's samples. Custom sizes and shapes to match existing existing stones.

2.4 MORTAR MATERIALS

A. Colored Cement Products: Packaged blend made from masonry cement and mortar pigments, all complying with specified requirements, and containing no other ingredients.

1. Colored Masonry Cement:

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) Cemex S.A.B. de C.V.
2) Holcim (US) Inc.
3) Lafarge North America Inc.
4) Lehigh Hanson; HeidelbergCement Group.

2. Formulate blend as required to produce color indicated or, if not indicated, as selected from manufacturer's standard colors.

B. Aggregate for Mortar: ASTM C144.

1. For mortar that is exposed to view, use washed aggregate consisting of natural sand or crushed stone.
2. For joints less than 1/4 inch thick, use aggregate graded with 100 percent passing the No. 16 sieve.
3. White-Mortar Aggregates: Natural white sand or crushed white stone.
4. Colored Aggregates: Natural sand or crushed stone of color necessary to produce required mortar color.

C. Water: Potable.

2.5 ACCESSORIES

A. Anchors: Type and size indicated, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666.

B. Dowels: 1/2-inch- diameter round bars, fabricated from Type 304 stainless steel complying with ASTM A240/A240M, ASTM A276/A276M, or ASTM A666 .

C. Proprietary Acidic Cleaner: Manufacturer's standard-strength cleaner designed for removing mortar/grout stains, efflorescence, and other new construction stains from new masonry without discoloring or damaging masonry surfaces. Use product expressly approved for intended use by cast stone manufacturer and expressly approved by cleaner manufacturer for use on cast stone and adjacent masonry materials.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Diedrich Technologies, Inc.; a Hohmann & Barnard company.
    b. EaCo Chem, Inc.
    c. PROSOCO, Inc.

2.6 MORTAR MIXES

A. Do not use admixtures including pigments, air-entraining agents, accelerators, retarders, water-repellent agents, antifreeze compounds, or other admixtures unless otherwise indicated.

1. Do not use calcium chloride in mortar or grout.
2. Use masonry cement mortar unless otherwise indicated.

B. Preblended dry mortar mix complying with ASTM C1714/C1714M and capable of producing mortar strength as indicated in ASTM C270.

1. For setting mortar, use Type N.
2. For pointing mortar, use Type N.

C. Pigmented Mortar: Use colored cement product[or select and proportion pigments with other ingredients to produce color required. Do not add pigments to colored cement products].

1. Pigments do not exceed 10 percent of portland cement by weight.
2. Pigments do not exceed 5 percent of masonry cement by weight.
3. Mix to match Architect's sample.
4. Application: Use pigmented mortar for exposed mortar joints.

D. Colored-Aggregate Mortar: Produce required mortar color by using colored aggregates and natural color or white cement as necessary to produce required mortar color.

1. Mix to match Architect's sample.
2. Application: Use colored-aggregate mortar for exposed mortar joints.

2.7 SOURCE QUALITY CONTROL

A. Engage a qualified independent testing agency to sample and test cast stone units according to ASTM C1364.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 SETTING CAST STONE IN MORTAR

A. Set cast stone as indicated in TMS 604.

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Coordinate installation of cast stone with installation of flashing specified in other Sections.

C. Wet joint surfaces thoroughly before applying mortar or setting in mortar.

D. Set units in full bed of mortar with full head joints unless otherwise indicated.

1. Set units with joints 3/8 to 1/2 inch wide unless otherwise indicated.
2. Build anchors and ties into mortar joints as units are set.
3. Fill dowel holes and anchor slots with mortar.
4. Fill collar joints solid as units are set.
5. Build concealed flashing into mortar joints as units are set.
6. Keep head joints in copings and between other units with exposed horizontal surfaces open to receive sealant.
7. Keep joints at shelf angles open to receive sealant.

E. Rake out joints for pointing with mortar to depths of not less than 3/4 inch. Rake joints to uniform depths with square bottoms and clean sides. Scrub faces of units to remove excess mortar as joints are raked.

F. Point mortar joints by placing and compacting mortar in layers not greater than 3/8 inch. Compact each layer thoroughly and allow it to become thumbprint hard before applying next layer.

G. Tool exposed joints slightly concave when thumbprint hard. Use a smooth plastic jointer larger than joint thickness.

H. Rake out joints for pointing with sealant to depths of not less than 3/4 inch. Scrub faces of units to remove excess mortar as joints are raked.

I. Point joints with sealant to comply with applicable requirements in Section 07 92 00 "Joint Sealants."

1. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

J. Provide sealant joints at head joints of copings and other horizontal surfaces; at expansion, control, and pressure-relieving joints; and at locations indicated.

1. Keep joints free of mortar and other rigid materials.
2. Build in compressible foam-plastic joint fillers where indicated.
3. Form joint of width indicated, but not less than 3/8 inch.
4. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.
5. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 92 00 "Joint Sealants."

3.3 SETTING ANCHORED CAST STONE WITH SEALANT-FILLED JOINTS

A. Set cast stone as indicated in TMS 604.

B. Set cast stone as indicated on Drawings. Set units accurately in locations indicated, with edges and faces aligned according to established relationships and indicated tolerances.

1. Install anchors, supports, fasteners, and other attachments indicated or necessary to secure units in place.
2. Shim and adjust anchors, supports, and accessories to set cast stone in locations indicated with uniform joints.

C. Keep cavities open where unfilled space is indicated between back of cast stone units and backup wall; do not fill cavities with mortar or grout.

D. Fill anchor holes with sealant.

1. Where dowel holes occur at pressure-relieving joints, provide compressible material at ends of dowels.

E. Set cast stone supported on clip or continuous angles on resilient setting shims. Use material of thickness required to maintain uniform joint widths. Hold shims back from face of cast stone a distance at least equal to width of joint.

F. Keep joints free of mortar and other rigid materials. Remove temporary shims and spacers from joints after anchors and supports are secured in place and cast stone units are anchored. Do not begin sealant installation until temporary shims and spacers are removed.

1. Form open joint of width indicated, but not less than 3/8 inch.

G. Prime cast stone surfaces to receive sealant and install compressible backer rod in joints before applying sealant unless otherwise indicated.

H. Prepare and apply sealant of type and at locations indicated to comply with applicable requirements in Section 07 92 00 "Joint Sealants."

3.4 INSTALLATION TOLERANCES

A. Variation from Plumb: Do not exceed 1/8 inch in 10 ft., , or 1/2 inch maximum.

B. Variation from Level: Do not exceed , , or 1/2 inch maximum.

C. Variation in Joint Width: Do not vary joint thickness more than 1/8 inch in 36 inches or one-fourth of nominal joint width, whichever is less.

D. Variation in Plane between Adjacent Surfaces (Lipping): Do not vary from flush alignment with adjacent units or adjacent surfaces indicated to be flush with units by more than 1/16 inch, except where variation is due to warpage of units within tolerances specified.

3.5 ADJUSTING AND CLEANING

A. Remove and replace stained and otherwise damaged units and units not matching approved Samples. Cast stone may be repaired if methods and results are approved by Architect.

B. Replace units in a manner that results in cast stone matching approved Samples, complying with other requirements, and showing no evidence of replacement.

C. In-Progress Cleaning: Clean cast stone as work progresses.

1. Remove mortar fins and smears before tooling joints.
2. Remove excess sealant immediately, including spills, smears, and spatter.

D. Final Cleaning: After mortar is thoroughly set and cured, clean exposed cast stone as follows:

1. Remove large mortar particles by hand with wooden paddles and nonmetallic scrape hoes or chisels.
2. Test cleaning methods on sample; leave one sample uncleaned for comparison purposes. Obtain Architect's approval of sample cleaning before proceeding with cleaning of cast stone.
3. Protect adjacent surfaces from contact with cleaner by covering them with liquid strippable masking agent or polyethylene film and waterproof masking tape.
4. Wet surfaces with water before applying cleaners; remove cleaners promptly by rinsing thoroughly with clear water.
5. Clean cast stone by methods described in Cast Stone Institute Technical Bulletin #39.
6. Clean cast stone with proprietary acidic cleaner applied according to manufacturer's written instructions.

END OF SECTION 04 72 00

SECTION 05 12 23 - STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fabrication and erection of structural steel work, as shown on the drawings and specified herein. Work shall include, but not be limited to the following items:

1. Structural steel.
2. Base and bearing plates.
3. Deck support angles and framing for roof openings.
4. Steel lintel members for masonry openings.
5. Edge angles and bent plates.
6. Connection plates.
7. Architecturally Exposed Structural Steel (AESS).
8. All other steel items as listed in AISC - "Code of Standard Practice for Steel Buildings and Bridges" as shown on structural and architectural drawings.

B. Work shall also include grouting of all structural steel members where indicated.

C. Structural notes indicated on the drawings regarding structural steel framing should be considered a part of this specification.

1.2 RELATED WORK

A. Pertinent Sections of Division 01.

B. Section 03 30 00 - Cast-in-Place Concrete.
C. Section 05 21 00 - Steel Joists.
D. Section 05 31 00 - Steel Deck.
E. Section 05 40 00 - Cold-Formed Steel Framing Systems.

1.3 REFERENCES

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards except where more stringent requirements are shown or specified. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1. AISC - Specification for Structural Joints Using High-Strength Bolts.
2. AISC 303 - Code of Standard Practice for Buildings and Bridges.
3. AISC 360-16 - Specification for Structural Steel Buildings.
4. ASTM A6 - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling.
5. ASTM A36 - Standard Specification for Carbon Structural Steel.
6. ASTM A53 - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless.
7. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.

8. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
9. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
10. ASTM A193 - Standard Specification for Alloy-Steel and Stainless Steel Bolting for High Temperature or High Pressure Service and Other Special Purpose Applications.
11. ASTM A449 - Standard Specification for Hex Cap Screws, Bolts and Studs, Steel, Heat Treated, 120/105/90 ksi Minimum Tensile Strength, General Use.
12. ASTM A500 - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes.
13. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.
14. ASTM A572 - Standard Specification for High-Strength Low-Alloy Columbium-Vanadium Structural Steel.
15. ASTM A913 - Standard Specification for High-Strength Low-Alloy Steel Shapes of Structural Quality, Produced by Quenching and Self-Tempering Process (QST).
16. ASTM A992 - Standard Specification for Steel for Structural Steel Shapes.
17. ASTM A1085 - Standard Specification for Cold-Formed Welded Carbon Steel Hollow Structural Sections (HSS).
18. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel.
19. ASTM E94 - Standard Guide to Radiographic Examination Using Industrial Radiographic Film.
20. ASTM E165 - Standard Practice for Liquid Penetrant Examination for General Industry.
21. ASTM E709 - Standard Guide for Magnetic Particle Testing.
22. ASTM F436 - Standard Specification for Hardened Steel Washers.
23. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners.
24. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength.
25. ASTM F3125 - Standard Specification for High Strength Structural Bolts, Steel and Alloy Steel, Heat Treated, 120 ksi and 150 ksi Minimum Tensile Strength, Inch Dimensions.
26. AWS D1.1 - Structural Welding Code - Steel.
27. SSPC - Steel Structures Painting Council.

1.4 QUALITY ASSURANCE

A. Fabrication, Erection, and Welding Qualifications:

1. Fabricate structural steel members in accordance with AISC Specification for the design, fabrication, and erection of structural steel for buildings.
2. Steel erector shall not have less than five (5) years of continuous experience in the erection of structural steel framing.
3. All welding of structural steel shall be performed by operators who have been recently qualified as prescribed in "Qualification Procedures" of the American Welding Society (AWS).
4. Tolerances: Tolerances shall be as indicated by the AISC Code of Standard Practice for Buildings and Bridges, except that tolerances for fabricating, rolling, cambering and erection shall not be cumulative.

1.5 SUBMITTALS

A. Shop Drawings:

1. Prepare and submit complete erection and detailed shop drawings for Engineer's approval, including framing plans indicating size, weight, and location of all structural members. Shop drawings shall indicate methods of connecting, anchoring, fastening, bracing, and attaching work of other trades.

    a. Where contract documents indicate verify in field (VIF) dimensions, shop drawings shall indicate these dimensions and Contractor shall note the dimensions have been verified.
    b. This specification modifies AISC Code of Standard Practice by deleting the following sentence from 4.4.1(c): "Release by the Owner's Designated Representatives for Design and Construction for the Fabricator to begin fabrication using the approved submittals." Review of the shop drawings by the Engineer shall not relieve the fabricator of this responsibility.

2. Furnish both the Engineer and Architect with one copy of the following:

    a. Final shop drawings containing all review notations.
    b. Field Use/For Construction drawings.

3. The steel fabricator shall submit a setting plan for all embedded items for Engineer's approval.
4. Shop drawings shall identify and mark AESS members and items. Specific project requirements for AESS (required blast cleaning, SSPC designation, special handling, etc.) relating to shop fabrication and field erection practices shall be indicated on the shop drawings.
5. Welder's Certification: Submit certification for all welders employed on the project demonstrating they have been AWS qualified to perform the welding procedures required for this project.
6. General Contractor/Construction Manager to provide copies of field concrete cylinder breaks indicating the concrete meets 75% of the design compressive strength to the steel erector.

B. The General Contractor/Construction Manager shall conduct a field survey of as-built anchors and bearing plate locations and elevations prior to steel erection. Survey shall be furnished to the steel fabricator. Contractor shall identify deviations from approved shop drawings and submit proposed repairs and modifications to the Engineer and steel fabricator for approval.

1.6 DELIVERY, STORAGE AND HANDLING

A. Steel members shall be transported, stored, and erected in a manner that will avoid any damage or deformation. Materials should be stored to allow easy access for inspection and identification. Bent or deformed members will be rejected and shall be replaced or repaired at the expense of the responsible party. Store clear of the ground and in such a manner as to eliminate excessive handling.

B. Store fasteners in a protected location. Clean and re-lubricate bolts and nuts before use.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Structural Steel:

1. All structural steel shall be free from defects impairing strength, durability, or appearance. All structural steel shall meet the latest minimum requirements as follows:

    a. Structural steel wide flange shapes shall:

        1) Conform to the ASTM designations listed in the General Notes of the drawings, unless noted otherwise.

    b. Structural steel angles, channels, bars, plates and miscellaneous steelshall conform to the ASTM designations listed in the General Notes of the drawings.
    c. Square and rectangular structural tubing shall be cold formed conforming to the ASTM designations listed in the General Notes of the drawings.
    d. Round structural tubing shall be cold formed conforming to the ASTM designations listed in the General Notes of the drawings.
    e. Steel pipe shall conform to the ASTM designations listed in the General Notes of the drawings.

B. High Strength Structural Bolts:

1. High strength structural bolts shall conform to the ASTM designations listed in the General Notes of the drawings.
2. High strength bolts shall be detailed and installed in accordance with AISC - "Specification for Structural Joints Using High-Strength Bolts."
3. Manufacturer's symbol and grade markings shall appear on all bolts and nuts.

C. Anchoring Devices:

1. Anchor Rods: Anchor rods used with structural steel members shall be plain threaded rods conforming to the ASTM designations listed in the General Notes of the drawings.
2. Expansion Anchors: Expansion anchors shall consist of one-piece wedge type carbon steel anchors with heavy-duty nuts and washers. All components shall be zinc plated in accordance with ASTM B633. Refer to the drawing details and General Notes for the expansion anchors used as the basis of design and the acceptable alternates.
3. Adhesive Anchoring System: Adhesive anchoring system shall consist of a threaded anchor rod complete with nut and washer and the adhesive cartridge. Refer to the drawing details and General Notes for the adhesive anchoring systems used as the basis of design and the acceptable alternates.

    a. Nuts shall meet ASTM A563, Grade DH, and washers shall meet ASTM F436.
    b. All components shall be zinc plated in accordance with ASTM B633 SC1.
    c. Adhesive shall consist of a two-part acrylic based adhesive applied in a dual cartridge dispensing system that properly mixes the components at the point of application.

D. Welding Materials:

1. Type required for material being welded in conformance with AWS D1.1.

E. Galvanizing: Where indicated on the drawings, steel shall be galvanized by the hot-dip process after fabrication conforming to ASTM A123. All exterior steel that will remain exposed shall be galvanized, unless otherwise indicated.

F. Paints and Primers:

1. Fabricator's standard lead- and chromate-free, non-asphaltic, rust-inhibiting primer.
2. Galvanizing repair paint: SSPC Paint 20.
3. Refer to Specification Section 09 90 00 for additional paint requirements.

G. Non-Shrink Grout for Base and Bearing Plates: Non-shrink grout, conforming to ASTM C1107, shall be pre-mixed, non-metallic, non-corrosive, non-staining product containing selected silica sand, Portland cement, shrinkage compensating agents, plasticizing and water reducing agents. All constituents shall meet the requirements of these specifications. Minimum compressive strength at 28-days shall be 7,000 psi as determined by ASTM C109. Follow manufacturer's instructions for handling, mixing, placing, and curing. Acceptable products are:

1. Euclid Chemical Company - Euco N.S. Grout
2. L&M Construction Chemical - Crystex.
3. Master Builders - Masterflow 713.
4. Sonneborn - Sonnogrout.
5. Five Star Products Inc. - Five Star Grout.
6. Dayton Superior - Sure-Grip High Performance Grout.
7. Dayton Superior - 1107 Advantage Grout.

2.2 FABRICATION AND MANUFACTURE

A. Fabrication Procedures (non-AESS):

1. Fabricate all structural steel items in accordance with AISC Specifications and as indicated on the approved shop drawings.
2. Provide camber in structural members where indicated.
3. Properly mark materials for field assembly and location for which intended. Fabricate for delivery sequence that will expedite erection and minimize handling of materials.
4. Complete structural steel assemblies before shop priming or galvanizing.

B. Architecturally Exposed Structural Steel (AESS):

1. Definitions:

a. AESS 1: Basic elements which require workmanship exceeding what would be done for non-AESS.
b. AESS 2: Feature elements viewed at a distance greater than 20 ft.
c. AESS 3: Feature elements viewed at a distance less than 20 ft.
d. AESS 4: Showcase elements with special surface and edge treatment beyond fabrication.
e. AESS C: Custom elements with characteristics specifically described within the drawings.

2. Fabricate and erect all structural steel items identified on the drawings as AESS in accordance with the AISC Code of Standard Practice for Buildings and Bridges.

a. Shop fabricate and assemble to the maximum extent possible. Locate field joints at concealed locations, if possible. Detail assemblies to minimize handling and to expedite erection.
b. Fabricate with exposed surfaces smooth, square, and free of surface blemishes including pitting, rust, scale, seam marks, roller marks, rolled trade names, and roughness.
c. Remove blemishes by filling or grinding or by welding and grinding, before cleaning, treating, and shop priming.

3. Prepare AESS surfaces according to Table 10.1 in the AISC Steel Design Manual, unless noted otherwise.

    a. Fabrication and erection tolerances, which are more stringent than required by the AISC Code of Standard Practice for Buildings and Bridges.

        1) Curved Members: Distortion of webs, stems, outstanding flanges, and legs of angles shall not be visible from a distance of 20 feet under any lighting conditions.
        2) Tolerance for walls of curved hollow steel sections after rolling shall be approximately 1/2-inch.

    b. Welded Connections: Comply with AWS D1.1, AWD D1.8 and Section 05 05 23.

        1) Remove backing bars or run-off tabs; back-gouge and grind steel smooth.
        2) Remove erection bolts, fill holes, and grind smooth.
        3) Fill weld access holes and grind smooth.

    c. Requirements, if any, of a mockup of components for inspection and acceptance of standards prior to the start of fabrication.
    d. Special handling and touch-up requirements.

C. Shop Connections:

1. All shop connections shall be welded, unless noted otherwise on drawings. Connections shall develop the full strength of the adjoining members unless detailed otherwise.
2. All holes shall be either drilled or punched, as no burning of holes will be permitted, including the enlargement of holes. Provide all holes required for connections and for attaching the work of other trades where such holes are shown if furnished prior to fabrication.
3. Connections shall be detailed as standard framed beam connections (bearing type) in accordance with the AISC Manual of Steel Construction. Connections which require oversized holes or slotted holes in which the force is other than normal to the axis of the slot shall be detailed as "Slip-Critical Connections" and noted as such on the erection drawings. Provide bearing plates and end anchorage for beams resting on masonry.
4. All full and partial penetration welds shall be fully detailed on the shop drawings. Use backing for all full penetration welds.
5. Weld access holes shall be fabricated in accordance with the recommendations of AWS D1.1 and AISC Specification.

D. Deck support framing and seats: Furnish all miscellaneous framing necessary to fully support the roof and floor steel decking.

E. Shop Priming:

1. Unless noted otherwise below, structural steel shall not be shop primed.
2. The following are steel surfaces to receive shop priming:

    a. Surfaces outside the building envelope that are not galvanized, including the following:

        1) Exterior columns if exposed on the architectural drawings..

    b. Surfaces to be painted per Architect's drawings.

3. If the steel pieces are to be shop primed, the following surfaces are exceptions to shop priming:

    a. Surfaces embedded in concrete or mortar. Extend priming of partially embedded members to a depth of 2 inches.
    b. Surfaces to be field welded.
    c. Surfaces to be high-strength bolted with slip-critical connections.
    d. Top flanges of beams supporting composite steel decking.
    e. Surfaces to receive sprayed fire-resistive materials.
    f. Galvanized surfaces.

4. Surface Preparation: Clean Surfaces to be painted. Remove loose rust and mill scale and spatter, slag, or flux deposits. Prepare surfaces according to the following specifications and standards:

    a. SSPC-SP 3, "Power Tool Cleaning."

5. Priming: Apply primer in accordance with paint manufacturer's recommendations, and at a rate recommended by SSPC to provide a dry film thickness of not less than 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

F. Finished Paint System:

1. Finished paint coats shall be in accordance with paint manufacturer's recommendations and Division 9.
2. Paint shall be free of sags, runs, drips or other defects. Allow ample drying time before handling to prevent damage to coatings.
3. Strip paint corners, crevices, bolts, welds, and sharp edges.
4. Apply two coats of shop paint to surfaces that will be inaccessible after assembly or erection. Change color of the second coat to distinguish it from the first.

G. Finished Paint System for Exposed Structural Steel: Structural steel exposed to the elements of weather shall be painted as follows:

1. Apply one coat of steel primer in shop as specified above.
2. Apply two coats of alkyd enamel paint to a minimum dry film thickness of [1.5]<Insert> mils for each coat. Paint shall be applied according to the manufacturer's recommendations.
3. Paint shall be free of sags, runs, drips or other defects. Allow ample drying time before handling to prevent damage to coatings.

H. Galvanizing:

1. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A123.

    a. Fill vent holes and grind smooth after galvanizing.
    b. Unless otherwise noted on drawings or in Division 9, all exterior steel components exposed to the elements shall be galvanized, including, but not limited to, lintels.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Examine the areas and conditions under which work of this Section will be performed. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions have been corrected.

3.2 ERECTION

A. Erection Procedures:

1. The erector and not the Structural Engineer shall be responsible for the means, methods, and safety of erection of the structural steel framing.
2. Erection of all structural steel items shall meet the requirements of AISC "Specification and Code of Standard Practice."
3. All work shall be erected square, plumb, straight and true, accurately fitted and with tight joints and intersections, by mechanics experienced in the erection of structural steel. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.
4. Clean the bearing surface and other surfaces that will be in permanent contact before assembly.
5. All base plates shall be supported on steel wedges, steel shims or heavy-duty leveling nuts until the supported members have been leveled and plumbed.

    a. Snug tighten anchor rods after supported members have been positioned and plumb. Do not remove wedges or shims but, if protruding, cut off flush with edge of base plate before packing with grout.
    b. Promptly place non-shrink grout between bearing surfaces and base plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturers written installation instructions for shrinkage-resistant grouts.

6. Field connections of structural work shall be made with either high strength bolts (bearing type) or by welding. Proper precaution shall be taken to ensure anchored items will not be distorted or overstressed due to improperly fabricated items.
7. Splice members only where indicated unless, with the Structural Engineer's approval, splices not indicated would result in lower costs due to reduced shipping expense. For splices not indicated, submit structural calculations prepared under direct supervision of and signed by a Structural Engineer licensed in the state where the project is located.
8. Do not use thermal cutting during erection unless approved by the Engineer/Architect in writing.
9. Steel erection shall not proceed without concrete in footings, piers, and walls attaining 75% of the intended minimum compressive design strength. Documentation must be provided indicating compliance with this requirement.

B. Surveys:

1. Establish permanent benchmarks necessary for accurate erection of structural steel.
2. Check elevations of concrete surfaces, and locations of anchor bolts and similar items, before erection proceeds.

C. Bracing and Protection:

1. Steel shall be well plumbed, leveled and braced to prevent any movement.

    a. Contractor shall provide and maintain all necessary temporary guying of steel frame to safely resist all wind and construction loads during erection and to assure proper alignment of all parts of the steel frame.

2. Provide all temporary flooring, bracing, shoring and guards necessary to prevent damage or injury. All partially erected steel shall be secured in an approved manner during interruptions of work.

D. Anchor and Foundation Rods:

1. All anchor or foundation rods and similar steel items to be built into concrete or masonry are to be set by the concrete or masonry contractors and shall be furnished promptly so they may be built in as the work progresses because cutting of structural steel members to accommodate errors pertaining to embedded items will not be permitted.

3.3 FIELD WELDING

A. Welding Procedures:

1. All field welding shall be in accordance with AISC Specifications and conform to AWS D1.1 "Structural Welding Code - Steel".

    a. Comply with AISC's "Code of Standard Practice for Steel Buildings and Bridges" for bearing, adequacy of temporary connections, alignment, and removal of paint on surfaces adjacent to field welds.
    b. Assemble and weld built-up sections by methods that will maintain true alignment of axes without exceeding tolerances of AISC's "Code of Standard Practice" for Steel Buildings and Bridges" for mill material.

2. Contractor shall remove ceramic ferrules from shear stud connectors in sufficient time to allow for inspection of welds prior to placement of the concrete.

3.4 REPAIRS, PROTECTION, AND TOUCH UP

A. Repair damaged galvanized coatings and on galvanized items with galvanized repair paint according to ASTM A780 and manufacturer's written instructions.

B. Touch up Painting: After installation, promptly clean, prepare, and prime or reprime field welds, final connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates and abutting structural steel.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.
2. Apply a compatible primer of the same type as shop primer used on adjacent surfaces.
3. Secure approval by the Architect prior to field painting.

3.5 GROUTING

A. Grouting under structural framing members shall be completed after all members have been plumbed and braced and before imposed loads are placed thereon.

B. Remove all defective concrete, dirt, oil, grease, and other foreign matter from surfaces to which grout will be placed.

3.6 MISCELLANEOUS STEEL AND STEEL LINTELS

A. Furnish and install all miscellaneous steel as detailed in architectural and structural drawings.

B. The steel fabricator shall furnish all steel lintels required for masonry wall construction indicated in the architectural and structural drawings and schedules.
C. Provide additional steel framing for continuous support of steel deck edges at openings and column interruptions.
D. All exterior exposed steel shall be hot-dip galvanized in accordance with ASTM A123.

END OF SECTION

SECTION 05 31 00 - STEEL DECK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fabrication and erection of steel deck. The Work shall include, but not be limited to the following:

1. Roof deck, roof deck accessories, and roof deck fasteners.
2. Acoustical roof deck, acoustical insulation component and accessories.
3. Composite floor deck.
4. Cellular composite floor deck.
5. Noncomposite form deck.
6. Shear studs.

B. Structural notes indicated on the drawings regarding steel decking shall be considered a part of this specification.

1.2 RELATED WORK

A. Pertinent Sections of Division 01.

B. Section 03 30 00 - Cast-in-Place Concrete.
C. Section 05 12 23 - Structural Steel.

1.3 REFERENCES

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members.
2. ASCE 9 - Standard for the Structural Design of Composite Slabs and Standard Practice for Construction and Inspection of Composite Slabs.
3. ASTM A36 - Standard Specification for Carbon Structural Steel.
4. ASTM A108 - Standard Specification for Steel Bar, Carbon and Alloy, Cold-Finished.
5. ASTM A653 - Standard Specification for Steel Sheet, Zinc Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
6. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
7. ASTM A1008 - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable.
8. AWS D1.1 - Structural Welding Code - Steel.
9. AWS D1.3 - Structural Welding Code - Sheet Steel.
10. SDI Roof Deck Design Manual.
11. SDI Diaphragm Design Manual.

1.4 QUALITY ASSURANCE

A. Fabricator: Company specializing in performing the work of this section with minimum five (5) years documented experience at manufacturing steel deck. Fabrication Company shall be a current member of the Steel Deck Institute (SDI).

B. Erector: Company specializing in performing the work of this section with minimum five (5) years documented experience at erecting steel deck.

C. Welding: Qualify Welding Procedure Specifications (WPS) and welding operator in accordance with AWS D1.3. Provide certifications that welders to be employed in the construction have satisfactorily passed AWS qualifications tests. If recertification of welders is required, retesting will be the contractor's responsibility.

D. Furnish and install steel deck in accordance with the manufacturer's current ICC Research Committee Report to obtain diaphragm values indicated.

1.5 SUBMITTALS

A. Prepare and submit shop drawings for Engineer's approval. Shop drawings shall indicate deck layout, depth, uncoated metal thickness, framing and supports with unit dimensions and sections, shear stud layout and complete end jointing. Contractor to verify measurements, lines, elevations, and details of field conditions to conform with actual conditions.

1. Provide details of all accessories.
2. Shop drawings shall also indicate typical welding pattern for steel deck and accessories.

B. Prepare and submit allowable construction span tables and allowable total load tables for Engineer's approval. Tables shall be accompanied with a letter of certification from the manufacturer stating the tabulated design values were determined in accordance with the Steel Deck Institute's Design Manuals for Roof Deck, Floor Deck and Diaphragm Design.

1. The gauges and section moduli indicated on the drawings or specified herein are minimum and the gauge and section modulus of the deck furnished shall meet or exceed these minimum requirements. All gauges are United States standard, measured prior to coating.

C. WPS and Procedure Qualification Records (PQR) shall be current and approved by the Structural Engineer.

D. Provide manufacturer's latest recommendations and installation instructions.

E. Prepare and submit product data of proposed materials.

1.6 DELIVERY, STORAGE AND HANDLING

A. All decking materials shall be transported, stored, and erected in a manner that will prevent damage or deformation of sheets. Damaged material shall not be erected or repaired without Structural Engineer's approval.

B. Deck panels shall be stored clear of the ground, elevated on one end, and protected from weather with waterproof covering.

1.7 COORDINATION

A. Portions of decking to receive spray applied fireproofing shall be a galvanized finish. Contractor shall certify compatibility of any shop primer with field applied finishes or fireproofing required for this project.

PART 2 - PRODUCTS

2.1 STEEL ROOF DECK

A. Fabricate panels to comply with the "SDI Roof Deck Design Manual," and the following:

1. Steel decking sheet material, minimum yield strength, depth, gauge, profile, and finish are indicated on the drawings, as classified by the Steel Deck Institute (SDI). Panels shall be formed with integral ribs and overlapping side flanges.
2. Galvanized Steel Sheet: ASTM A653 Structural Steel (SS), Grade 33, with a G60 zinc coating conforming to ASTM A924 for galvanized deck.

2.2 FASTENERS

A. Support Fasteners:

1. Welded: Refer to the drawings for weld size and spacing requirements.

a. Welding rods shall comply with all applicable requirements of the AWS Codes.
b. Shear studs may replace support fasteners. Refer to the drawings for requirements.

1) Provide headed stud type of cold finished carbon steel per Section 05 12 23.
2) Use ferrules suitable for use with galvanized steel deck.

c. Weld washers are required for material less than 0.028" thick. Weld washers shall be a minimum thickness of 0.0598" and be applicable to AWS D1.3 type welding and of type as recommended by the deck manufacturer.
d. Weld metal shall penetrate all layers of deck material and shall have good fusion to the supporting steel. Fasten ribbed deck to steel support members at ends and intermediate supports.

1) All welding shall be in conformance with previously cited AWS recommendations in appearance and quality of welds, and the methods used in correcting welding work.

B. Side Lap Fasteners:

1. Mechanical: Zinc coated self-drilling, self-tapping type (minimum No. 10) steel screws. Refer to the drawings for fastener spacing requirements.

2.3 ACCESSORIES

A. Steel materials to conform to ASTM A1008 meeting the requirements of ASTM A653, G60 coating.

B. Provide all closers, fillers, starters, sump pans, metal cant strips, column closures, and similar accessories required for a complete installation. Provide cover plates at all locations where direction of deck span changes. Unless otherwise noted, accessories shall be of the same steel sheet material, finish, and thickness as the deck sections.

C. Recessed Sump Pans: Single piece steel sheet of same material, finish, and thickness as the deck, with 3-inch-wide flanges and recessed pan of 1-1/2-inch minimum depth. Cut drain holes in the field.

PART 3 - EXECUTION

3.1 ERECTION

A. Verify field conditions are acceptable and are ready to receive work. Correct inaccuracies in alignment or level before deck units are finally placed.

B. Deck units and deck accessories herein specified shall be thoroughly and securely erected by experienced workmen fastening to supporting steel members specified. All work shall be in conformance with the manufacturer's latest printed recommendations and approved shop drawings.

C. Beginning of installation means installer accepts existing conditions.

D. The finished work shall be true, flat planes and to slopes indicated with end joints flush and without sharp protruding edges. Exposed underside of deck shall be true without defect.

E. Where large predetermined openings for elevators, stairs, ducts, and similar elements passing through the deck units occur, furnish prefabricated units to fit job conditions. Where other holes or openings are required in decking after erection, reinforce such holes as indicated on the drawings. Cantilever deck to the edge of slabs only as indicated on the drawings.

F. Burning of holes in decking will not be permitted.

G. Steel decking shall be installed to span supporting steel members at right angles. Panels shall be securely anchored to each structural support it rests on or passes.

H. Except where single spans are indicated, furnish decking in minimum lengths to span 3 spans with telescoping or nested 2-inch end laps and interlocking or nested side laps.

3.2 ROOF DECK

A. Fasten roof deck panels to steel supporting members using welds, as specified herein and on the drawings.

B. Deck shall be fastened through the bottom of the deck rib to all structural supports for the specific deck sections.

C. End bearing of roof decking shall have a minimum of 1-1/2 inches of bearing occurring over structural supports.

D. Install sound absorbing insulation into the topside ribs of the acoustical deck as specified in the deck manufacturer's installation instructions. Coordinate with the roofing installation to protect the insulation from damage.

E. Place deck panels on structural supports and adjust to final position with ends aligned. Attach to supports immediately after placement.
F. Roof sump pans shall be installed over openings provided in roof deck with flanges welded to the top of the deck. Space welds at 12 inches apart with at least 1 weld in each corner.
G. Install all roof deck accessories in accordance with the roof deck manufacturer's written instructions.

3.3 FIELD TOUCH UP

A. After erection, all weld burn marks and abraded spots shall be cleaned and field painted with a rust-inhibiting metal primer matching formulations and color of shop coat or a zinc-rich rust inhibiting paint for galvanized deck surfaces.

END OF SECTION

SECTION 05 40 00 - COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior non-load-bearing wall framing.
2. Interior non-load-bearing wall framing.
3. Soffit framing.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Cold-formed steel framing materials.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated Design Submittal: For cold-formed steel framing.

1.3 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.4 DELIVERY, STORAGE, AND HANDLING

A. Protect and store cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling as required in AISI S202.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. ClarkDietrich.
2. MarinoWARE.
3. MBA Building Supplies.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

a. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height.
b. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft..

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F.
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

a. Upward and downward movement of 3/4 inch.

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing complies with AISI S100 and AISI S240.

D. Fire-Resistance Ratings: Comply with ASTM E119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Framing Members, General: Comply with AISI S240 for conditions indicated.

B. Steel Sheet: ASTM A1003/A1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.
2. Coating: G60, A60, AZ50, or GF30 for interior framing; G90 or equivalent for exterior framing.

C. Steel Sheet for Vertical Deflection Clips: ASTM A653/A653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G90.

2.4 EXTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch .
2. Flange Width: 1-5/8 inches .

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs .
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips, Exterior: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch .
2. Flange Width: 1 inch plus twice the design gap for other applications .

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch.
2. Flange Width: 1-5/8 inches.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches.

C. Vertical Deflection Clips, Interior: Manufacturer's standard bypass clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

D. Single Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch.
2. Flange Width: 1 inch plus twice the design gap for other applications.

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.6 SOFFIT FRAMING

A. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0538 inch .
2. Flange Width: 1-5/8 inches , minimum.

2.7 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A1003/A1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.

4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.8 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A36/A36M, zinc coated by hot-dip process according to ASTM A123/A123M.

B. Anchor Bolts: ASTM F1554, Grade 36 , threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A153/A153M, Class C .

C. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Mechanical Fasteners: ASTM C1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

E. Welding Electrodes: Comply with AWS standards.

2.9 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A780/A780M .

B. Cement Grout: Portland cement, ASTM C150/C150M, Type I; and clean, natural sand, ASTM C404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

D. Sill Sealer Gasket: Closed-cell neoprene foam, 1/4 inch thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.10 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sill sealer gasket at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.
2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 07 21 00 "Thermal Insulation," in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 INSTALLATION OF EXTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: Maximum 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to bypassing studs and anchor to building structure.
4. Connect drift clips to cold-formed steel framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5 INSTALLATION OF INTERIOR NONLOADBEARING WALL FRAMING

A. Install continuous tracks sized to match studs. Align tracks accurately and securely anchor to supporting structure.

B. Fasten both flanges of studs to top and bottom track unless otherwise indicated. Space studs as follows:

1. Stud Spacing: Maximum 16 inches.

C. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar requirements.

D. Isolate non-load-bearing steel framing from building structure to prevent transfer of vertical loads while providing lateral support.

1. Install single deep-leg deflection tracks and anchor to building structure.
2. Install double deep-leg deflection tracks and anchor outer track to building structure.
3. Connect vertical deflection clips to studs and anchor to building structure.
4. Connect drift clips to cold-formed steel metal framing and anchor to building structure.

E. Install horizontal bridging in wall studs, spaced vertically in rows indicated on Shop Drawings but not more than 48 inches apart. Fasten at each stud intersection.

1. Channel Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs.
2. Strap Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bar Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

F. Top Bridging for Single Deflection Track: Install row of horizontal bridging within 12 inches of single deflection track. Install a combination of bridging and stud or stud-track solid blocking of width and thickness matching studs, secured to stud webs or flanges.

1. Install solid blocking at centers indicated on Shop Drawings.

G. Install miscellaneous framing and connections, including stud kickers, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.6 INSTALLATION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error are not to exceed minimum fastening requirements of sheathing or other finishing materials.

3.7 REPAIR

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A780/A780M and manufacturer's written instructions.

3.8 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION 05 40 00

SECTION 06 10 00 - ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wood blocking and nailers.
2. Plywood backing panels.

B. Related Requirements:

1. Section 06 16 00 "Sheathing" for sheathing, subflooring, and underlayment.

1.2 DEFINITIONS

A. Boards or Strips: Lumber of less than 2 inches nominal size in least dimension.

B. Dimension Lumber: Lumber of 2 inches nominal size or greater but less than 5 inches nominal size in least dimension.

C. Exposed Framing: Framing not concealed by other construction.

D. OSB: Oriented strand board.

E. Timber: Lumber of 5 inches nominal size or greater in least dimension.

F. Lumber grading agencies, and abbreviations used to reference them, include the following:

1. NeLMA: Northeastern Lumber Manufacturers' Association.
2. NLGA: National Lumber Grades Authority.
3. SPIB: The Southern Pine Inspection Bureau.
4. WCLIB: West Coast Lumber Inspection Bureau.
5. WWPA: Western Wood Products Association.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of process and factory-fabricated product. Indicate component materials and dimensions and include construction and application details.

1. Include data for wood-preservative treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Indicate type of preservative used and net amount of preservative retained.

2. Include data for fire-retardant treatment from chemical treatment manufacturer and certification by treating plant that treated materials comply with requirements. Include physical properties of treated materials based on testing by a qualified independent testing agency.
3. For fire-retardant treatments, include physical properties of treated lumber both before and after exposure to elevated temperatures, based on testing by a qualified independent testing agency according to ASTM D5664.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Stack wood products flat with spacers beneath and between each bundle to provide air circulation. Protect wood products from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PRODUCTS, GENERAL

A. Lumber: Comply with DOC PS 20 and applicable rules of grading agencies indicated. If no grading agency is indicated, comply with the applicable rules of any rules-writing agency certified by the ALSC Board of Review. Grade lumber by an agency certified by the ALSC Board of Review to inspect and grade lumber under the rules indicated.

1. Factory mark each piece of lumber with grade stamp of grading agency.
2. For exposed lumber indicated to receive a stained or natural finish, mark grade stamp on end or back of each piece.
3. Where nominal sizes are indicated, provide actual sizes required by DOC PS 20 for moisture content specified. Where actual sizes are indicated, they are minimum dressed sizes for dry wood products.
4. Dress lumber, S4S, unless otherwise indicated.

B. Maximum Moisture Content of Lumber:

1. Boards: 15 percent.
2. Dimension Lumber: 15 percent for 2-inch nominal thickness or less; no limit for more than 2-inch nominal thickness unless otherwise indicated.
3. Timber. No limit.

C. Engineered Wood Products: Acceptable to authorities having jurisdiction and for which current model code research or evaluation reports exist that show compliance with building code in effect for Project.

1. Allowable design stresses, as published by manufacturer, shall meet or exceed those indicated. Manufacturer's published values shall be determined from empirical data or by rational engineering analysis and demonstrated by comprehensive testing performed by a qualified independent testing agency.

2.2 PRESERVATIVE TREATMENT

A. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with ground, Use Category UC3b for exterior construction not in contact with ground, and Use Category UC4a for items in contact with ground.

1. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
2. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not require incising, contain colorants, bleed through, or otherwise adversely affect finishes.

B. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.

C. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

D. Application: Treat items indicated on Drawings, and the following:

1. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
2. Wood sills, sleepers, blocking, furring, stripping, and similar concealed members in contact with masonry or concrete.
3. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
4. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
5. Wood floor plates that are installed over concrete slabs-on-grade.

2.3 FIRE-RETARDANT TREATMENT

A. General: Where fire-retardant-treated materials are indicated, materials shall comply with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

B. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame-spread index of 25 or less when tested according to ASTM E84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Treatment shall not promote corrosion of metal fasteners.

2. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D2898. Use for exterior locations and where indicated.
3. Interior Type A: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D3201/D3201M at 92 percent relative humidity. Use where exterior type is not indicated.
4. Design Value Adjustment Factors: Treated lumber shall be tested according to ASTM D5664 and design value adjustment factors shall be calculated according to ASTM D6841.

C. Kiln-dry lumber after treatment to maximum moisture content of 19 percent. Kiln-dry plywood after treatment to maximum moisture content of 15 percent.

D. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.

1. For exposed lumber indicated to receive a stained or natural finish, mark end or back of each piece.

E. For exposed items indicated to receive a stained or natural finish, chemical formulations shall not bleed through, contain colorants, or otherwise adversely affect finishes.

F. Application: Treat items indicated on Drawings, and the following:

1. Framing for raised platforms.
2. Concealed blocking.
3. Framing for non-load-bearing partitions.
4. Framing for non-load-bearing exterior walls.
5. Plywood backing panels.

2.4 MISCELLANEOUS LUMBER

A. Provide miscellaneous lumber indicated and lumber for support or attachment of other construction, including the following:

1. Blocking.
2. Nailers.
3. Rooftop equipment bases and support curbs.
4. Furring.

B. Dimension Lumber Items: Construction or No. 2 grade lumber of any of the following species:

1. Hem-fir (north); NLGA.
2. Mixed southern pine or southern pine; SPIB.
3. Spruce-pine-fir; NLGA.
4. Hem-fir; WCLIB or WWPA.
5. Spruce-pine-fir (south); NeLMA, WCLIB, or WWPA.

C. Concealed Boards: 15 percent maximum moisture content and [any of]the following species and grades:

1. Mixed southern pine or southern pine; No. 2 grade; SPIB.
2. Hem-fir or hem-fir (north); Construction or No. 2 Common grade; NLGA, WCLIB, or WWPA.
3. Spruce-pine-fir (south) or spruce-pine-fir; Construction or No. 2 Common grade; NeLMA, NLGA, WCLIB, or WWPA.

D. For blocking not used for attachment of other construction, Utility, Stud, or No. 3 grade lumber of any species may be used provided that it is cut and selected to eliminate defects that will interfere with its attachment and purpose.

E. For blocking and nailers used for attachment of other construction, select and cut lumber to eliminate knots and other defects that will interfere with attachment of other work.

F. For furring strips for installing plywood or hardboard paneling, select boards with no knots capable of producing bent-over nails and damage to paneling.

2.5 PLYWOOD BACKING PANELS

A. Equipment Backing Panels: Plywood, DOC PS 1, Exterior, C-C Plugged , fire-retardant treated, in thickness indicated or, if not indicated, not less than 3/4-inch nominal thickness.

2.6 FASTENERS

A. General: Fasteners shall be of size and type indicated and shall comply with requirements specified in this article for material and manufacture. Provide nails or screws, in sufficient length, to penetrate not less than 1-1/2 inches into wood substrate.

1. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, or in area of high relative humidity, provide fasteners with hot-dip zinc coating complying with ASTM A153/A153M or ASTM F2329 .
2. For pressure-preservative-treated wood, use stainless steel fasteners.
3. For redwood, use stainless steel fasteners.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

D. Post-Installed Anchors: Fastener systems with an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC193 or ICC-ES AC308 as appropriate for the substrate.

2.7 MISCELLANEOUS MATERIALS

A. Flexible Flashing: Composite, self-adhesive, flashing product consisting of a pliable, butyl rubber rubberized-asphalt compound, bonded to a high-density polyethylene film, aluminum foil, or spunbonded polyolefin to produce an overall thickness of not less than 0.025 inch.

B. Adhesives for Gluing Furring to Concrete or Masonry: Formulation complying with ASTM D3498 that is approved for use indicated by adhesive manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Framing Standard: Comply with AF&PA's WCD 1, "Details for Conventional Wood Frame Construction," unless otherwise indicated.

B. Set work to required levels and lines, with members plumb, true to line, cut, and fitted. Fit rough carpentry accurately to other construction. Locate furring, nailers, blocking, grounds, and similar supports to comply with requirements for attaching other construction.

C. Install plywood backing panels by fastening to studs; coordinate locations with utilities requiring backing panels. Install fire-retardant-treated plywood backing panels with classification marking of testing agency exposed to view.

D. Provide blocking and framing as indicated and as required to support facing materials, fixtures, specialty items, and trim.

1. Provide metal clips for fastening gypsum board or lath at corners and intersections where framing or blocking does not provide a surface for fastening edges of panels. Space clips not more than 16 inches o.c.

E. Provide fire blocking in furred spaces, stud spaces, and other concealed cavities as indicated and as follows:

1. Fire block furred spaces of walls, at each floor level, at ceiling, and at not more than 96 inches o.c. with solid wood blocking or noncombustible materials accurately fitted to close furred spaces.
2. Fire block concealed spaces of wood-framed walls and partitions at each floor level, at ceiling line of top story, and at not more than 96 inches o.c. Where fire blocking is not inherent in framing system used, provide closely fitted solid wood blocks of same width as framing members and 2-inch nominal thickness.

F. Sort and select lumber so that natural characteristics do not interfere with installation or with fastening other materials to lumber. Do not use materials with defects that interfere with function of member or pieces that are too small to use with minimum number of joints or optimum joint arrangement.

G. Comply with AWPA M4 for applying field treatment to cut surfaces of preservative-treated lumber.

1. Use inorganic boron for items that are continuously protected from liquid water.
2. Use copper naphthenate for items not continuously protected from liquid water.

H. Where wood-preservative-treated lumber is installed adjacent to metal decking, install continuous flexible flashing separator between wood and metal decking.

I. Securely attach rough carpentry work to substrate by anchoring and fastening as indicated, complying with the following:

1. Table 2304.9.1, "Fastening Schedule," in ICC's International Building Code (IBC).
2. ICC-ES evaluation report for fastener.

J. Use steel common nails unless otherwise indicated. Select fasteners of size that will not fully penetrate members where opposite side will be exposed to view or will receive finish materials. Make tight connections between members. Install fasteners without splitting wood. Drive nails snug but do not countersink nail heads unless otherwise indicated.

K. For exposed work, arrange fasteners in straight rows parallel with edges of members, with fasteners evenly spaced, and with adjacent rows staggered.

1. Comply with approved fastener patterns where applicable. Before fastening, mark fastener locations, using a template made of sheet metal, plastic, or cardboard.
2. Use finishing nails unless otherwise indicated. Countersink nail heads and fill holes with wood filler.
3. Use common nails unless otherwise indicated. Drive nails snug but do not countersink nail heads.

3.2 INSTALLATION OF WOOD BLOCKING AND NAILERS

A. Install where indicated and where required for[screeding or] attaching other work. Form to shapes indicated and cut as required for true line and level of attached work. Coordinate locations with other work involved.

B. Attach items to substrates to support applied loading. Recess bolts and nuts flush with surfaces unless otherwise indicated.

3.3 PROTECTION

A. Protect wood that has been treated with inorganic boron (SBX) from weather. If, despite protection, inorganic boron-treated wood becomes wet, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

B. Protect rough carpentry from weather. If, despite protection, rough carpentry becomes wet enough that moisture content exceeds that specified, apply EPA-registered borate treatment. Apply borate solution by spraying to comply with EPA-registered label.

END OF SECTION 06 10 00

SECTION 06 15 23 - CROSS-LAMINATED TIMBER PANELS (CLT)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section is intended to supplement the detailed Structural General Notes, references and requirements for this Project as described in the Structural Drawings prepared by the Structural Engineer of Record (SEOR). Where content of this Section may appear to conflict with specific standards or requirements for Work of this Section, the Notes and Requirements of the Structural Drawings shall always govern.

B. A letter of assurance is to the Authority Having Jurisdiction is required where components are designed by the supplier.

1.2 SECTION INCLUDES

A. Cross-laminated timber roof panels.

B. Connection hardware.

1.3 RELATED SECTIONS

A. Section 05 12 00: Structural Steel.

B. Section 06 10 00: Rough Carpentry.

C. Section 06 18 00: Glued-Laminated Structural Unit (Glu Lam).

1.4 REFERENCES

A. APA PRG 320-2012 - Standard for Performance-Rated Cross-Laminated Timber.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

1.5 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of cross-laminated timber panels with size, location and installation of service utilities.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

C. Furnish loose connection hardware and anchorage items to be embedded in or attached to other construction before starting this Work. Provide locations, setting diagrams, templates, instructions, and directions, as required, for installation.

1.6 SUBMITTALS

A. See Section 013000 - Administrative Requirements, Meetings & Submittals, for submittal procedures.

B. Product Data: For each type of product.
   1. Include data on lumber, adhesives, fabrication, and protection.
   2. Sealers and similar architectural specifications.
   3. For connectors, include installation instructions.

C. Samples: For each Quality appearance grade panel, with shop-applied sealer, 6" x 8".

D. Shop Drawings: Show fabrication and erection of cross-laminated timber panels.
   1. Submit erection drawings.
      a. Indicate member locations, elevations, and spacing. Label each member with a piece number or other unique mark.
      b. Do not reproduce structural Drawings for use as erection drawings.
   2. Submit piece drawings for each panel.
      a. Show layout, dimensions, and elevations of each panel.
      b. Clearly indicate species, stress grade, service grade, appearance grade, and shop applied finishes.
      c. Include details of cuts, openings, holes, cambers, fastenings, and connection hardware.

E. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating that structural cross-laminated timber complies with the requirements in APA PRG 320.

F. The fabricator and erector shall keep a QA/QC log of items such as but not limited to:
   1. Environmental conditions at all stages, such as during fabrication, storage, transportation, erection and ideally until building is completely finished.
   2. Quality control log showing the actual length, thickness and width of the panels. Length, width, thickness and diagonal measurement to be noted on top surface of panels. Tolerances as per these specifications.
   3. Site deliveries including verified load manifests with notes of damaged or missing materials and elements.
   4. Material and element install log with sign off for QC on hardware/fastener installation.
   5. Log of equipment used, such as but not limited to torque drills (with torque clutch) for screw installation through steel plates etc.
   6. Log of any changes or modifications.
   7. The inclusion of representative pictures within the log is recommended.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this Section with minimum three years of experience, and certified in accordance with APA PRG 320. If European CLT is used, manufacturer shall be certified with a European Technical Assessment.

B. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

C. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.8 DELIVERY, STORAGE AND HANDLING

A. Deliver, store and handle materials in accordance with manufacturer’s written instructions.

B. Deliver and Acceptance Requirements:
   1. Deliver materials to site in original factory packaging, labeled with manufacturer's name and address.
   2. Apply protective sealer to glued-laminated and/or cross-laminated units before shipping unless specified otherwise.
   3. Wrap architectural grade members prior to leaving plant with a moisture-resistant wrapping.
   4. Use padded, non-marring slings for handling glued-laminated and/or cross-laminated members.
   5. Protect corners with wood blocking.
   6. Make adequate provision for delivery and handling stresses.

C. Storage and Handling Requirements
   1. Store materials off the ground and in accordance with manufacturer's recommendations in clean, dry, wall-ventilated area.
   2. Slit underside of membrane covering during storage at site without defacing member.
   3. Store units and protect from weather, block off ground and separate with stripping, so air may circulate around faces of members.
   4. Cover units with opaque, moisture-resistant membrane if stored outside.
   5. Store and protect products from nicks, scratches, and blemishes.
   6. Replace defective or damaged materials with new ones, unless written approval by the manufacturer.

1.9 WARRANTY

A. See Section 017800 - Warranty & Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five-year period after Date of Substantial Completion Certification.

C. Provide five-year manufacturer's warranty for work of this Section.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Materials Transparency: For each product, provide copies of all available current product disclosures from the following list:
   1. Health Product Declaration (HPD).
   2. Declare Label.
   3. Cradle to Cradle product certification.
   4. Cradle to Cradle Material Health certification.
   5. Project Lens Certification.
   6. Environmental Product Declaration (EPD).
   7. Recycled Content.
   8. FSC Certification

   Expectations for material transparency documentation and sustainable content requirements are listed in Part 3 of Section 01 81 20 by CSI division and material.

B. Engineered wood, composite wood, and Agrifiber products shall contain no added urea-formaldehyde (NAUF).

2.2 MANUFACTURERS

A. Nordic

B. Structurlam (www.structurlam.com/)

C. Smartlam (www.smartlam.com)

D. Stora Enso (www.storaenso.com)

E. Substitutions: APPROVED SUBSTITUTION ONLY.

2.3 MATERIALS

A. Laminating Stock and thicknesses:
1. Exposed Face Plies (underside): No. 1/No.2 Douglas Fir.
2. Non-exposed Face Plies (Topside) and Inner plies: No.1/No.2 Douglas Fir.

B. Wood Screws: As specified on the Drawings.

C. Structural Steel Connectors: Generally as specified in Section 051200. All steel connectors to be accurately machined. All steel and connectors shall be prime painted unless noted otherwise. See also 1.6.5 and Section 061819, 2.3.7.

D. Wrapping Materials: Weatherproof, lightproof, stain-free material.

2.4 FABRICATION

A. General: Fabricate panels to APA PRG 320 unless noted otherwise

B. Service Grade: Interior typical and exterior at overhangs. See drawings.

C. Appearance Grade:
1. “Visual” Quality where exposed.
   a. Use “J” grade lumber or highest aesthetic quality characterized by small tight knots, clear appearance and minimal defects for exposed face.
   b. Shake and checks are permitted up to 610mm long, none through.
   c. Blue stain is not permitted unless noted otherwise.
   d. Heart stain is permitted.
   e. Knots are permitted with NLGA Select Structural limitation.
   f. Pitch streaks and wane on face are not permitted.
   g. Side pressure on exposed faces is required.
   h. See architectural specifications for additional information on stains/coatings. The general clear coating shall be applied in the factory. The stain/waterproof finish to be applied in the field.
2. “Non-Visual” where concealed.
   a. Shake and checks are permitted up to 915mm long or ¼ of the panel length, whichever is less.
   b. Heart or blue stain is permitted.
   c. Knots are permitted if well-spaced.
   d. Pitch streaks and wane on face are permitted.
   e. Side pressure on exposed faces is not required.

D. Tolerances:

1. Thickness: +/- 1/16”
2. Width: +/- 1/8”
3. Length: +/- 1/8”
4. Squareness: The length of two panel face diagonals measured between panel corners shall not differ by more than 2mm.
5. Straightness: Deviation of edges from a straight line between adjacent panel corners shall not exceed 1mm.

E. Verify dimensions and site conditions prior to fabrication where possible.

F. Fabricate panels with 90-degree corners. Do not chamfer.

G. Shop fabricate for connections to the greatest extent possible, including cutting to length. Dress exposed surfaces as needed to remove planning and surfacing marks.

H. Placement of lifting devices onto panels in shop may be required. Supplier to coordinate with installer. Lifting devices to be installed at panel edges or on surfaces not intended as final finish.

I. Mark panels for identification during erection. Ensure marks will be concealed in final assembly for appearance grade panels. Clearly mark on 3 sides.

J. Splices: Do not splice or join panels in locations other than those indicated without permission.

K. Steel: Fabricate steel hardware and connections with joints neatly fitted, welded, and ground smooth. See section 051200 - Structural Steel for additional details. Test fit in shop.

L. Third party review: Owner may engage and pay for the services of a qualified third party to perform review of QA/QC procedures, shop tests and inspections.
1. Owner may require the installation of moisture sensors onto the products at time of manufacturing.
2. Provide a schedule of shop fabrication prior to commencement of Work.
3. Provide access to places where products are being fabricated or produced to perform tests and inspections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates in areas to receive panels, with Installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install timber panels in accordance with manufacturer's instructions.

B. General: Timber panel installer to submit installation method statement provided by a Professional Engineer, including temporary loading conditions and bracing of structure during installation.

C. Erect timber panels in accordance with final reviewed shop drawings, level and plumb, and with uniform, close-fitting joints. Fit panels without trimming, cutting, or other modifications, unless approved in writing by the Consultant.

D. Provide temporary shores, guys, braces, and other supports during erection to keep timber panels secure and in alignment against wind loads, seismic loads, temporary construction loads, and loads equal in intensity to design loads. Any failure to make proper and adequate provisions for stresses during erection shall be solely the responsibility of the Installer.

E. Handle and temporarily support timber panels to prevent surface damage, edge damage, compression, and other effects that might interfere with indicated finish.

F. Install connectors as indicated.

G. Provide moisture barrier at all locations where panels abut concrete or masonry construction. Acceptable barriers include light gauge metal, asphalt-impregnated building paper, closed-cell foam gasket material, saturated felt roll roofing, or 0.1mm thick polyethylene.

H. Provide field finish of panels as specified in Section 099100.

I. Repair damaged surfaces and finishes after completing erection. Replace damaged panels if repairs are not approved by Architect.

J. Site cutting or boring of panels, other than shown on shop drawings, is not permitted without written consent of consultant.

3.3 PROTECTION

A. Protection of panels be coordinated with installer.

B. Do not remove wrappings until they no longer serve a useful purpose, including protection from weather, sunlight, soiling, and damage from Work of other trades.

C. Coordinate wrapping removal with finishing Work. Retain wrapping where it can serve as a painting shield.

D. Slit underside of wrapping to prevent accumulation of moisture inside the wrapping. Do not deface panels

3.4 ERECTION TOLERANCES

A. Connections used may require tighter tolerances as specified below. Supplier and installer responsible to coordinate during shop drawing process.

B. Overall Squareness: For rectangular areas, the corner-to-corner diagonal measurements should not deviate from each other by more than 13mm or 0.25% of the length of the shortest side of the rectangle, whichever is greater.

C. Walls:
   1. Plumbness: 0.25% of wall height (1:400) maximum deviation from plumb measured at any point along the wall.
      a. Position: plus or minus 10mm from theoretical at base.
   2. Floors and Roofs:
      a. Elevation: plus or minus 2mm from theoretical.

3.5 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements, for additional requirements.

B. Provide manufacturer's field representative to inspect installed work of this Section

END OF SECTION

SECTION 06 16 00 - SHEATHING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall sheathing.
2. Parapet sheathing.
3. Composite nail base insulated roof sheathing.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for plywood backing panels.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Wall sheathing.
2. Composite nail base insulated roof sheathing.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Stack panels flat with spacers beneath and between each bundle to provide air circulation. Protect sheathing from weather by covering with waterproof sheeting, securely anchored. Provide for air circulation around stacks and under coverings.

PART 2 - PRODUCTS

2.1 WOOD PANEL PRODUCTS

A. Thickness: As needed to comply with requirements specified, but not less than thickness indicated.

B. Factory mark panels to indicate compliance with applicable standard.

2.2 WALL SHEATHING

A. Plywood Sheathing, Walls: Either DOC PS 1 or DOC PS 2, Exterior sheathing.

1. Span Rating: Not less than 16/0.
2. Nominal Thickness: Not less than 3/4 inch.

B. Glass-Mat Gypsum Sheathing, Walls: ASTM C1177/C1177M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Certainteed; SAINT-GOBAIN.

    b. Continental Building Products Inc.

    c. Georgia-Pacific Gypsum LLC.
    d. USG Corporation.

2. Type and Thickness: Regular, 1/2 inch thick.
3. Size: 48 by 96 inches for vertical installation.

2.3 PARAPET SHEATHING

A. Plywood Sheathing, Parapets: Either DOC PS 1 or DOC PS 2, Exterior sheathing.

1. Span Rating: Not less than 16/0.
2. Nominal Thickness: Not less than 3/4 inch.

B. Glass-Mat Gypsum Sheathing, Parapets: ASTM C1177/C1177M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Certainteed; SAINT-GOBAIN.
    b. Gold Bond Building Products, LLC provided by National Gypsum Company.
    c. USG Corporation.

2. Type and Thickness: Regular, 1/2 inch thick.
3. Size: 48 by 96 inches for vertical installation.

2.4 COMPOSITE NAIL BASE INSULATED ROOF SHEATHING

A. Oriented-Strand-Board-Surfaced, Polyisocyanurate-Foam Sheathing: ASTM C1289, Type V with DOC PS 2, Exposure 1 oriented strand board on one face.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Hunter Panels.
    b. Johns Manville; a Berkshire Hathaway company.
    c. Rmax, Inc.
    d. The Dow Chemical Company.

2. Polyisocyanurate-Foam Thickness: 3-1/2 inches, R-Value 18 min.
3. Oriented-Strand-Board Nominal Thickness: 5/8 inch.

2.5 FASTENERS

A. General: Provide fasteners of size and type indicated that comply with requirements specified in this article for material and manufacture.

1. For parapet wall sheathing, provide fasteners of Type 304 stainless steel.

B. Screws for Fastening Wood Structural Panels to Cold-Formed Metal Framing: ASTM C954, except with wafer heads and reamer wings, length as recommended by screw manufacturer for material being fastened.

C. Screws for Fastening Gypsum Sheathing to Cold-Formed Metal Framing: Steel drill screws, in length recommended by sheathing manufacturer for thickness of sheathing to be attached.

1. For steel framing less than 0.0329 inch thick, use screws that comply with ASTM C1002.
2. For steel framing from 0.033 to 0.112 inch thick, use screws that comply with ASTM C954.

PART 3 - EXECUTION

3.1 INSTALLATION, GENERAL

A. Do not use materials with defects that impair quality of sheathing or pieces that are too small to use with minimum number of joints or optimum joint arrangement. Arrange joints so that pieces do not span between fewer than three support members.

B. Cut panels at penetrations, edges, and other obstructions of work; fit tightly against abutting construction unless otherwise indicated.

C. Securely attach to substrate by fastening as indicated, complying with the following:

1. Table 2304.10.1, "Fastening Schedule," in the ICC's International Building Code.
2. ICC-ES evaluation report for fastener.

D. Coordinate wall and roof sheathing installation with flashing and joint-sealant installation so these materials are installed in sequence and manner that prevent exterior moisture from passing through completed assembly.

E. Do not bridge building expansion joints; cut and space edges of panels to match spacing of structural support elements.

F. Coordinate sheathing installation with installation of materials installed over sheathing so sheathing is not exposed to precipitation or left exposed at end of the workday when rain is forecast.

3.2 INSTALLATION OF GYPSUM SHEATHING

A. Comply with GA-253 and with manufacturer's written instructions.

1. Fasten gypsum sheathing to wood framing with [nails] [or] [screws].
2. Fasten gypsum sheathing to cold-formed metal framing with screws.
3. Install panels with a 3/8-inch gap where non-load-bearing construction abuts structural elements.
4. Install panels with a 1/4-inch gap where they abut masonry or similar materials that might retain moisture, to prevent wicking.

B. Apply fasteners so heads bear tightly against face of sheathing, but do not cut into facing.

C. Horizontal Installation: Install sheathing with V-grooved edge down and tongue edge up. Interlock tongue with groove to bring long edges in contact with edges of adjacent panels without forcing. Abut ends over centers of studs, and stagger end joints of adjacent panels not less than one stud spacing. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

D. Vertical Installation: Install vertical edges centered over studs. Abut ends and edges with those of adjacent panels. Attach at perimeter and within field of panel to each stud.

1. Space fasteners approximately 8 inches o.c. and set back a minimum of 3/8 inch from edges and ends of panels.
2. For sheathing under stucco cladding, panels may be initially tacked in place with screws if overlying self-furring metal lath is screw-attached through sheathing to studs immediately after sheathing is installed.

E. Seal sheathing joints in accordance with sheathing manufacturer's written instructions.

1. Apply elastomeric sealant to joints and fasteners and trowel flat. Apply sufficient amount of sealant to completely cover joints and fasteners after troweling. Seal other penetrations and openings.
2. Apply glass-fiber sheathing tape to glass-mat gypsum sheathing joints and apply and trowel sealant to embed entire face of tape in sealant. Apply sealant to exposed fasteners with a trowel so fasteners are completely covered. Seal other penetrations and openings.

3.3 FIELD QUALITY CONTROL

A. ABAA Quality Assurance Program: Perform examinations, preparation, installation, testing, and inspections under ABAA's Quality Assurance Program.

B. Testing and Inspecting Agency: Owner will engage a qualified testing agency to perform tests and inspections.

C. Inspections: Air-barrier and water-resistant glass-mat gypsum sheathing, accessories, and installation are subject to inspection for compliance with requirements. Inspections may include the following:

1. Continuity of air-barrier system has been achieved throughout the building envelope with no gaps or holes.
2. Laps in strips and transition strips have complied with minimum requirements and have been shingled in the correct direction (or mastic has been applied on exposed edges), with no fishmouths.
3. Termination mastic has been applied on cut edges.
4. Strips and transition strips have been firmly adhered to substrate.
5. Compatible materials have been used.
6. Transitions at changes in direction and structural support at gaps have been provided.
7. Connections between assemblies (sheathing and sealants) have complied with requirements for cleanliness, surface preparation and priming, structural support, integrity, and continuity of seal.
8. All penetrations have been sealed.

D. Air barriers will be considered defective if they do not pass tests and inspections.

E. Repair damage to air barriers caused by testing; follow manufacturer's written instructions.

F. Prepare test and inspection reports.

END OF SECTION 06 16 00

SECTION 06 18 00 - GLUED-LAMINATED CONSTRUCTION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Design and construction using structural glued-laminated timber. Work shall include, but not be limited to the following items:

1. Framing members.
2. Anchoring and fastening devices.
3. Wood treatment.

B. Dimensional lumber items associated with glued-laminated timber framing is specified in Division 06.

C. Structural notes indicated on the drawings regarding glued-laminated construction shall be considered a part of this specification.

1.2 RELATED WORK

A. Pertinent Sections of Division 01.

B. Section 06 10 00 - Rough Carpentry.

C. Section 06 15 23 Cross-Laminated Timber Panels .

1.3 REFERENCES

A. Codes and Standards: Comply with the provisions of the following codes, specifications, and standards, except where more stringent requirements are shown or specified. Where any provision of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1. AITC 108 - Standard for Heavy Timber Construction.
2. AITC 109 - Standard for Preservative Treatment of Structural Glued Laminated Timber.
3. AITC 110 - Standard Appearance Grades for Structural Glued Laminated Timber.
4. AITC 111 - Recommended Practice for Protection of Structural Glued Laminated Timber During Transit, Storage and Erection.
5. AITC 117 - Standard Specification for Structural Glued Laminated Timber of Softwood Species.
6. AITC - Timber Construction Manual.
7. ANSI A190.1 - Standard for Wood Products - Structural Glued Laminated Timber.
8. ASTM A36 - Standard Specification for Carbon Structural Steel.
9. ASTM A123 - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products.
10. ASTM A153 - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware.
11. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60,000 PSI Tensile Strength.
12. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts.

13. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
14. ASTM A1011 - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength.
15. ASTM D245 - Standard Practice for Establishing Structural Grades and Related Allowable Properties for Visually Graded Lumber.
16. ASTM D3737 - Standard Practice for Establishing Allowable Properties for Structural Glued Laminated Timber (Glulam).
17. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.
18. AWPA M4 - Standard for the Care of Preservative-Treated Wood Products.
19. AWPA P5 - Standard for Waterborne Preservatives.
20. AWPA T1 - Use Category System: Processing and Treatment Standard.
21. AWPA U1 -Use Category System: User Specification for Treated Wood.
22. NDS - National Design Specification for Wood Construction with Commentary.
23. NDS Supplement - National Design Specification Values for Wood Construction.
24. NIST PS 20 - Voluntary Product Standard - American Softwood Lumber Standard.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. The glued-laminated timber manufacturer shall be an AITC or APA-EWS licensed firm complying with AITC A190.1.
2. Shall have not less than five (5) years of continuous experience in manufacturing glued-laminated structural units.
3. Factory mark each piece of structural glued-laminated timber with AITC Quality Mark or APA-EWS trademark. Place mark on surfaces that will not be exposed in the final installed condition.

B. Design Qualifications:

1. Structural Performance: Structural glued-laminated timber and connectors shall withstand the effects of structural loads without exceeding allowable design working stresses listed in AITC 117 or determined according to ASTM D3737 and acceptable to the Authorities Having Jurisdiction.

1.5 SUBMITTALS

A. Product Data: For each type of product indicated.

1. Include data on lumber, adhesives, fabrication and protection.
2. Include connector installation instructions.
3. Wood treatment data as follows, including chemical treatment manufacturer's warranty and instructions for handling, storing, installing, and finishing treated materials:

    a. For each type of preservative-treated wood product, include certification by treating plant stating type of preservative solution and pressure process used, net amount of preservative retained, and compliance with applicable standard.
    b. For waterborne-treated products, include statement that moisture content of treated materials was reduced to levels indicated before shipment to the project site.

B. Shop Drawings:

1. Show layout of structural glued-laminated timber system and full dimensions of each member.

a. Indicate species and laminating combination, adhesive type, and other variables in required work.
b. Include large scale details of connections.

C. Samples: Provide full width and depth, 24 inches long, showing the range of variation to be expected in appearance of structural glued-laminated timber, including variations due to specified treatment.

D. Samples: Apply specified factory finish to three sides of half-length of each sample.

E. Certificates of Conformance: Issued by a qualified testing and inspecting agency indicating structural glued-laminated timber complies with requirements in AITC A190.1.

F. Material Certificates: For preservative-treated wood products, from manufacturer. Indicate type of preservatives used and net amount of preservative retained.

G. Research / Evaluation Reports: For structural glued-laminated timber, from ICC-ES.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with provisions of AITC 111.

B. All members shall be delivered, piled, and handled so as to protect them from warping due to excessive moisture or damage. Members shall be stored off the ground and individually wrapped using a plastic-coated paper covering with water-resistant seams.

C. All installed exposed members shall be protected from moisture until covered with subsequent roofing materials or flashings.

PART 2 - PRODUCTS

2.1 STRUCTURAL GLUED-LAMINATED TIMBER

A. General: Provide structural glued-laminated timber that complies with AITC A190.1 and AITC 117 or research / evaluation reports acceptable to authorities having jurisdiction.

1. Provide structural glued-laminated timber made from single species.
2. Provide structural glued-laminated timber made from solid lumber laminations; do not use laminated veneer lumber.
3. Provide structural glued-laminated timber made with wet-use adhesive complying with AITC A190.1.

B. Species and Grades for Structural Glued-Laminated Timber: Provide grades needed to comply with structural properties, combination symbols and beam stress classifications indicated on drawings.

C. Appearance Grade: Premium grade at all columns and Architectural grade at all beams, complying with AITC 110.

1. For Premium and Architectural appearance grades, fill voids as required by AITC 110.
2. For Premium appearance grade, use clear wood inserts, of matching grain and color, for filling voids and knot holes more than 1/4 inch wide.

D. Penetrating Sealer: Manufacturer's standard, transparent, penetrating wood sealer compatible with indicated finish.

E. Preservative Treatment: Glued-laminated timber shall comply with AWPA U1.

1. Use preservative solution without substances that may interfere with application of indicated finishes.
2. Do not incise structural glued-laminated timber or wood used to produce structural glued-laminated timber.

2.2 TIMBER CONNECTORS

A. Provide connectors as detailed on the drawings. Basis of design for metal framing anchor products is Simpson Strong-Tie Co. Inc.

B. Materials: Refer to drawings for connection material.:

1. Structural steel shapes, plates, and flat bars complying with ASTM A36.
2. Round steel bars complying with ASTM A575, Grade M1020.
3. Connection material shall comply with "System Performance Requirements" Article section 1.5 and as noted on the drawings.

C. Bolts: Provide 3/4-inch diameter bolts complying with ASTM A307, Grade A; nuts complying with ASTM A563; and, where indicated, flat washers.

D. Finish steel assemblies and fasteners with rust-inhibitive primer, 2-mil dry film thickness.

E. Unless noted otherwise, all timber connections are to be concealed with all holes plugged.

2.3 FABRICATION

A. Shop fabricate for connections to greatest extent possible, including cutting to length and drilling bolt holes.

1. Dress exposed surfaces as needed to remove planning and surfacing marks.

B. Camber: Fabricate horizontal and inclined members of less than 1:1 slope with either circular or parabolic camber equal to 1/500 of span.

C. Where preservative-treated members are indicated, fabricate (cut, drill, surface, and sand) before treatment to greatest extent possible. Where fabrication must be done after treatment, apply a field-treatment preservative to comply with AWPA M4.

1. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

D. Seal Coat: After fabricating, sanding, and end-coat sealing, apply a heavy saturation coat of penetrating sealer on surfaces of each unit, except for preservative-treated wood where treatment included a water repellent.

2.4 FACTORY FINISH

A. Wiped Stain Finish: Manufacturer's standard, dry-appearance, penetrating acrylic stain and sealer; oven dried and resistant to mildew and fungus.

1. Color: As selected by Architect/Engineer from manufacturer's full range.

B. Clear Finish: Manufacturer's standard, two-coat, clear varnish finish; resistant to mildew and fungus.

2.5 MISCELLANEOUS MATERIAL

A. Galvanizing Repair Paint: SSPC-Paint 20 with dry film containing a minimum of 94 percent zinc dust by weight.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates in areas to receive structural glued-laminated timber, with installer present, for compliance with requirements, installation tolerances, and other conditions affecting performance of the work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Beginning of installation means acceptance of existing conditions.

3.2 INSTALLATION

A. General: Erect structural glued-laminated timber true and plumb and with uniform, close-fitting joints. Provide temporary bracing to maintain lines and levels until permanent supporting members are in place.

1. Install structural glued-laminated timber to comply with the shop drawings.
2. Handle and temporarily support glued-laminated timber to prevent surface damage, compression, and other effects that might interfere with indicated finish.
3. Lift with padded slings and protect corners with wood blocking.

B. Cutting: Avoid extra cutting after fabrication. Where field fitting is unavoidable, comply with requirements for shop fabrication.

C. Fit structural glued-laminated timber by cutting and restoring exposed surfaces to match specified surfacing and finishing.

1. Predrill for fasteners using timber connectors as templates.
2. Finish exposed surfaces to remove planning or surfacing marks and to provide a finish equivalent to that produced by machine sanding with No. 120 grit sandpaper.

3. Where preservative-treated members must be cut during erection, apply a field-treatment preservative to comply with AWPA M4.

    a. Use inorganic boron (SBX) treatment for members not in contact with the ground and continuously protected from liquid water.

D. Install timber connectors as indicated.

1. Unless otherwise indicated, install bolts with same orientation within each connection and in similar connections.
2. Install bolts with orientation as indicated or, if not indicated, as directed by the Architect/Engineer.

E. Where beams penetrate through exterior walls, apply waterproof sealer as recommended by the manufacturer.

3.3 ADJUSTING

A. Repair damaged surfaces and finishes after completing erection. Replace damaged structural glued-laminated timber if repairs are not approved by the Architect/Engineer.

3.4 TOLERANCES

A. Framing Members: 1/2 inch maximum from true position.

3.5 PROTECTION

A. Do not remove wrappings on individually wrapped members until they no longer serve a useful purpose, including protection from weather, sunlight, soiling, and damage from work of other trades.

1. Coordinate wrapping removal with finishing work. Retain wrapping where it can serve as a painting shield.

B. Slit underside of wrapping to prevent accumulation of moisture inside the wrapping.

END OF SECTION

SECTION 06 42 16 - FLUSH WOOD PANELING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Flush wood paneling (wood-veneer wall surfacing) (WD-1 and 2).
2. Solid Wood Paneling (WD-3).
3. Fire-retardant-treated materials.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring, blocking, shims, and hanging strips required for installing paneling that is concealed within other construction before paneling installation.

1.3 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements, and other related units of Work specified in other Sections to ensure that paneling can be installed as indicated.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data for fire-retardant treatment from chemical-treatment manufacturer and certification by treating plant that treated materials comply with requirements.

B. Shop Drawings: For flush wood paneling.

1. Include plans, elevations, sections, and attachment details.
2. Show details full size.
3. Show locations and sizes of furring and blocking, including concealed blocking specified in other Sections.
4. For paneling produced from premanufactured sets, show finished panel sizes, set numbers, sequence numbers within sets, and method of cutting panels to produce indicated sizes.
5. For paneling veneered in fabrication shop, show veneer leaves with dimensions, grain direction, exposed face, and identification numbers indicating the flitch and sequence within the flitch for each leaf.

C. Samples: For each exposed product and for each color and finish specified, in manufacturer's or fabricator's standard size.

D. Samples for Verification: For the following:

1. Lumber for Transparent Finish: Not less than 5 inches wide by 12 inches long, for each species and cut, finished on one side and one edge.
2. Veneer-Faced Panel Products for Transparent Finish: 8 by 10 inches, for each species and cut. Include at least one face-veneer seam and finish as specified.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate products similar to those required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Fabricator of products.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Do not deliver paneling until painting and similar operations that might damage paneling have been completed in installation areas. Store paneling in installation areas or in areas where environmental conditions comply with requirements specified in "Field Conditions" Article.

1.7 FIELD CONDITIONS

A. Environmental Limitations with Humidity Control: Do not deliver or install paneling until building is enclosed, wet-work is complete, and HVAC system is operating and will maintain temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during the remainder of the construction period.

B. Field Measurements: Where paneling is indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

1. Locate concealed framing, blocking, and reinforcements that support paneling by field measurements before being enclosed/concealed by construction and indicate measurements on Shop Drawings.

C. Established Dimensions: Where paneling is indicated to fit to other construction, establish dimensions for areas where woodwork is to fit. Provide allowance for trimming at site, and coordinate construction to ensure that actual dimensions correspond to established dimensions.

PART 2 - PRODUCTS

2.1 PANELING, GENERAL

A. Quality Standard: Unless otherwise indicated, comply with the "Architectural Woodwork Standards" for grades of flush wood paneling (wood-veneer wall surfacing) indicated for construction, finishes, installation, and other requirements.

1. The Contract Documents contain requirements that are more stringent than the referenced woodwork quality standard. Comply with requirements of Contract Documents in addition to those of the referenced quality standard.

2.2 FLUSH WOOD PANELING (WOOD-VENEER WALL SURFACING) (WD-1 and 2)

A. Grade: Premium .

B. Wood Species and Cut: White oak, rift sliced. Stained to match Architects Sample.

C. Veneer Matching Method:

1. Adjacent Veneer Leaves: Book match.
2. Within Panel Face: Running match.

D. Panel-Matching Method:

1. Made-to-order, sequence-matched panels within each separate area.

E. Panel Core Construction: Fire-retardant particleboard or fire-retardant MDF.

1. Thickness: As indicated on Drawings.

F. Exposed Panel Edges: Inset solid-wood or wood-veneer matching faces .

G. Panel Reveals: As Indicated on drawings.

H. Fire-Retardant-Treated Paneling: Panels shall consist of wood-veneer and fire-retardant particleboard or fire-retardant, medium-density fiberboard (MDF). Panels shall have a flame-spread index of 25 or less and a smoke-developed index of 450 or less per ASTM E84, and be listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction.

I. Assemble panels by gluing and concealed fastening.

2.3 FLUSH WOOD PANELING (SOLID WOOD WALL SURFACING) (WD-3)

A. Grade: Premium.

B. Wood Species and Cut:

1. WD-3: White Oak, Rift Cut.

a. Size as indicated on drawings.

b. Stained to match Architect's sample for WD-1.

2.4 MATERIALS

A. Materials, General: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.

B. Wood Moisture Content: 5 to 10 percent.

C. Composite Wood Products: Provide materials that comply with requirements of referenced quality standard for each quality grade specified unless otherwise indicated.

1. MDF: ANSI A208.2, Grade 130.

D. Adhesives: Do not use adhesives that contain urea formaldehyde.

2.5 FIRE-RETARDANT-TREATED MATERIALS

A. Fire-Retardant-Treated Materials, General: Where fire-retardant-treated materials are indicated, use materials that are acceptable to authorities having jurisdiction and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.

1. Use treated materials that comply with requirements of referenced quality standard. Do not use materials that are warped, discolored, or otherwise defective.
2. Use fire-retardant-treatment formulations that do not bleed through or otherwise adversely affect finishes. Do not use colorants to distinguish treated materials from untreated materials.
3. Identify fire-retardant-treated materials with appropriate classification marking of qualified testing agency in the form of removable paper label or imprint on surfaces that will be concealed from view after installation.

B. Fire-Retardant-Treated Lumber and Plywood: Products with a flame-spread index of 25 or less when tested according to ASTM E84, with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.

1. Kiln-dry lumber and plywood after treatment to a maximum moisture content of 19 and 15 percent, respectively.
2. For items indicated to receive a stained or natural finish, use organic resin chemical formulation.
3. Mill lumber after treatment within limits set for wood removal that do not affect listed fire-test-response characteristics, using a woodworking shop certified by testing and inspecting agency.
4. Mill lumber before treatment and implement procedures during treatment and drying processes that prevent lumber from warping and developing discolorations from drying sticks or other causes, marring, and other defects affecting appearance of paneling.

C. Fire-Retardant Fiberboard: MDF panels complying with ANSI A208.2, made from softwood fibers, synthetic resins, and fire-retardant chemicals mixed together at time of panel manufacture to achieve flame-spread index of 25 or less and smoke-developed index of 200 or less per ASTM E84.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Panel Source International, Inc.; Pyroblock Platinum
b. SierraPine; Medite FR.

2.6 INSTALLATION MATERIALS

A. Furring, Blocking, Shims, and Hanging Strips: Fire-retardant-treated softwood lumber, kiln-dried to less than 15 percent moisture content.

B. Anchors: Select material, type, size, and finish required for each substrate for secure anchorage. Provide metal expansion sleeves or expansion bolts for post-installed anchors. Use nonferrous-metal or hot-dip galvanized anchors and inserts at inside face of exterior walls.

C. Installation Adhesive: Product recommended by panel fabricator for each substrate for secure anchorage.

2.7 FABRICATION

A. Sand fire-retardant-treated wood lightly to remove raised grain on exposed surfaces before fabrication.

B. Complete fabrication, including assembly, to maximum extent possible, before shipment to Project site. Disassemble components only as necessary for shipment and installation. Where necessary for fitting at site, provide ample allowance for scribing, trimming, and fitting.

1. Notify Architect seven days in advance of the dates and times paneling fabrication will be complete.

C. Shop cut openings, to maximum extent possible, to receive hardware, appliances, plumbing fixtures, electrical work, and similar items. Locate openings accurately and use templates or roughing-in diagrams to produce accurately sized and shaped openings. Sand edges of cutouts to remove splinters and burrs.

2.8 SHOP FINISHING

A. General: Finish paneling at fabrication shop as specified in this Section. Defer only final touchup, cleaning, and polishing until after installation.

B. Preparation for Finishing: Comply with referenced quality standard for sanding, filling countersunk fasteners, sealing concealed surfaces, and similar preparations for finishing paneling, as applicable to each unit of work.

C. Transparent Finish:

1. Grade: Same as item to be finished.
2. Finish: System - 5, conversion varnish .
3. Wash Coat for Closed-Grain Woods: Apply wash-coat sealer to woodwork made from closed-grain wood before staining and finishing.
4. Staining: Match Architect's sample.
5. Open Finish for Open-Grain Woods: Do not apply filler to open-grain woods.
6. Sheen: Satin, 31-45 gloss units measured on 60-degree gloss meter per ASTM D523.

PART 3 - EXECUTION

3.1 PREPARATION

A. Before installation, condition paneling to humidity conditions in installation areas.

B. Before installing paneling, examine shop-fabricated work for completion and complete work as required, including removal of packing and backpriming.

3.2 INSTALLATION

A. Grade: Install paneling to comply with quality standard grade of paneling to be installed.

B. Install paneling level, plumb, true in line, and without distortion. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches. Install with no more than 1/16 inch in 96-inch vertical cup or bow and 1/8 inch in 96-inch horizontal variation from a true plane.

1. For flush paneling with revealed joints, install with variations in reveal width, alignment of top and bottom edges, and flushness between adjacent panels not exceeding 1/32 inch.

C. Anchor paneling to supporting substrate with concealed panel-hanger clips.

1. Do not use face fastening unless covered by trim.

D. Complete finishing work specified in this Section to extent not completed at shop or before installation of paneling. Fill nail holes with matching filler where exposed.

1. Apply specified finish coats, including stains and paste fillers if any, to exposed surfaces where only sealer/prime coats are shop applied.

3.3 ADJUSTING AND CLEANING

A. Repair damaged and defective paneling, where possible, to eliminate defects. Where not possible to repair, replace paneling. Adjust for uniform appearance.

B. Clean paneling on exposed surfaces. Touch up shop-applied finishes to restore damaged or soiled areas.

END OF SECTION 06 42 16

SECTION 07 21 00 - THERMAL INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Extruded polystyrene foam-plastic board insulation.
2. Mineral-wool blanket insulation.
3. Mineral-wool board insulation.
4. Protection Board for foundation insulation.

B. Related Requirements:

1. Section 07 53 23 "Ethylene-Propylene-Diene-Monomer (EPDM) Roofing" for insulation specified as part of roofing construction.
2. Section 09 29 00 "Gypsum Board" for sound attenuation blanket used as acoustic insulation.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.
2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.
3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Maximum flame-spread and smoke-developed indexes less than Class A, 25 and 450 when tested in accordance with ASTM E84.

B. Labeling: Provide identification of mark indicating R-value of each piece of insulation 12 inches and wider in width.

2.2 EXTRUDED POLYSTYRENE FOAM-PLASTIC BOARD INSULATION (XPS)

A. Extruded Polystyrene Board Insulation, Type IV : ASTM C578, Type IV, 25 psi minimum compressive strength; unfaced.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. DiversiFoam Products.
b. Kingspan Insulation LLC.
c. Owens Corning.
d. The Dow Chemical Company.

B. Extruded Polystyrene Board Insulation, Type IV, Drainage Panels : ASTM C578, Type IV, 25 psi minimum compressive strength; unfaced.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. DiversiFoam Products.
b. Owens Corning.
c. The Dow Chemical Company.

2.3 MINERAL-WOOL BLANKET INSULATION

A. Mineral-Wool Blanket Insulation, Unfaced : ASTM C665, Type I (blankets without membrane facing); consisting of fibers; complying with ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. Owens Corning.
c. ROCKWOOL.

2.4 MINERAL-WOOL BOARD INSULATION

A. Mineral-Wool Board Insulation, Types IA and IB, Unfaced <Insert drawing designation>: ASTM C612, Types IA and IB; passing ASTM E136 for combustion characteristics.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Johns Manville; a Berkshire Hathaway company.
b. Owens Corning.
c. ROCKWOOL.

2. Nominal Density: 4 lb/cu. ft..

2.5 INSULATION FASTENERS

A. Adhesively Attached, Spindle-Type Anchors: Plate welded to projecting spindle; capable of holding insulation of specified thickness securely in position with self-locking washer in place.

B. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch- thick galvanized-steel sheet, with beveled edge for increased stiffness, sized as required to hold insulation securely in place, but not less than 1-1/2 inches square or in diameter.

C. Anchor Adhesive: Product with demonstrated capability to bond insulation anchors securely to substrates without damaging insulation, fasteners, or substrates.

D. Insulation Fastener Accessories: Provide double-pointed weld pins, lagging pins, quilting pins, duct liner pins, insulation hangers, specialty washers, special caps, j-hooks, capacitor discharge annular weld pins, capacitor discharge acoustical lagging pins, and other accessory materials that are recommended in writing by insulation fastener manufacturer to produce complete insulation supports.

2.6 ACCESSORIES

A. Insulation for Miscellaneous Voids:

1. Spray Polyurethane Foam Insulation: ASTM C1029, Type II, closed cell, with maximum flame-spread and smoke-developed indexes of 75 and 450, respectively, per ASTM E84.

B. Protection Board for Foundation Insulation:

1. Product: Provide one of the following products: At top of wall locations.

a. Nudo, Inc.; GroundBreaker, Provide 12" width by max. length where exposure is greater than 6 inches.
b. Weather-Bloc Systems; Insul-Guard, Provide 12" width by max. length where foundation exposure is 6 inches or less; provide 16" width by max. length were exposure is greater than 6 inches.

PART 3 - EXECUTION

3.1 PREPARATION

A. Clean substrates of substances that are harmful to insulation, including removing projections capable of puncturing insulation or vapor retarders, or those that interfere with insulation attachment.

3.2 INSTALLATION, GENERAL

A. Comply with insulation manufacturer's written instructions applicable to products, applications and applicable codes.

B. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

C. Install insulation with manufacturer's R-value label exposed after insulation is installed.

D. Extend insulation to envelop entire area to be insulated. Fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

E. Provide sizes to fit applications and selected from manufacturer's standard thicknesses, widths, and lengths. Apply single layer of insulation units unless multiple layers are otherwise shown or required to make up total thickness or to achieve R-value.

3.3 INSTALLATION OF FOUNDATION WALL INSULATION

A. Butt panels together for tight fit.

B. Anchor Installation: Install board insulation on concrete substrates by adhesively attached, spindle-type insulation anchors as follows:

1. Fasten insulation anchors to concrete substrates with insulation anchor adhesive in accordance with anchor manufacturer's written instructions.
2. Space anchors in accordance with insulation manufacturer's written instructions for insulation type, thickness, and application.
3. Apply insulation standoffs to each spindle to create cavity width indicated on Drawings between concrete substrate and insulation.
4. After adhesive has dried, install board insulation by pressing insulation into position over spindles and securing it tightly in place with insulation-retaining washers, taking care not to compress insulation.
5. Where insulation will not be covered by other building materials, apply capped washers to tips of spindles.

C. Adhesive Installation: Install with adhesive or press into tacky waterproofing or dampproofing in accordance with manufacturer's written instructions.

3.4 INSTALLATION OF CAVITY-WALL INSULATION

A. Foam-Plastic Board Insulation: Install pads of adhesive spaced approximately 24 inches o.c. both ways on inside face and as recommended in writing by manufacturer.

1. Fit courses of insulation between[wall ties and other] obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.
3. Supplement adhesive attachment of insulation by securing boards with two-piece wall ties designed for this purpose and specified in Section 04 20 00 "Unit Masonry."

B. Mineral-Wool Board Insulation: Install insulation fasteners 4 inches from each corner of board insulation, at center of board, and as recommended by manufacturer.

1. Fit courses of insulation between[masonry wall ties and other] obstructions, with edges butted tightly in both directions, and with faces flush.
2. Press units firmly against inside substrates.

3.5 INSTALLATION OF INSULATION IN FRAMED CONSTRUCTION

A. Blanket Insulation: Install in cavities formed by framing members in accordance with the following requirements:

1. Use insulation widths and lengths that fill the cavities formed by framing members. If more than one length is required to fill the cavities, provide lengths that will produce a snug fit between ends.
2. Place insulation in cavities formed by framing members to produce a friction fit between edges of insulation and adjoining framing members.
3. Maintain 3-inch clearance of insulation around recessed lighting fixtures not rated for or protected from contact with insulation.
4. For metal-framed wall cavities where cavity heights exceed 96 inches, support unfaced blankets mechanically and support faced blankets by taping flanges of insulation to flanges of metal studs.

B. Miscellaneous Voids: Install insulation in miscellaneous voids and cavity spaces where required to prevent gaps in insulation using the following materials:

1. Detailing Foam Insulation for Voids: Apply in accordance with manufacturer's written instructions.

C. Spray-Applied Cellulosic Insulation: Apply spray-applied insulation in accordance with manufacturer's written instructions.

1. Do not apply insulation until installation of pipes, ducts, conduits, wiring, and electrical outlets in walls is completed and windows, electrical boxes, and other items not indicated to receive insulation are masked.
2. After insulation is applied, make flush with face of studs by using method recommended by insulation manufacturer.

3.6 INSTALLATION OF BOARD INSULATION

A. Install board insulation in accordance with manufacturer's written instructions per project applications and conditions.

3.7 PROTECTION

A. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes.

B. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

END OF SECTION 07 21 00

SECTION 07 42 00 – SOLID PHENOLIC EXTERIOR WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: A drained and back-ventilated rainscreen system designed and tested by panel manufacturer .System to be engineered and fully fabricated by a single manufacturer.

B. The Work of this Section shall include but not be limited to the following:

1. Solid phenolic single-skin panels.
2. Flashing, weather-seals, cover plates and formed metal trim.
3. Miscellaneous anchors, fasteners, adhesives, sealants, and related accessories.

1.2 DEFINITIONS

A. Rainscreen Principle: The cavity behind the outer leaf of the rainscreen is drained and positive back ventilated to promote rapid evaporation of any rainwater deposited on the inner leaf surface. The inner leaf surface should be waterproof and/or breathable by means of a properly installed barrier that is continuous under all other building exterior finishes.

1. Rainscreen System includes:

a. Drained and Ventilated Wall Cladding.
b. Air Barrier on cladding substrate.
c. Flashings to drain water from cavity.

1.3 REFERENCES

A. ASTM:

1. ASTM 509 Air Leakage of Air/Water Barrier, Cavity Ventilation and Water Management.
2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
3. ASTM E119 Fire Resistance of Building Construction and Materials.
4. ASTM G26/G155 Accelerated Weathering.
5. ASTM C297 Bond Strength.
6. ASTM D1037Flexural Strength.
7. ASTM B117 Salt Spray.
8. ASTM D2247 Water Resistance.
9. ASTM E330 Structural Performance.
10. ASTM D1761 Mechanical Fastener Withdrawal Resistance.
11. ASTM C518 Thermal Conductivity.

B. ISO:

1. ISO 4589-2 Oxygen Index.
2. ISO 1183 Density.
3. ISO 527-2 Tensile Strength.
4. ISO 178 Flexural Strength and Flexural Modulus.

C. EN:

1. EN 438-2-29 Resistance to Artificial Weathering.
2. EN 438-2-28 Resistance to UV Light.
3. EN 438-2-17 Dimensional stability at elevated temperature.
4. EN 438-2-15 Resistance to wet conditions.
5. EN 438-2-21 Impact Resistance.
6. EN 438-2-7 Straightness of edge Tolerance.
7. EN 438-2-6 Length width Tolerance.
8. EN 438-2-9 Flatness Tolerance.
9. EN 438-2-5 Thickness Tolerance.

D. NFPA:

1. NFPA 259 Potential Heat of Building Materials.
2. NFPA Multistory Flammability Characteristics.
3. NFPA 268 Ignitability of Exterior Wall Assemblies.
4. NFPA 251 Fire Resistance of Building Construction and Materials.

1.4 SYSTEM DESCRIPTION

A. Performance Requirements: Provide panels that have been manufactured, fabricated and installed to maintain performance criteria stated by manufacturer without defects, damage or failure.

1.5 SUBMITTALS

A. General: Submit listed submittals in accordance with Conditions of the Contract and Division 01 Submittal Procedures Section.

B. Product Data: Submit manufacturer's product data for specified products.

C. Shop Drawings: Submit shop drawings showing layout, profiles and product components, including edge conditions, panel joints, fixture location, anchorage, accessories, finish colors, patterns and textures.

D. Samples: Submit selection and verification samples for finishes, colors and textures.

E. Quality Assurance Submittals: Submit the following:

1. Test Reports: Submit certified test reports showing compliance with specified performance characteristics and physical properties.
2. Certificates:

a. Qualification Certificates: Submit certificate indicating compliance with qualification requirements in Quality Assurance article.

b. Product certificates signed by manufacturer certifying materials comply with specified performance characteristics and criteria and physical requirements.

3. Manufacturer's Instructions: Manufacturer's installation instructions.
4. Manufacturer's Field Reports: Manufacturer's field reports specified herein.

F. Closeout Submittals: Submit the following:

1. Operation and Maintenance Data: Operation and maintenance data for installed products in accordance with Division 1 Closeout Submittals (Maintenance Data and Operation Data) Section. Include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.
2. Warranty: Warranty documents specified herein.

1.6 QUALITY ASSURANCE

A. Qualifications:

1. Manufacturer Qualifications: Manufacturer producing product in ISO 9001 certified facility, capable of providing field service representation during fabrication and approving application method.
2. Fabricator Qualifications: Fabricator must be licensed by the Manufacturer or have experience fabricating Phenolic panel systems for projects of a similar type and scope.
3. Installer Qualifications: Installer shall be approved by the manufacturer and experienced in performing work of similar type and scope.

1.7 DELIVERY, STORAGE & HANDLING

A. General: Comply with Division 01 Product Requirements Sections.

B. Ordering: Comply with manufacturer's ordering instructions and lead time requirements to avoid construction delays.

C. Delivery: Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

D. Storage and Protection: Store materials protected from exposure to harmful weather conditions, at temperature and humidity conditions recommended by manufacturer.

1.8 PROJECT CONDITIONS

A. Field Measurements: Verify actual measurements/openings by field measurements before fabrication; show recorded measurements on shop drawings. Coordinate field measurements and fabrication schedule with construction progress to avoid construction delays.

1.9 WARRANTY

A. Project Warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer's Warranty: Submit, for Owner's acceptance, manufacturer's standard warranty document executed by authorized company official. Manufacturer's warranty is in addition to, and not a limitation of, other rights Owner may have under Contract Documents.

PART 2 - PRODUCTS

2.1 SOLID PHENOLIC WALL PANELS

A. Sole Source Product: Subject to compliance with requirements, provide the following:

1. Manufacturer:Fundermax

a. Product: Max Compact Exterior.
b. Finish/Color: Natural Oak 0125 NT

B. Design Criteria:

1. Panel Thickness: 8 mm.
2. Panel Size: 8 inches high by 96 inches long.
3. Fastening System: Modulo Clip; Exposed fastener system color matched to panels; recommended by manufacturer and capable of attachement to rainscreen attachment system.
4. Orientation: Horizontal.

C. Substitutions: No substitutions permitted.

2.2 ACCESSORIES

A. Provide accessories per drawings and standard manufacturers details.

B. General: Provide manufacturer's rainscreen design components and flashing elements for a complete, weathertight, ventilated wall installation.

C. Venting Starter Strip: Perforated recycled extrusion starter strip configured to serve as vent and drip edge at bottom of wall cladding.

D. Venting Top Strip: Perforated recycled vinvl extrusion closure strip configured to serve as a vent and closure at top of wall cladding.

E. Sealants: Type recommended by manufacturer of rain screen system, meeting requirements of Division 07 Section "Joint Sealants".

F. Flashing and Lap Tapes: Self adhering single and double sided adhesive flashing, lap and transition tapes, as recommended by maufacturer for application.

1. UV- Resistant Black Tape: 35 mil, thick, 4 inch wide exposed open joint tape.
2. Aluminized Tape: 20 mil, 4.5 inch and 9 inch wide, UV stable, moisture-resistant, and self priming flashing and transition tape.

2.3 FABRICATION

A. Fabricate solid phenolic wall panels and accessory items in accordance with manufacturer's recommendations and approved submittals.

B. Fabricate panels to profile indicated.

PART 3 - EXECUTION

3.1 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data, including product technical bulletins, product catalog installation instructions and product carton instructions for installation.

3.2 EXAMINATION

A. Site Verification of Conditions: Verify substrate conditions, which have been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

B. Verify that substrate air and water barrier is properly installed prior to start of panel installation. Notify Contractor and Architect if deficiencies exist and do not proceed until corrections are made.

3.3 INSTALLATION

A. Install solid phenolic wall panels plumb and level and accurately spaced in accordance with manufacturer's recommendations and approved submittals.

B. Fasten solid phenolic wall panels to supporting rainscreen attachment system with color-matched fasteners approved in writing by manufacturer.

C. Accessory Items: Install corner profiles, gaskets and trim with fasteners and adhesive appropriate for use with adjoining construction as indicated on drawings and as recommended by manufacturer.

END OF SECTION 07 42 00

SECTION 07 42 13.19 - INSULATED METAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Laminated-insulation-core metal wall panels.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Laminated-insulation-core metal wall panels.

B. Product Data Submittals: For each product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

C. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.
2. Accessories: Include details of the flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches.

D. Samples for Verification: For each type of exposed finish, prepared on Samples of size indicated below.

1. Metal Panels: 12 inches long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Field quality-control reports.

D. Sample Warranties: For special warranties.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.7 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.8 COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.9 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing in accordance with ASTM E72:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested in accordance with ASTM E283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft..

C. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft..

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F, ambient; 180 deg F, material surfaces.

E. Fire-Test-Response Characteristics: Provide metal wall panels and system components with the following fire-test-response characteristics, as determined by testing identical panels and system components per test method indicated below by UL or another testing and inspecting agency acceptable to authorities having jurisdiction. Identify products with appropriate markings of applicable testing agency.

1. Fire-Resistance Characteristics: Provide materials and construction tested for fire resistance per ASTM E119.

2. Intermediate-Scale Multistory Fire Test: Tested mockup, representative of completed multistory wall assembly of which wall panel is a part, complies with NFPA 285 for test method and required fire-test-response characteristics of exterior non-load-bearing wall panel assemblies.
3. Radiant Heat Exposure: No ignition when tested in accordance with NFPA 268.
4. Potential Heat: Acceptable level when tested in accordance with NFPA 259.
5. Surface-Burning Characteristics: Provide wall panels with a flame-spread index of 25 or less and a smoke-developed index of 450 or less, per ASTM E84.

2.2 LAMINATED-INSULATION-CORE METAL WALL PANELS

A. General: Provide factory-formed and -assembled metal wall panels fabricated from two metal facing sheets and core material laminated or otherwise securely bonded to facing sheets during fabrication without use of contact adhesives, and with joints between panels designed to form weathertight seals. Include accessories required for weathertight installation.

B. Shiplap-Edge, Laminated-Insulation-Core Metal Wall Panels : Formed with flush exterior panel facing and with shiplap edges; designed for sequential installation by mechanically attaching panels to supports using concealed clips and fasteners; with factory-applied gaskets in side laps.

1. Manufacturers: Subject to compliance with requirements, provide products by the following: Basis of Design:

    a. Kingspan Insulated Panels, Inc.; QuadCore KS Series; Azteco.

2. Aluminum Sheet: Fabricate panel with exterior and interior facings of same material and thickness. Provide facings of aluminum coil-coated sheet, ASTM B209, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

    a. Thickness: 0.032 inch.
    b. Surface: Smooth, flat finish.
    c. Exterior Finish: Three-coat fluoropolymer .

        1) Color: Custom Color to Match Architect's samples.

    d. Interior Finish: Siliconized polyester.

        1) Color: Custom Color to Match Architect's samples.

3. Panel Width: 30 inches.
4. Orientation: Vertical.
5. Reveal: 1/8 inch.
6. Core Material: Manufacturers' standard.
7. Clips: Manufacturer's standard one piece, formed from stainless steel.
8. Gaskets: Extruded, dry seal silicone.
9. Panel Thickness: 3.0 inches.

2.3 MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C645, cold-formed, metallic-coated steel sheet, ASTM A653/A653M, G90 coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closures: Provide closures at eaves and rakes, fabricated of same metal as metal panels.
2. Backing Plates: Provide metal backing plates at panel end splices, fabricated from material recommended by manufacturer.
3. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, parapet caps, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant type recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch wide and 1/8 inch thick.
2. Joint Sealant: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C1311.

2.4 FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.

a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal wall panel manufacturer for application but not less than thickness of metal being secured.

2.5 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Aluminum Panels and Accessories:

1. Three-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in both color coat and clear topcoat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal wall panel manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal wall panel manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages in accordance with ASTM C754 and metal panel manufacturer's written recommendations.

3.3 INSTALLATION OF METAL PANELS

A. General: Install metal panels in accordance with manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.
2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.
5. Install flashing and trim as metal panel work proceeds.
6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Align bottoms of metal panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
8. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.
2. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Joint Sealers: Install gaskets, joint fillers, and sealants where indicated and where required for weathertight performance of metal wall panel assemblies. Provide types of gaskets, fillers, and sealants indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal wall panel manufacturer.

1. Seal metal wall panel end laps with double beads of tape or sealant, full width of panel. Seal side joints where recommended by metal wall panel manufacturer.
2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.4 INSTALLATION OF INSULATION-CORE METAL WALL PANELS

A. General: Apply continuous ribbon of sealant to panel joint on concealed side of insulated metal wall panels as vapor seal; apply sealant to panel joint on exposed side of panels for weather seal.

1. Fasten foamed-insulation-core metal wall panels to supports with fasteners at each lapped joint at location and spacing and with fasteners recommended by manufacturer.
2. Apply panels and associated items true to line for neat and weathertight enclosure. Avoid "panel creep" or application not true to line.
3. Provide metal-backed washers under heads of exposed fasteners on weather side of insulated metal wall panels.
4. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
5. Provide sealant tape at lapped joints of insulated metal wall panels and between panels and protruding equipment, vents, and accessories.
6. Apply a continuous ribbon of sealant tape to panel side laps and elsewhere as needed to make panels weathertight.
7. Apply snap-on battens to exposed-fastener, insulated-core metal wall panel seams to conceal fasteners.

B. Laminated-Insulation-Core Metal Wall Panels:

1. Shiplap-Edge Panels: Mechanically attach wall panels to supports using staggered, concealed side clips engaging tongue-and-groove panel edges. Install clips to supports with self-tapping fasteners.

a. Horizontal Joints: Maintain reveal joint of consistent width.
b. Vertical Joints: Maintain reveal joint of consistent width.

2. Framed-Edge Panels: Mechanically attach wall panels through integral, extruded edge members to supports using self-tapping fasteners. Seal joints with manufacturer's standard gaskets.

C. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, copings, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

D. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.5 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect completed metal wall panel installation, including accessories.

C. Metal wall panels will be considered defective if they do not pass test and inspections.

D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.6 CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed, unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. After metal panel installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

C. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13.19

SECTION 07 42 13.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Metal composite material (MCM) panels.
2. Metal composite material (MCM) system.

1.2 DEFINITIONS

A. MCM: Metal composite material; cladding material formed by joining two thin metal skins to polyethylene or fire-retardant core and bonded under precise temperature, pressure, and tension.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Owner's insurer if applicable, MCM system Installer, MCM system manufacturer's representative, and installers whose work interfaces with or affects MCM panels, including installers of doors, windows, and louvers.
2. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
3. Review methods and procedures related to MCM system installation, including manufacturer's written instructions.
4. Examine support conditions for compliance with requirements, including alignment between and attachment to structural members.
5. Review flashings, special siding details, wall penetrations, openings, and condition of other construction that affect MCM system.
6. Review governing regulations and requirements for insurance, certificates, and tests and inspections if applicable.
7. Review temporary protection requirements for system assembly during and after installation.
8. Review procedures for repair of panels damaged after installation.
9. Document proceedings, including corrective measures and actions required, and furnish copy of record to each participant.

1.4 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel, system, and accessory.

1. Metal composite material (MCM) panels.
2. Metal composite material (MCM) system.

B. Shop Drawings:

1. Include fabrication and installation layouts of MCM system; details of edge conditions, joints, panel profiles, corners, anchorages, attachment assembly, trim, flashings, closures, accessories, and special details.
2. Accessories: Include details of flashing, trim, and anchorage, at a scale of not less than 1-1/2 inches per 12 inches.
3. Provide signed and sealed drawings, by a qualified design professional in Project jurisdiction, of MCM system showing compliance with performance requirements and design criteria identified for this Project.

C. Samples for Verification: For each type of MCM panel and MCM system required, with factory-applied color finishes.

1. MCM Panel: One sample, Manufacturers' standard size.
2. MCM System: 12 inches long by actual panel width, fabricated into panel systems indicated. Include fasteners, closures, and other MCM panel accessories.

D. Delegated Design Submittals: For MCM system, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.5 INFORMATIONAL SUBMITTALS

A. Test and Evaluation Reports:

1. Product Test Reports: For each MCM panel MCM system, for tests performed by qualified testing agency or by manufacturer and witnessed by a qualified testing agency.

a. MCM Panel Manufacturer's Material Test Reports: Certified test reports showing compliance with specific performance or third-party listing documenting compliance in accordance with the IBC.
b. Fabricator's MCM System Test Reports: Certified test reports showing system compliance with specific performance or third-party listing documenting compliance in accordance with the IBC.

1) Dry or Wet Seal System: Tested to AAMA 501.1.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For MCM panels.

B. Warranty Documentation:

1. Manufacturers' special warranties.
2. Installer's special warranties.

1.7 QUALITY ASSURANCE

A. Manufacturer Qualifications: Minimum 5 years' experience.

B. Fabricator Qualifications: Approved by MCM panel manufacturer.

C. Installer Qualifications: Entity that employs installers and supervisors who are trained and approved by MCM system manufacturer.

D. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.

1.8 MOCKUPS

A. Build mockups to set quality standards for fabrication and installation.

1. Build mockup , including corner, supports, attachments, and accessories.
2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Owner specifically approves such deviations by Change Order.
3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.9 DELIVERY, STORAGE, AND HANDLING

A. Deliver components, MCM panels, and other manufactured items so as not to be damaged or deformed. Package MCM panels for protection during transportation and handling.

B. Unload, store, and erect MCM panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack MCM panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store MCM panels to ensure dryness, with positive slope for drainage of water. Do not store MCM panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on MCM panels during installation.

1.10 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of MCM panels to be performed in accordance with manufacturers' written instructions and warranty requirements.

1.11 COORDINATION

A. Coordinate MCM panel installation with rain drainage work, flashing, trim, construction of soffits, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.12 WARRANTY

A. Panel Integrity Warranty: Manufacturer agrees to repair or replace components of MCM panels that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.
b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: Minimum 10 years from date of Substantial Completion.

B. Panel Finish Warranty: Manufacturer agrees to repair finish or replace MCM panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

C. MCM System Warranty: System manufacturer's standard form in which manufacturer agrees to repair or replace components of MCM systems that fail in materials or workmanship within specified warranty period.

1. Warranty Period: Minimum Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design MCM system.

B. Structural Performance: MCM systems to withstand the effects of the following loads, based on testing in accordance with ASTM E330/E330M:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.
3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

C. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested in accordance with ASTM E283/E283M at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

D. Water Penetration under Static Pressure: No water penetration when tested in accordance with ASTM E331 at the following test-pressure difference:

1. Test-Pressure Difference: 6.24 lbf/sq. ft..

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

F. Fire-Resistance Ratings: Comply with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from listings of another qualified testing agency.

G. Fire Propagation Characteristics: MCM system passes NFPA 285 testing.

2.2 METAL COMPOSITE MATERIAL (MCM) WALL PANELS

A. Metal Composite Material (MCM) Wall Panels: Provide MCM panels fabricated from two metal facings bonded to a solid, extruded thermoplastic core.

1. Manufacturers: Subject to compliance with requirements, provide products by the following: Basis of Design: Alucobond Plus

a. ALUCOBOND; 3A Composites USA, Inc.
b. Arconic.

2. Core: FR.
3. Panel Thickness: 0.157 inch.
4. Bond Strength: 22.5 in-lb/in. when tested for bond integrity in accordance with ASTM D1781.
5. Fire Performance: Flame-spread index less than 75 and smoke-developed index less than 450, in accordance with ASTM E84 or UL 723.

B. MCM Panel Materials:

1. Aluminum-Faced Panels <Insert drawing designation>: ASTM B209/B209M alloy as standard with manufacturer, temper as required to suit finish and forming operations with 0.020-inch- thick, aluminum sheet facings.

a. Exterior Finish: Color anodized Black.

2.3 METAL COMPOSITE MATERIAL (MCM) SYSTEM

A. Dry-Seal Barrier MCM System: Provide factory-formed and -assembled, MCM panels formed into profile for dry-seal barrier system installation. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Citadel Architectural Products, Inc.
    b. Coated Metals Group.
    c. East Coast Metal Systems.
    d. Fairfield Metal, LLC.
    e. MillerClapperton.
    f. NOW Specialties, Inc.
    g. Sobotec.

B. System Panel Depth: As indicated on drawings.

C. Attachment Assembly Components: Manufacturer's standard formed from extruded aluminum.

D. Labeling: Comply with labeling requirement of applicable building code.

2.4 ACCESSORIES

A. Metal Subframing and Furring: ASTM C955 cold-formed, metallic-coated steel sheet ASTM A653/A653M, G90 hot-dip galvanized coating designation or ASTM A792/A792M, Class AZ50 aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of MCM system.

B. System Accessories: Provide components required for a complete, weathertight wall system including trim, copings, fasciae, mullions, sills, corner units, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of MCM panels unless otherwise indicated.

C. Flashing and Trim: Provide flashing and trim formed from same material as MCM panels as required to seal against weather and to provide finished appearance. Locations include, but are not limited to, bases, drips, sills, jambs, corners, endwalls, framed openings, rakes, fasciae, soffits, reveals, and fillers. Finish flashing and trim with same finish system as adjacent MCM panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Use gasketed or approved coated fasteners between dissimilar metals.

1. Aluminum Panels: Use aluminum or stainless steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.
2. Provide exposed fasteners with heads matching color of MCM panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: ASTM C920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in MCM panels and remain weathertight; and as recommended in writing by MCM system manufacturer.

2.5 FABRICATION

A. Fabricate and finish MCM panels at the factory, by panel manufacturer's standard procedures and processes, as necessary to fulfill indicated panel performance requirements demonstrated by laboratory testing.

B. Shop-fabricate MCM systems and accessories by fabricator's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with requirements of MCM panel manufacturer, of indicated system profiles, and with dimensional and structural requirements.

1. Fabricate panels to dimensions indicated on Drawings based on an assumed design temperature of 70 deg F. Allow for ambient temperature range at time of fabrication.
2. Formed MCM panel lines, breaks, and angles to be sharp and straight, with surfaces free from warp or buckle.
3. Fabricate panels with sharply cut edges and no displacement of face sheet or protrusion of core.
4. Fabricated Panel Tolerances: Shop-fabricate panels to sizes and joint configurations indicated on Drawings.

    a. Width: Plus or minus 0.079 inch at 70 deg F.
    b. Length: Plus or minus 0.079 inch at 70 deg F.
    c. Squareness: Plus or minus 0.079 inch at 70 deg F.

5. Fabricate MCM panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.
6. Attach routed-and-returned panel flanges to perimeter extrusions or panel clips with manufacturer's standard fasteners.

C. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's written instructions and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil-canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Sealed Joints: Form non-expansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
4. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
5. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal manufacturer.

    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal manufacturer for application, but not less than thickness of metal being secured.

2.6 FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Anodized Aluminum Finish: Color in accordance with AAMA 611, AA-M12C22A41, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, MCM system supports, and other conditions affecting performance of the Work.

1. Examine wall framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by MCM system manufacturer.
2. Examine wall sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by MCM system manufacturer.

a. Verify that air- or water-resistive barriers have been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and assemblies penetrating MCM system to verify actual locations of penetrations relative to seam locations of MCM panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF MCM SYSTEM

A. General: Install MCM system in accordance with system manufacturer's written instructions in orientation, sizes, and locations indicated on Drawings. Install panels perpendicular to supports unless otherwise indicated. Anchor MCM system securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving MCM system.
2. Flash and seal MCM system at perimeter of all openings. Fasten with self-tapping screws.
3. Install screw fasteners in predrilled holes.
4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Install flashing and trim as MCM system work proceeds.
6. Align bottoms of MCM panels and fasten with blind rivets, bolts, or self-tapping screws. Fasten flashings and trim around openings and similar elements with self-tapping screws.
7. Provide weathertight escutcheons for all items penetrating system.
8. Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by MCM system manufacturer.
9. Attach MCM panels to supports at locations, spacings, and with fasteners recommended by manufacturer to meet listed performance requirements.

B. Attachment Assembly, General: Install attachment assembly required to support MCM panels and to provide a complete weathertight wall system, including tracks, drainage channels, anchor channels, perimeter extrusions, and panel clips.

1. Install subframing, furring, and other panel support members and anchorages in accordance with ASTM C955.
2. Install support system at locations, at spacings, and with fasteners recommended by MCM system manufacturer to meet listed performance requirements.

C. Dry-Seal MCM System: Attach MCM panels by interlocking panel clips into tracks in a sequential series.

1. Seal horizontal and vertical joints between adjacent MCM panels with manufacturer's standard gaskets.

D. Install panels to allow individual panels to "free float" and be installed and removed without disturbing adjacent panels.

E. Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install accessory components required for a complete MCM system assembly including trim, copings, corners, seam covers, flashings, sealants gaskets, fillers, closure strips, and similar items. Provide types indicated by MCM system manufacturer.

F. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling and tool marks and that is true to line and levels indicated, with exposed edges folded back to form hems. Install trim to fit substrates and to result in waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 ft. with no joints allowed within 24 inches of corner or intersection. Where lapped expansion provisions cannot be used or would not be sufficiently waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with mastic sealant (concealed within joints).

3.3 INSTALLATION TOLERANCES

A. Shim and align MCM panels within installed tolerance of 1/4 inch in 20 ft., non-accumulative, on level, plumb, and location lines as indicated, and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Water-Spray Test: After installation, test area of assembly as directed by Architect for water penetration in accordance with AAMA 501.2.

C. MCM system will be considered defective if it does not pass test and inspections.

D. Additional tests and inspections, at Contractor's expense, are performed to determine compliance of replaced or additional work with specified requirements.

E. Prepare test and inspection reports.

3.5 CLEANING

A. Remove temporary protective coverings and strippable films as MCM panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of installation, clean finished surfaces as recommended by MCM panel manufacturer. Maintain in a clean condition during construction.

B. After installation, clear weep holes and drainage channels of obstructions, dirt, and sealant.

3.6 PROTECTION

A. Replace MCM panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 07 42 13.23

SECTION 07 42 65 - THERMAL AND AIR BARRIER SYSTEM

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Provide a thermal and air barrier wall system for exterior cold-formed metal wall assemblies. Work includes:

1. Exterior wall insulation panels and accessories.
2. Rainscreen attachment system.

1.3 REFERENCES

A. Reference standards:

1. ASTM International (ASTM):

a. ASTM C203-99: Test Methods for Breaking Load and Flexural Properties of Block-Type Thermal Insulation.
b. ASTM C209-98: Test Method for Cellulosic Fiber Insulating Board.
c. ASTM C518-04: Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus.
d. ASTM C1029-05: Specification for Spray-Applied Rigid Cellular Polyurethane Thermal Insulation.
e. ASTM C1289-06: Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board.
f. ASTM D1621-04a: Test Method for Compressive Properties of Rigid Cellular Plastics.
g. ASTM D1622-03: Test Method for Apparent Density of Rigid Cellular Plastics.
h. ASTM D2126-99: Test Method for Response of Rigid Cellular Plastics to Thermal and Humid Aging.
i. ASTM E84-05: Test Method for Surface Burning Characteristics of Building Materials.
j. ASTM E96/E96M-05: Test Method for Water Vapor Transmission of Materials.
k. ASTM E331-00: Test Method for Water Penetration of Exterior Windows, Curtain Walls and Doors by Uniform Static Air Pressure Difference
l. ASTM E 2357-05: Test Method for Determining Air Leakage of Air Barrier Assemblies.

2. Factory Mutual (FM):

a. FM 4880: Class I Wall and Ceiling Panels Building Corner Fire Test.

3. Underwriters Laboratories Inc. (UL):

a. UL 723: Surface Burning Characteristics of Building Materials.

4. National Fire Protection Association (NFPA):

a. NFPA 285-2006: Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.

1.4 SYSTEM DESCRIPTION

A. Furnish and install an exterior wall system that effectively controls thermal, air and water performance and provides continuity of the building envelope enclosure. The system shall include the following:

1. Insulated sheathing secured to the exterior of the metal wall framing assembly.
2. Spray polyurethane foam applied to the interior wall cavity.
3. Joint, penetration, and gap sealing material for sealing component joints, penetrations through the wall system, and gaps between the building envelope enclosure, components, and wall opening frames.

B. Performance Characteristics:

1. Thermal performance:

a. Exterior insulation: ASTM C518, Stabilized R-value of 6.5 per inch of thickness with a minimum six month exposure capability to outdoor elements and 15 year thermal warranty.

b. Interior spray polyurethane foam: ASTM C518, 140 degree F/90 day Aged R-Value (measured at 75 degree F Mean Temp.), for product with a minimum 30 degree F ambient and substrate application temperature is R6.1/inch and 140degreeF/90day Aged R-Value (measured at 75degree F Mean Temp.), for product with a minimum 45 degree F ambient and substrate application temperature is R6.4/inch and 140 degree F/90 day Aged R-Value (measured at 75 degree F Mean Temp.), for product with a minimum 60 degree F ambient and substrate application temperature is R6.1/inch.

1) Core density: ASTM D1622, Minimum 2.0 pcf.
2) Acceptable adhesion to substrate based on specific minimum application temperature.

2. Air barrier performance: When tested in accordance with ASTM E2357, at a test pressure of not less than 6.24 psf, air infiltration shall not exceed 0.04 cfm per square foot (0.2 L/s*m^2) of fixed wall area. Testing should be conducted at positive and negative sustained wind loading of 12.5psf (600Pa) for one-hour duration in each direction, pressure cycling of the wall at 2000 cycles in both the positive and negative direction, ending with wind gust loading at 25psf.

3. Water penetration: When tested in accordance with ASTM E331, no uncontrolled water penetration shall occur at a minimum differential pressure of 6.24 psf for minimum test duration of 2hrs.
4. Mold resistance: Thermal wall and air barrier system components shall provide non-food source for fungal growth.

C. Code Compliance: Exterior wall system and component materials shall comply with the following requirements:

1. Exterior Insulation:

a. Class 1 (25 Flame Spread Index and < 450 Smoke Developed Index) classified at max. thickness per UL 723 criteria or ASTM E84 criteria.
b. Fire Performance Evaluation as a component of an NFPA 285 approved wall assembly per the requirements of the International Building Code.

2. System complies with ASTM E2357-05: Test Method for determining Air Leakage of Air Barrier Assemblies.
3. System complies with NFPA 285 06: Standard method of Testing for the Evaluation of Flammability Characteristics of Exterior Non-Load Bearing Wall Assemblies containing Combustible components using the Intermediate Scale, Multi-Story Test Apparatus.

D. Fire Resistance:

1. System complies with NFPA 285 2006: Standard Method of Test for the Evaluation of Flammability Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components Using the Intermediate-Scale, Multistory Test Apparatus.
2. Fire-stopping measures, per code, should be included at the floor line in the stud cavity when the wall assembly extends beyond the edge of the floor line.

E. All joints, penetrations and gaps of the thermal and air barrier wall system shall be made watertight and air-tight.

1.5 SUBMITTALS

A. Product Data: Submit manufacturer's product data and installation instructions for each thermal wall and air barrier system component product required.

B. Shop Drawings: Submit shop drawings for rainscreen attachment system.

C. At bid submission, provide the following evidence to the Architect:

1. Thermal and Air Barrier Wall System Manufacturer Contractor Accreditation.

a. Acceptable Accreditation Methods:

1) Dow Thermax Wall System Accreditation Program.

D. Reports:

1. Submit Test Reports, summarized by Manufacturer of material(s), verifying qualities of thermal and air barrier wall system components meet or exceed specified requirements.

    a. Include results of ASTM E2357 air barrier system testing and ASTM E331 water penetration tests.
    b. Include mill certificates indicating steel framing sheet complies with the specified requirements.

2. Submit Field Inspection and Test Reports in accordance with Field Quality Control requirements

E. Samples: Submit following material samples.

1. Insulation panel, 12" square.
2. Insulation fasteners/washers and joint flashing tape, one each.

F. Submit Material Safety Data Sheets (MSDS) for thermal and air barrier wall system components.

1.6 QUALITY ASSURANCE

A. Installer Qualifications:

1. The air barrier Installer shall be, during the award period as well as for the duration of the installation, officially recognized as a Certified Installer by the Thermal and Air Barrier Wall System Manufacturer (Certified Installer). The Certified Installer shall carry liability insurance and bonding.
2. Each worker who is installing air barriers must be, or accompanied by, a Certified Installer.
3. Each Certified Installer can supervise a maximum of five workers. The Certified Installer shall be thoroughly trained and experienced in the installation of air barriers of the types being applied. Certified Installers shall perform or directly supervise all air/vapor barrier work on the project.
4. Certified Installers shall have their Thermal and Air Barrier Wall System Manufacturer Certification photo-identification cards in their possession and available on the project site, for inspection upon request.

B. Pre-installation Meeting: Prior to commencement of application, review and document methods and procedures related to installation, including the following:

1. Participants: Authorized representatives of the Contractor, Construction Manager, Owner, Architect, Applicator, and Manufacturer.
2. Review metal wall framing assemblies for potential interference and conflicts and coordinate layout and support provisions for interfacing work.
3. Review insulated sheathing [and spray polyurethane foam] methods and procedures related to application, including manufacturer's installation guidelines, Thermal and Air Barrier Wall System Manufacturer's Certification Program.
4. Review construction schedule and confirm availability of products, applicator personnel, equipment and facilities.
5. Review governing regulatory requirements, and requirements for insurance and certificates as applicable.
6. Review field quality control procedures.

1.7 DELIVERY, STORAGE AND HANDLING

A. Deliver Thermal and Air Barrier Wall System materials in Manufacturer's unopened containers or bundles, fully identified by name, brand, type and grade. Exercise care to avoid damage during unloading, storing and installation.

B. Store, protect and handle Thermal and Air Barrier Wall System materials in accordance with the Manufacturer's recommendations to prevent damage, contamination and deterioration. Keep materials free of dirt and other foreign matter.

1.8 PROJECT CONDITIONS

A. Environmental Requirements: Install Thermal and Air Barrier Wall System work only when weather conditions are in compliance with Manufacturer's specific environmental requirements and conditions will permit work to be performed in accordance with Manufacturer's recommendations and warranty requirements.

1.9 WARRANTY

A. Submit the following warranties:

1. Exterior insulation warranty: Six month exposure and 15 year thermal warranty.
2. Water Resistance: 15 year warranty, when used in conjuction with The Dow Chemical Company "LIQUIDARMOR" flashing and sealant.
3. Rainscreen Attachment System: Manufacturer's 10 year Limited Warranty.

PART 2 - PRODUCTS

2.1 EXTERIOR INSULATION

A. Exterior Insulation: Glass-fiber-reinforced enhanced polyisocyanurate foam core sheathing faced with nominal 4 mil aluminum on one side and 1.25 mil aluminum on the other side, complying with ASTM C1289 and meeting the following physical properties:

1. ASTM C1289 Type 1, Class 2
2. Compressive Strength (ASTM D1621): 25 psi, minimum.
3. Aged Thermal Resistance (ASTM C518, measured at Mean Temp of 75F): R-6.5 at 1 inch RSI 1.06 per 25 mm of thickness with 15 year thermal warranty
4. Flexural Strength (ASTM C203): Minimum 40 psi.
5. Water Absorption (ASTM C209): Maximum.1.0 percent by volume.
6. Water Vapor Permeance (ASTM E96): <0.3 perms.
7. Maximum Use Temperature: 250 degrees F.

B. Sole Source Product: The Dow Chemical Company "THERMAX XARMOR (ci) Exterior Insulation".

1. Panel Size: 4'-0" wide x 8'-0" long, square edge, shiplap (shiplap on thickness of 1.55" and greater) panels.
2. Thickness: As indicated on Drawings.

C. Accessories:

1. Fasteners: Provide insulated sheathing manufacturer's recommended polymer or other corrosion-protective coated steel screw fasteners for anchoring sheathing to metal wall framing. Fastener length and size based on wall sheathing thickness.

    a. Sole Source Product: Wind-lock Corporation "ci-Lock Steel Series Selection" with 1-3/4 inch diameter high-grade plastic washers.

2. Insulation Flashing Tape: Provide insulation manufacturer's recommended board joint tape for sealing joints, seams and veneer tie penetrations through the insulation layer, and at perimeter of door, window, and other openings in insulation board.

    a. Acceptable Products:

        1. The Dow Chemical Company "LIQUIDARMOR CM" spray flashing and sealant; black or dark gray color.

        2. The Dow Chemical Company "LIQUIDARMOR LT" flexible single component silicone flashing; lack or dark gray color.

3. Penetration Filler: Provide insulated sheathing manufacturer's recommended polyurethane foam for sealing penetrations of insulated sheathing.

    a. Sole Source Product: The Dow Chemical Company "Great Stuff Pro Gaps & Cracks" single-component polyurethane insulating foam sealant.
    b. Sole Source Product: The Dow Chemical Company "Great Stuff Pro Window & Door" single-component polyurethane low-pressure foam sealant.

4. Gap Air Infiltration Filler: Two Component, Quick Cure Polyurethane Foam:

    a. Sole Source Product: The Dow Chemical Company "FROTH-PAK Foam Insulation" two component, quick-cure polyurethane foam.

        1) NFPA 286 Approval for Exposed use to the interior of the building without the need for a 15-min thermal barrier.
        2) ASTM E-84 Class A.

5. Flexible polyethylene foam gasketing strip to reduce air infiltration between a concrete foundation and sill plate.

    a. Sole Source Product: The Dow Chemical Company "WEATHERMATE SILL SEAL Foam Gasket".

6. Transition Flashing: DuraGard CM.

2.2 RAINSCREEN ATTACHMENT SYSTEM

A. Cold-rolled steel framing to ASTM A792, 55% AL-ZN, nominal coating weight of 0.5 oz per square foot (total both sides) of gauge and spacing required to comply with cladding panel system's structural requirements as recommended in writing by the cladding manufacturer.

1. Sole Source Manufacturer: Knight Wall Systems.

B. Rainscreen Attachment System Components: In gauge recommended in writing by manufacturer's engineering review. Provide the following types as shown on the Drawings:

1. Vertical Girt: CI-Girt, black color.
2. Vertical Girt: RevealGirt, black color.
3. Manufacturer may substitute, upon approval of shop drawings by Architect, other rail profiles for specific conditions where RevealRail may not suitably address fastening requirements- i.e. PanelRail at cladding perimeter or corners.

C. Accessories:

1. Fasteners: As recommended in writing by manufacturer's engineering review. Provide in black finish to match system components.

2. Thermal Isolating Washers: Knight Wall Systems; ThermaStop Isolator.

3. Galvanic Protection: Utilize tapes and other methods as necessary to separate and prevent contact between dissimilar materials.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and installation conditions for compliance with requirements for installation conditions affecting performance of the work.

1. Verify that metal wall studs, opening framing, bridging, bracing and other framing support members and anchorage have been installed within thermal wall system alignment tolerances and requirements.
2. Verify that substrate surfaces to receive spray polyurethane foam are free of frost, oil, grease, oxidation, dirt, loose paint, loose scale, or other deleterious material that would impair bond.
3. Verify that items required to penetrate the thermal wall system are placed and penetration gaps and cracks are properly sealed before installation of spray polyurethane foam.
4. Do not proceed with thermal and air barrier wall system installation until unsatisfactory conditions have been corrected.

B. Installation constitutes acceptance of existing conditions and responsibility for satisfactory performance.

3.2 INSULATION INSTALLATION

A. Install insulation in accordance with manufacturer's recommendations. Fasten to exterior face of exterior metal stud wall framing using sheathing manufacturer's recommended type and length screw fasteners with washers. Abut panels tightly together and around openings and penetrations.

1. Install sheathing panels horizontally with blue aluminum facing to exterior. Use maximum lengths to minimize number of joints. Locate edge joints parallel to and on framing. Center end joints over supports and stagger in each course. Provide additional framing wherever panel joints do not bear against framing, plates or sill members.
2. Fasten panels to each support with fasteners spaced 12 inches on center at perimeter and 16 inches on center in panel field. Set back perimeter fasteners 3/8" from edges and ends of panel units. Drive fasteners to bear tight and flush with surface of insulation. Do not countersink. Perimeter fasteners can be detailed to bridge the gap of abutting board joints due to the 1.75" diameter of the washer used to fasten the board to the studs. Maximum of two board joints may be bridged per fastener.
3. Install flashing joint tape at end and edge joints with sufficient hand pressure to ensure seal and in accordance with sheathing manufacturer's joint sealing recommendations.
4. Install flashing tape behind wall tie and mechanical fastening assemblies for rain screen claddings.
5. Seal sheathing joints and penetrations of sheathing in accordance with sheathing manufacturer's joint and penetration sealing recommendations.
6. After base flashing, which may include a termination bar running horizontally along the top edge of the flashing, is installed on exterior of insulated sheathing, install WEATHERMATE Flashing 6-inch or 9-inch, with butyl rubber adhesive to the exterior sheathing and lapped over the top edge of the base flashing.
7. Install Spray Polyurethane Foam on interior face of exterior insulation board to a maximum/nominal thickness of 1-1/2 inches. Maintain a continuous layer of spray foam from floor to floor to roof to complete air barrier.

3.3 RAINSCREEN ATTACHMENT SYSTEM INSTALLATION

A. Install rainscreen attachment system plumb and level and accurately spaced in accordance with rainscreen attachment manufacturer's, and cladding manufacturer's, recommendations and approved submittals.

END OF SECTION 07 42 65

SECTION 07 53 23 - ETHYLENE-PROPYLENE-DIENE-MONOMER (EPDM) ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Ethylene-propylene-diene-terpolymer (EPDM) roofing.
2. Accessory roofing materials.
3. Vapor retarder.
4. Roof insulation.
5. Insulation accessories and cover board.
6. Ballast.
7. Walkways.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry for wood nailers, curbs, and blocking.
2. Section 07 62 00 "Sheet Metal Flashing and Trim" for metal roof flashings and counterflashings.
3. Section 07 92 00 "Joint Sealants" for joint sealants, joint fillers, and joint preparation.

1.2 DEFINITIONS

A. Roofing Terminology: Definitions in ASTM D1079 and glossary of NRCA's "The NRCA Roofing Manual: Membrane Roof Systems" apply to work of this Section.

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Roofing Conference: Conduct conference at Project site.

1. Meet with Owner, Architect, Construction Manager, Owner's insurer if applicable, testing and inspecting agency representative, roofing Installer, roofing system manufacturer's representative, deck Installer, air barrier Installer, and installers whose work interfaces with or affects roofing, including installers of roof accessories and roof-mounted equipment.
2. Review methods and procedures related to roofing installation, including manufacturer's written instructions.
3. Review and finalize construction schedule, and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
4. Examine deck substrate conditions and finishes, including flatness and fastening.
5. Review structural loading limitations of roof deck during and after roofing.
6. Review base flashings, special roofing details, roof drainage, roof penetrations, equipment curbs, and condition of other construction that affects roofing system.

7. Review governing regulations and requirements for insurance and certificates if applicable.
8. Review temporary protection requirements for roofing system during and after installation.
9. Review roof observation and repair procedures after roofing installation.

1.4 ACTION SUBMITTALS

A. Product Data:

1. Ethylene-propylene-diene-terpolymer (EPDM) roofing.
2. Accessory roofing materials.
3. Substrate board.
4. Vapor retarder.
5. Roof insulation.
6. Insulation accessories and cover board.
7. Ballast.
8. Walkways.

B. Product Data Submittals:

1. For insulation and roof system component fasteners, include copy of SPRI's Directory of Roof Assemblies listing.

C. Shop Drawings: Include roof plans, sections, details, and attachments to other work, including the following:

1. Layout and thickness of insulation.
2. Base flashings and membrane terminations.
3. Flashing details at penetrations.
4. Tapered insulation, thickness, and slopes.
5. Roof plan showing orientation of steel roof deck and orientation of roof membrane and fastening spacings and patterns for mechanically fastened roofing system.
6. Insulation fastening patterns for corner, perimeter, and field-of-roof locations.
7. Tie-in with air barrier.

D. Samples for Verification: For the following products:

1. Roof membrane and flashings of color required.
2. Walkway pads or rolls, of color required.

E. Wind Uplift Resistance Submittal: For roofing system, indicating compliance with wind uplift performance requirements.

1.5 INFORMATIONAL SUBMITTALS

A. Manufacturer Certificates:

1. Performance Requirement Certificate: Signed by roof membrane manufacturer, certifying that roofing system complies with requirements specified in "Performance Requirements" Article.

    a. Submit evidence of complying with performance requirements.

2. Special Warranty Certificate: Signed by roof membrane manufacturer, certifying that all materials supplied under this Section are acceptable for special warranty.

B. Product Test Reports: For components of roof membrane and insulation, for tests performed by a qualified testing agency, indicating compliance with specified requirements.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For roofing system to include in maintenance manuals.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: A qualified firm that is approved, authorized, or licensed by roofing system manufacturer to install manufacturer's product and that is eligible to receive manufacturer's special warranty.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver roofing materials to Project site in original containers with seals unbroken and labeled with manufacturer's name, product brand name and type, date of manufacture, approval or listing agency markings, and directions for storing and mixing with other components.

B. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.

1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

C. Protect roof insulation materials from physical damage and from deterioration by sunlight, moisture, soiling, and other sources. Store in a dry location. Comply with insulation manufacturer's written instructions for handling, storing, and protecting during installation.

D. Handle and store roofing materials, and place equipment in a manner to avoid permanent deflection of deck.

1.9 FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit roofing system to be installed in accordance with manufacturer's written instructions and warranty requirements.

1.10 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of roofing system that fail in materials or workmanship within specified warranty period.

1. Special warranty includes roof membrane, base flashings, roof insulation, fasteners, cover boards, substrate board, and other components of roofing system.
2. Warranty Period: 30 years from Date of Substantial Completion.

B. Special Project Warranty: Submit roofing Installer's warranty, on warranty form at end of this Section, signed by Installer, covering the Work of this Section, including all components of roofing system such as roof membrane, base flashing, roof insulation, fasteners, cover boards, substrate boards, vapor retarders, and walkway products, for the following warranty period:

1. Warranty Period: Two years from Date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. General Performance: Installed roofing system and base flashings to withstand specified uplift pressures, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Roofing and flashings to remain watertight.

1. Accelerated Weathering: Roof membrane to withstand 2000 hours of exposure when tested in accordance with ASTM G152, ASTM G154, or ASTM G155.
2. Impact Resistance: Roof membrane to resist impact damage when tested in accordance with ASTM D3746, ASTM D4272, or the "Resistance to Foot Traffic Test" in FM Approvals 4470.

B. Material Compatibility: Roofing materials to be compatible with one another and adjacent materials under conditions of service and application required, as demonstrated by roof membrane manufacturer based on testing and field experience.

C. Wind Uplift Resistance: Design roofing system to resist the following wind uplift pressures when tested in accordance with FM Approvals 4474, UL 580, or UL 1897:

1. Zone 1 (Roof Area Field): 24 lbf/sq. ft..
2. Zone 2 (Roof Area Perimeter): 32 lbf/sq. ft..

3. Zone 3 (Roof Area Corners): 44 lbf/sq. ft..

D. Exterior Fire-Test Exposure: ASTM E108 or UL 790, Class A; for application and roof slopes indicated; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

E. Fire-Resistance Ratings: Comply with fire-resistance-rated assembly designs indicated. Identify products with appropriate markings of applicable testing agency.

2.2 ETHYLENE-PROPYLENE-DIENE-TERPOLYMER (EPDM) ROOFING

A. EPDM Sheet: ASTM D4637/D4637M, Type II, scrim or fabric internally reinforced, EPDM sheet with factory-applied seam tape.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Carlisle Syntec Systems.
b. Firestone Building Products.
c. Johns Manville; a Berkshire Hathaway company.
d. Versico Roofing Systems; Carlisle Construction Materials.

2. Thickness: 60 mils, nominal.
3. Exposed Face Color: .

a. Black under Ballasted Roof system.
b. White with exposed membrane system.

4. Source Limitations: Obtain components for roofing system from roof membrane manufacturer.

2.3 ACCESSORY ROOFING MATERIALS

A. General: Accessory materials recommended by roofing system manufacturer for intended use and compatible with other roofing components.

1. Adhesives and sealants shall comply with the following limits for VOC content:

a. Plastic Foam Adhesives: 50 g/L.
b. Gypsum Board and Panel Adhesives: 50 g/L.
c. Multipurpose Construction Adhesives: 70 g/L.
d. Fiberglass Adhesives: 80 g/L.
e. Contact Adhesives: 80 g/L.
f. PVC Welding Compounds: 510 g/L.
g. Other Adhesives: 250 g/L.
h. Single-Ply Roof Membrane Sealants: 450 g/L.
i. Nonmembrane Roof Sealants: 300 g/L.
j. Sealant Primers for Nonporous Substrates: 250 g/L.
k. Sealant Primers for Porous Substrates: 775 g/L.

B. Sheet Flashing: 60-mil- thick EPDM, partially cured or cured, according to application.

C. Prefabricated Pipe Flashings: As recommended by roof membrane manufacturer.

D. Bonding Adhesive: Manufacturer's standard, water based.

E. Seaming Material: Manufacturer's standard, synthetic-rubber polymer primer and 3-inch-wide minimum, butyl splice tape with release film.

F. Lap Sealant: Manufacturer's standard, single-component sealant, colored to match membrane roofing.

G. Water Cutoff Mastic: Manufacturer's standard butyl mastic sealant.

H. Metal Termination Bars: Manufacturer's standard, predrilled stainless steel or aluminum bars, approximately 1 by 1/8 inch thick; with anchors.

I. Metal Battens: Manufacturer's standard, aluminum-zinc-alloy-coated or zinc-coated steel sheet, approximately 1 inch wide by 0.05 inch thick, prepunched.

J. Ballast Retaining Bar: Perimeter securement system consisting of a slotted extruded-aluminum retention bar with an integrated compression fastening strip.

1. Fasteners: 1-1/2-inch stainless steel fasteners with neoprene washers.

K. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening components to substrate, and acceptable to roofing system manufacturer.

L. Miscellaneous Accessories: Provide pourable sealers, preformed cone and vent sheet flashings, molded pipe boot flashings, preformed inside and outside corner sheet flashings, reinforced EPDM securement strips, T-joint covers, in-seam sealants, termination reglets, cover strips, and other accessories.

1. Provide white flashing accessories for white EPDM membrane roofing.

2.4 SUBSTRATE BOARD

A. Glass-Mat Gypsum Roof Substrate Board: ASTM C1177/C1177M, water-resistant gypsum board.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Georgia-Pacific Gypsum LLC.; DensDeck Prime Basis of Design.
b. Gold Bond Building Products, LLC provided by National Gypsum Company.
c. USG Corporation.

2. Thickness: 1/2 inch.
3. Surface Finish: Factory primed.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening substrate panel to roof deck.

2.5 VAPOR RETARDER

A. Rubberized-Asphalt-Sheet Vapor Retarder, Self-Adhering: ASTM D1970/D1970M, polyethylene film laminated to layer of rubberized asphalt adhesive, minimum 40-mil total thickness; maximum permeance rating of 0.1 perm; cold applied, with slip-resisting surface and release paper backing. Provide primer when recommended by vapor retarder manufacturer.

2.6 ROOF INSULATION

A. General: Preformed roof insulation boards manufactured or approved by EPDM roof membrane manufacturer.

B. Polyisocyanurate Board Insulation: ASTM C1289, Type II, Class 3 uncoated glass-fiber facer on both major surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Carlisle Syntec Systems.
    b. Firestone Building Products.
    c. Johns Manville; a Berkshire Hathaway company.
    d. Versico Roofing Systems; Carlisle Construction Materials.

2. Compressive Strength: 25 psi.
3. Size: 48 by 48 inches.
4. Thickness:

    a. Base Layer: 2.6 or 2.8 inches, as recommended by manufacturer.
    b. Upper Layer: As required to achieve R-value.

C. Tapered Insulation: Provide factory-tapered insulation boards.

1. Material: Match roof insulation.
2. Minimum Thickness: 1/4 inch.
3. Slope:

    a. Roof Field: 1/4 inch per foot unless otherwise indicated on Drawings.
    b. Saddles and Crickets: 1/2 inch per foot unless otherwise indicated on Drawings.

2.7 INSULATION ACCESSORIES AND COVER BOARD

A. General: Roof insulation accessories recommended by insulation manufacturer for intended use and compatibility with other roofing system components.

B. Fasteners: Factory-coated steel fasteners and metal or plastic plates complying with corrosion-resistance provisions in FM Approvals 4470, designed for fastening roof insulation[and cover boards] to substrate, and acceptable to roofing system manufacturer.

C. Insulation Adhesive: Insulation manufacturer's recommended adhesive formulated to attach roof insulation to substrate or to another insulation layer as follows:

1. Full-spread, spray-applied, low-rise, two-component urethane adhesive.

D. Glass-Mat Gypsum Cover Board: ASTM C1177/C1177M, water-resistant gypsum substrate.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Georgia-Pacific Gypsum LLC.; Dens Deck Prime.
b. Gold Bond Building Products, LLC provided by National Gypsum Company; DEXcell.
c. USG Corporation; Securock.

2. Thickness: 1/2 inch.
3. Surface Finish: Factory primed.

E. Protection Mat: Woven or nonwoven polypropylene, polyolefin, or polyester fabric; water permeable and resistant to UV degradation; type and weight as recommended by roofing system manufacturer for application.

2.8 BALLAST

A. Aggregate Ballast: Smooth, washed, riverbed gravel or other acceptable smooth-faced stone that withstands weather exposure without significant deterioration and does not contribute to membrane degradation, of the following size:

1. Size: ASTM D448, Size 3, ranging in size from 1 to 2 inches .

B. Rubber Roof Pavers: Interlocking, lightweight rubber units, 24 by 24 by 2-1/4 inches, 6 lb/sq. ft.; with grooved back for four-way drainage, beveled and doweled; and as follows:

2.9 WALKWAYS

A. Flexible Walkways: Factory-formed, nonporous, heavy-duty, slip-resisting, surface-textured walkway pads, approximately 3/16 inch thick and acceptable to roofing system manufacturer.

1. Size: Approximately 36 by 60 inches.
2. Color: Contrasting with roof membrane.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

1. Verify that roof openings and penetrations are in place, curbs are set and braced, and roof-drain bodies are securely clamped in place.
2. Verify that wood blocking, curbs, and nailers are securely anchored to roof deck at penetrations and terminations and that nailers match thicknesses of insulation.
3. Verify that surface plane flatness and fastening of steel roof deck complies with requirements in Section 05 31 00 "Steel Decking."

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean substrate of dust, debris, moisture, and other substances detrimental to roofing system installation in accordance with roofing system manufacturer's written instructions. Remove sharp projections.

B. Prevent materials from entering and clogging roof drains and conductors and from spilling or migrating onto surfaces of other construction. Remove roof-drain plugs when no work is taking place or when rain is forecast.

3.3 INSTALLATION OF ROOFING, GENERAL

A. Install roofing system in accordance with roofing system manufacturer's written instructions, FM Approvals' RoofNav assembly requirements, and FM Global Property Loss Prevention Data Sheet 1-29.

B. Complete terminations and base flashings and provide temporary seals to prevent water from entering completed sections of roofing system at end of workday or when rain is forecast. Remove and discard temporary seals before beginning work on adjoining roofing.

C. Install roof membrane and auxiliary materials to tie in to existing roofing to maintain weathertightness of transition[and to not void warranty for existing roofing system].

D. Coordinate installation and transition of roofing system component serving as an air barrier with air barrier specified under Section 07 27 26 "Fluid-Applied Membrane Air Barriers."

3.4 INSTALLATION OF SUBSTRATE BOARD

A. Install substrate board with long joints in continuous straight lines, with end joints staggered not less than 24 inches in adjacent rows.

1. At steel roof decks, install substrate board at right angle to flutes of deck.

a. Locate end joints over crests of steel roof deck.

2. Tightly butt substrate boards together.
3. Cut substrate board to fit tight around penetrations and projections, and to fit tight to intersecting sloping roof decks.
4. Fasten substrate board to top flanges of steel deck in accordance with recommendations in SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29.
5. Fasten substrate board to top flanges of steel deck to resist uplift pressure at corners, perimeter, and field of roof in accordance with roofing system manufacturers' written instructions.

3.5 INSTALLATION OF VAPOR RETARDER

A. Self-Adhering-Sheet Vapor Retarder: Prime substrate if required by manufacturer. Install self-adhering-sheet vapor retarder over area to receive vapor retarder, side and end lapping each sheet a minimum of 3-1/2 and 6 inches, respectively.

1. Extend vertically up parapet walls and projections to a minimum height equal to height of insulation and cover board.
2. Seal laps by rolling.

B. Completely seal vapor retarder at terminations, obstructions, and penetrations to prevent air movement into roofing system.

3.6 INSTALLATION OF INSULATION

A. Coordinate installing roofing system components so insulation is not exposed to precipitation or left exposed at end of workday.

B. Comply with roofing system and insulation manufacturer's written instructions for installing roof insulation.

C. Installation Over Metal Decking:

1. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows.

a. Locate end joints over crests of decking.
b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.

c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

1) Trim insulation so that water flow is unrestricted.

e. Fill gaps exceeding 1/4 inch with insulation.
f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
g. Mechanically attach base layer of insulation[and substrate board] using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to metal decks.

1) Fasten insulation in accordance with requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.
2) Fasten insulation to resist specified uplift pressure at corners, perimeter, and field of roof.

2. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.

a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.
f. Trim insulation so that water flow is unrestricted.
g. Fill gaps exceeding 1/4 inch with insulation.
h. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
i. Adhere each layer of insulation to substrate using adhesive in accordance with SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

D. Installation Over Wood and Wood Panel Decking:

1. Mechanically fasten slip sheet to roof deck using mechanical fasteners specifically designed and sized for fastening slip sheet to [wood] [wood panel] decks.

a. Fasten slip sheet in accordance with requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.

2. Install base layer of insulation with joints staggered not less than 24 inches in adjacent rows end joints staggered not less than 12 inches in adjacent rows.

    a. Where installing composite and noncomposite insulation in two or more layers, install noncomposite board insulation for bottom layer and intermediate layers, if applicable, and install composite board insulation for top layer.
    b. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    c. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    d. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

        1) Trim insulation so that water flow is unrestricted.

    e. Fill gaps exceeding 1/4 inch with insulation.
    f. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
    g. Mechanically attach base layer of insulation[and substrate board] using mechanical fasteners specifically designed and sized for fastening specified board-type roof insulation to [wood] [wood panel] decks.

        1) Fasten insulation in accordance with requirements in SPRI's Directory of Roof Assemblies for specified Wind Uplift Load Capacity.

3. Install upper layers of insulation and tapered insulation with joints of each layer offset not less than 12 inches from previous layer of insulation.

    a. Staggered end joints within each layer not less than 24 inches in adjacent rows.
    b. Install with long joints continuous and with end joints staggered not less than 12 inches in adjacent rows.
    c. Trim insulation neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
    d. Make joints between adjacent insulation boards not more than 1/4 inch in width.
    e. At internal roof drains, slope insulation to create a square drain sump with each side equal to the diameter of the drain bowl plus 24 inches.

        1) Trim insulation so that water flow is unrestricted.

    f. Fill gaps exceeding 1/4 inch with insulation.
    g. Cut and fit insulation within 1/4 inch of nailers, projections, and penetrations.
    h. Adhere each layer of insulation to substrate using adhesive according SPRI's Directory of Roof Assemblies listed roof assembly requirements for specified Wind Uplift Load Capacity and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

1) Set each layer of insulation in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

3.7 INSTALLATION OF COVER BOARDS

A. Install cover boards over insulation with long joints in continuous straight lines with end joints staggered between rows. Offset joints of insulation below a minimum of 6 inches in each direction.

1. Trim cover board neatly to fit around penetrations and projections, and to fit tight to intersecting sloping roof decks.
2. At internal roof drains, conform to slope of drain sump.

a. Trim cover board so that water flow is unrestricted.

3. Cut and fit cover board tight to nailers, projections, and penetrations.
4. Adhere cover board to substrate using adhesive in accordance with FM Approvals' RoofNav listed roof assembly requirements for specified Windstorm Resistance Classification and FM Global Property Loss Prevention Data Sheet 1-29, as follows:

a. Set cover board in a uniform coverage of full-spread insulation adhesive, firmly pressing and maintaining insulation in place.

B. Install slip sheet over cover board and immediately beneath roofing.

3.8 INSTALLATION OF ADHERED ROOF MEMBRANE

A. Adhere roof membrane over area to receive roofing in accordance with roofing system manufacturer's written instructions.

B. Unroll membrane roof membrane and allow to relax before installing.

C. Start installation of roofing in presence of roofing system manufacturer's technical personnel.

D. Accurately align roof membrane, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

E. Bonding Adhesive: Apply to substrate and underside of roof membrane at rate required by manufacturer, and allow to partially dry before installing roof membrane. Do not apply to splice area of roof membrane.

F. In addition to adhering, mechanically fasten roof membrane securely at terminations, penetrations, and perimeters.

G. Apply roof membrane with side laps shingled with slope of roof deck where possible.

H. Adhesive Seam Installation: Clean both faces of splice areas, apply splicing cement.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.
3. Apply a continuous bead of in-seam sealant before closing splice if required by roofing system manufacturer.

I. Tape Seam Installation: Clean and prime both faces of splice areas, apply splice tape.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.

J. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.

K. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

L. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

M. Adhere protection sheet over roof membrane at locations indicated.

3.9 INSTALLATION OF LOOSELY LAID AND BALLASTED ROOF MEMBRANE

A. Loosely lay roof membrane over area to receive roofing in accordance with roofing system manufacturer's written instructions.

B. Unroll roof membrane and allow to relax before installing.

C. Comply with requirements in ANSI/SPRI RP-4 for System 3.

D. Start installation of roofing in presence of roofing system manufacturer's technical personnel[and Owner's testing and inspection agency].

E. Accurately align roof membrane, without stretching, and maintain uniform side and end laps of minimum dimensions required by manufacturer. Stagger end laps.

F. Mechanically fasten or adhere roof membrane at corners, perimeters, and transitions in accordance with requirements in ANSI/SPRI RP-4.

1. At corners and perimeters, omit aggregate ballast leaving roof membrane exposed.
2. At corners and perimeters, adhere a second layer of roof membrane.

G. Apply roof membrane with side laps shingled with slope of deck where possible.

H. Factory-Applied Seam Tape Installation: Clean and prime surface to receive tape.

1. Firmly roll side and end laps of overlapping roof membrane to ensure a watertight seam installation.
2. Apply lap sealant and seal exposed edges of roofing terminations.

I. Leave seams uncovered until inspected by roofing system manufacturer.

J. Repair tears, voids, and lapped seams in roof membrane that do not comply with requirements.

K. Spread sealant or mastic bed over deck-drain flange at roof drains, and securely seal roof membrane in place with clamping ring.

L. Adhere protection sheet over roof membrane at locations indicated.

M. Aggregate Ballast: Apply uniformly over roof membrane at the rate required by roofing system manufacturer, but not less than the following, spreading with care to minimize possibility of damage to roofing system. Lay ballast as roof membrane is installed, leaving roof membrane ballasted at end of workday.

1. Ballast Weight:

a. Size 4 aggregate, 10 lb/sq. ft..

3.10 INSTALLATION OF BASE FLASHING

A. Install sheet flashings and preformed flashing accessories, and adhere to substrates in accordance with roofing system manufacturer's written instructions.

B. Apply bonding adhesive to substrate and underside of sheet flashing at required rate, and allow to partially dry. Do not apply to seam area of flashing.

C. Flash penetrations and field-formed inside and outside corners with cured or uncured sheet flashing.

D. Clean splice areas, apply splicing cement, and firmly roll side and end laps of overlapping sheets to ensure a watertight seam installation. Apply lap sealant and seal exposed edges of sheet flashing terminations.

E. Terminate and seal top of sheet flashings and mechanically anchor to substrate through termination bars.

3.11 INSTALLATION OF WALKWAYS

A. Flexible Walkways: Install walkway products in accordance with manufacturer's written instructions.

1. Install flexible walkways at the following locations:

a. Perimeter of each rooftop unit.

b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
d. Top and bottom of each roof access ladder.
e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
f. Locations indicated on Drawings.
g. As required by roof membrane manufacturer's warranty requirements.

2. Provide 6-inch clearance between adjoining pads.

B. Roof-Paver Walkways: Install walkway roof pavers in accordance with manufacturer's written instructions.

1. Install roof paver walkways at the following locations:

a. Perimeter of each rooftop unit.
b. Between each rooftop unit location, creating a continuous path connecting rooftop unit locations.
c. Between each roof hatch and each rooftop unit location or path connecting rooftop unit locations.
d. Top and bottom of each roof access ladder.
e. Between each roof access ladder and each rooftop unit location or path connecting rooftop unit locations.
f. Locations indicated on Drawings.
g. As required by roof membrane manufacturer's warranty requirements.

2. Provide 3 inches of space between adjacent roof pavers.

3.12 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to inspect substrate conditions, surface preparation, roof membrane application, sheet flashings, protection, and drainage components, and to furnish reports to Architect.

B. Final Roof Inspection: Arrange for roofing system manufacturer's technical personnel to inspect roofing installation on completion, in presence of Architect, and to prepare inspection report.

C. Repair or remove and replace components of roofing system where inspections indicate that they do not comply with specified requirements.

D. Additional testing and inspecting, at Contractor's expense, will be performed to determine if replaced or additional work complies with specified requirements.

3.13 PROTECTING AND CLEANING

A. Protect roofing system from damage and wear during remainder of construction period. When remaining construction does not affect or endanger roofing system, inspect roofing system for deterioration and damage, describing its nature and extent in a written report, with copies to Architect and Owner.

B. Correct deficiencies in or remove roofing system that does not comply with requirements, repair substrates, and repair or reinstall roofing system to a condition free of damage and deterioration at time of Substantial Completion and in accordance with warranty requirements.

C. Clean overspray and spillage from adjacent construction using cleaning agents and procedures recommended by manufacturer of affected construction.

END OF SECTION 07 53 23

SECTION 07 62 00 - SHEET METAL FLASHING AND TRIM

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Custom flashing and trim fabrications, made from the following:

1. Sheet metal materials.
2. Underlayment.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood nailers, curbs, and blocking.
2. Section 07 72 00 "Roof Accessories" for set-on-type curbs, equipment supports, roof hatches, vents, and other manufactured roof accessory units.
3. Section 07 95 13.13 "Interior Expansion Joint Cover Assemblies" for manufactured expansion-joint cover assemblies for interior floors, walls, and ceilings.
4. Section 07 95 13.16 "Exterior Expansion Joint Cover Assemblies" for manufactured expansion-joint cover assemblies for exterior building walls, soffits, and parapets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For sheet metal flashing and trim.

1. Plans, elevations, sections, and attachment details.
2. Fabrication and installation layouts, expansion-joint locations, and keyed details. Distinguish between shop- and field-assembled Work.
3. Identification of material, thickness, weight, and finish for each item and location in Project.
4. Details for forming, including profiles, shapes, seams, and dimensions.
5. Details for joining, supporting, and securing, including layout and spacing of fasteners, cleats, clips, and other attachments. Include pattern of seams.
6. Details of termination points and assemblies.
7. Details of expansion joints and expansion-joint covers, including showing direction of expansion and contraction from fixed points.
8. Details of roof-penetration flashing.
9. Details of edge conditions, including eaves, ridges, valleys, rakes, crickets, flashings, and counterflashings.
10. Details of special conditions.
11. Details of connections to adjoining work.
12. Formed flashing and trim at scale of not less than 1-1/2 inches per 12 inches .

C. Samples for Verification: Actual sample of finished products for each type of exposed finish for sheet metal and other metal accessories.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For sheet metal flashing and trim, and its accessories.

1.4 QUALITY ASSURANCE

A. Fabricator Qualifications: Entity that employs skilled workers who custom fabricate sheet metal flashing and trim similar to that required for this Project and whose products have a record of successful in-service performance.

B. Installer Qualifications: Entity that employs a supervisor who is an NRCA ProCertified Roofing Foreman or installers who are NRCA ProCertified Architectural Metal Flashings and Accessories Installers .

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store sheet metal flashing and trim materials in contact with other materials that might cause staining, denting, or other surface damage.

1. Store sheet metal flashing and trim materials away from uncured concrete and masonry.
2. Protect stored sheet metal flashing and trim from contact with water.

B. Protect strippable protective covering on sheet metal flashing and trim from exposure to sunlight and high humidity, except to extent necessary for period of sheet metal flashing and trim installation.

1.6 COORDINATION

A. Coordinate sheet metal flashing and trim layout and seams with sizes and locations of penetrations to be flashed, and joints and seams in adjacent materials.

B. Coordinate sheet metal flashing and trim installation with adjoining roofing and wall materials, joints, and seams to provide leakproof, secure, and noncorrosive installation.

1.7 WARRANTY

A. Special Warranty on Finishes: Manufacturer agrees to repair finish or replace sheet metal flashing and trim that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Sheet metal flashing and trim assemblies, including cleats, anchors, and fasteners, are to withstand wind loads, structural movement, thermally induced movement, and exposure to weather without failure due to defective manufacture, fabrication, installation, or other defects in construction. Completed sheet metal flashing and trim are not to rattle, leak, or loosen, and are to remain watertight.

B. Sheet Metal Standard for Flashing and Trim: Comply with SMACNA's "Architectural Sheet Metal Manual" requirements for dimensions and profiles shown unless more stringent requirements are indicated.

C. SPRI Wind Design Standard: Manufacture and install roof edge flashings and copings tested in accordance with ANSI/SPRI/FM 4435/ES-1 and capable of resisting the following design pressure:

1. Design Pressure: As indicated on Drawings.

D. FM Approvals Listing: Manufacture and install roof edge flashings and copings that comply with requirements in FM Approvals 4471 as part of a roofing system and that are listed in FM Approvals' "Approval Guide" and approved for windstorm classification, Class 1A-90. Identify materials with name of fabricator and design approved by FM Approvals.

E. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 SHEET METAL MATERIALS

A. Protect mechanical and other finishes on exposed surfaces from damage by applying strippable, temporary protective film before shipping.

B. Aluminum Sheet: Coil-coated sheet, ASTM B209/B209M, alloy as standard with manufacturer, with temper as required to suit forming operations and structural performance required.

1. Exposed Coil-Coated Finish:

a. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

2.3 UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment: Provide self-adhering, cold-applied, sheet underlayment, a minimum of 30 mils thick, specifically designed to withstand high metal temperatures beneath metal roofing. Provide primer when recommended by underlayment manufacturer.

1. Thermal Stability: Stable after testing at 240 deg F; ASTM D1970/D1970M.
2. Low-Temperature Flexibility: Passes after testing at minus 20 deg F or lower; ASTM D1970/D1970M.
3. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. Carlisle WIP Products; a brand of Carlisle Construction Materials.
    b. Henry Company; a Carlisle company.
    c. Protecto Wrap Company.

2.4 FABRICATION, GENERAL

A. Custom fabricate sheet metal flashing and trim to comply with details indicated and recommendations in cited sheet metal standard that apply to design, dimensions, geometry, metal thickness, and other characteristics of item required.

1. Fabricate sheet metal flashing and trim in shop to greatest extent possible.
2. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.
3. Verify shapes and dimensions of surfaces to be covered and obtain field measurements for accurate fit before shop fabrication.
4. Form sheet metal flashing and trim to fit substrates without excessive oil-canning, buckling, and tool marks; true to line, levels, and slopes; and with exposed edges folded back to form hems.
5. Conceal fasteners and expansion provisions where possible. Do not use exposed fasteners on faces exposed to view.

B. Fabrication Tolerances:

1. Fabricate sheet metal flashing and trim that is capable of installation to a tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.
2. Fabricate sheet metal flashing and trim that is capable of installation to tolerances specified.

C. Expansion Provisions: Form metal for thermal expansion of exposed flashing and trim.

1. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with butyl sealant concealed within joints.
2. Use lapped expansion joints only where indicated on Drawings.

D. Sealant Joints: Where movable, nonexpansion-type joints are required, form metal in accordance with cited sheet metal standard to provide for proper installation of elastomeric sealant.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by cited sheet metal standard and by FM Global Property Loss Prevention Data Sheet 1-49 for application, but not less than thickness of metal being secured.

G. Seams:

1. Fabricate nonmoving seams with flat-lock seams. Tin edges to be seamed, form seams, and solder.
2. Fabricate nonmoving seams with flat-lock seams. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use. Rivet joints where necessary for strength.
3. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints where necessary for strength.

H. Do not use graphite pencils to mark metal surfaces.

2.5 LOW-SLOPE ROOF SHEET METAL FABRICATIONS

A. Copings: Fabricate in minimum 96-inch- long, but not exceeding 12 ft.- long, sections. Fabricate joint plates of same thickness as copings. Furnish with continuous cleats to support edge of external leg and interior leg. Miter corners, watertight. Shop fabricate interior and exterior corners.

1. Joint Style: Butted with expansion space and 6-inch- wide, concealed backup plate.
2. Fabricate from the following materials:

a. Aluminum: 0.050 inch thick.

B. Base Flashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum: 0.040 inch thick.

C. Counterflashing: Shop fabricate interior and exterior corners. Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

D. Flashing Receivers: Fabricate from the following materials:

1. Aluminum: 0.032 inch thick.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, substrates, and other conditions affecting performance of the Work.

1. Verify compliance with requirements for installation tolerances of substrates.
2. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.
3. Verify that air- or water-resistant barriers have been installed over substrate to prevent air infiltration or water penetration.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF UNDERLAYMENT

A. Self-Adhering, High-Temperature Sheet Underlayment:

1. Install self-adhering, high-temperature sheet underlayment; wrinkle free.
2. Prime substrate if recommended by underlayment manufacturer.
3. Comply with temperature restrictions of underlayment manufacturer for installation; use primer for installing underlayment at low temperatures.
4. Apply in shingle fashion to shed water, with end laps of not less than 6 inches staggered 24 inches between courses.
5. Overlap side edges not less than 3-1/2 inches. Roll laps and edges with roller.
6. Roll laps and edges with roller.
7. Cover underlayment within 14 days.

3.3 INSTALLATION OF SHEET METAL FLASHING AND TRIM, GENERAL

A. Install sheet metal flashing and trim to comply with details indicated and recommendations of cited sheet metal standard that apply to installation characteristics required unless otherwise indicated on Drawings.

1. Install fasteners, protective coatings, separators, sealants, and other miscellaneous items as required to complete sheet metal flashing and trim system.
2. Install sheet metal flashing and trim true to line, levels, and slopes. Provide uniform, neat seams with minimum exposure of sealant.
3. Anchor sheet metal flashing and trim and other components of the Work securely in place, with provisions for thermal and structural movement.
4. Install sheet metal flashing and trim to fit substrates and to result in watertight performance.
5. Install continuous cleats with fasteners spaced not more than 12 inches o.c.
6. Space individual cleats not more than 12 inches apart. Attach each cleat with at least two fasteners. Bend tabs over fasteners.

7. Install exposed sheet metal flashing and trim with limited oil-canning, and free of buckling and tool marks.
8. Do not field cut sheet metal flashing and trim by torch.
9. Do not use graphite pencils to mark metal surfaces.

B. Metal Protection: Where dissimilar metals contact each other, or where metal contacts pressure-treated wood or other corrosive substrates, protect against galvanic action or corrosion by painting contact surfaces with bituminous coating or by other permanent separation as recommended by sheet metal manufacturer or cited sheet metal standard.

1. Coat concealed side of uncoated-aluminum sheet metal flashing and trim with bituminous coating where flashing and trim contact wood, ferrous metal, or cementitious construction.
2. Underlayment: Where installing sheet metal flashing and trim directly on cementitious or wood substrates, install underlayment and cover with slip sheet.

C. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim.

1. Space movement joints at maximum of 10 ft. with no joints within 24 inches of corner or intersection.
2. Form expansion joints of intermeshing hooked flanges, not less than 1 inch deep, filled with sealant concealed within joints.
3. Use lapped expansion joints only where indicated on Drawings.

D. Fasteners: Use fastener sizes that penetrate wood blocking or sheathing not less than 1-1/4 inches for nails and not less than 3/4 inch for wood screws.

E. Conceal fasteners and expansion provisions where possible in exposed work and locate to minimize possibility of leakage. Cover and seal fasteners and anchors as required for a tight installation.

F. Seal joints as required for watertight construction.

1. Use sealant-filled joints unless otherwise indicated.

a. Embed hooked flanges of joint members not less than 1 inch into sealant.
b. Form joints to completely conceal sealant.
c. When ambient temperature at time of installation is between 40 and 70 deg F, set joint members for 50 percent movement each way.
d. Adjust setting proportionately for installation at higher ambient temperatures.

1) Do not install sealant-type joints at temperatures below 40 deg F.

2. Prepare joints and apply sealants to comply with requirements in Section 07 92 00 "Joint Sealants."

3.4 INSTALLATION OF SLOPED ROOF SHEET METAL FABRICATIONS

A. Install sheet metal flashing and trim to comply with performance requirements, sheet metal manufacturer's written installation instructions, and cited sheet metal standard.

1. Provide concealed fasteners where possible, and set units true to line, levels, and slopes.
2. Install work with laps, joints, and seams that are permanently watertight and weather resistant.

B. Roof Edge Flashing:

1. Install roof edge flashings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated. Interlock bottom edge of roof edge flashing with continuous cleat anchored to substrate at staggered 3-inch centers.
3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for FM Approvals' listing for required windstorm classification.

C. Copings:

1. Install copings in accordance with ANSI/SPRI/FM 4435/ES-1.
2. Anchor to resist uplift and outward forces in accordance with recommendations in cited sheet metal standard unless otherwise indicated.

    a. Interlock exterior bottom edge of coping with continuous cleat anchored to substrate at 24-inch centers.
    b. Anchor interior leg of coping with washers and screw fasteners through slotted holes at 24-inch centers.

3. Anchor to resist uplift and outward forces in accordance with recommendations in FM Global Property Loss Prevention Data Sheet 1-49 for specified FM Approvals' listing for required windstorm classification.

D. Pipe or Post Counterflashing: Install counterflashing umbrella with close-fitting collar with top edge flared for elastomeric sealant, extending minimum of 4 inches over base flashing. Install stainless steel draw band and tighten.

E. Counterflashing: Coordinate installation of counterflashing with installation of base flashing.

1. Insert counterflashing in reglets or receivers and fit tightly to base flashing.
2. Extend counterflashing 4 inches over base flashing.
3. Lap counterflashing joints minimum of 4 inches.
4. Secure in waterproof manner by means of anchor and washer spaced at 12 inches o.c. along perimeter and 6 inches o.c. at corners areas unless otherwise indicated.

3.5 INSTALLATION TOLERANCES

A. Shim and align sheet metal flashing and trim within installed tolerance of 1/4 inch in 20 ft. on slope and location lines indicated on Drawings and within 1/8-inch offset of adjoining faces and of alignment of matching profiles.

3.6 CLEANING

A. Clean and neutralize flux materials. Clean off excess solder.

B. Clean off excess sealants.

3.7 PROTECTION

A. Remove temporary protective coverings and strippable films as sheet metal flashing and trim are installed unless otherwise indicated in manufacturer's written installation instructions.

B. On completion of sheet metal flashing and trim installation, remove unused materials and clean finished surfaces as recommended in writing by sheet metal flashing and trim manufacturer.

C. Maintain sheet metal flashing and trim in clean condition during construction.

D. Replace sheet metal flashing and trim that have been damaged or that have deteriorated beyond successful repair by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 62 00

SECTION 07 71 29 - MANUFACTURED ROOF EXPANSION JOINTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Flanged bellows-type roof expansion joints.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wooden curbs or cants for mounting roof expansion joints.
2. Section 07 62 00 "Sheet Metal Flashing and Trim" for shop- and field-fabricated sheet metal expansion-joint systems, flashing, and other sheet metal items.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Flanged bellows-type roof expansion joints.

B. Shop Drawings: For roof expansion joints.

1. Include plans, elevations, sections, and attachment details.
2. Include details of splices, intersections, transitions, fittings, method of field assembly, and location and size of each field splice.
3. Provide isometric drawings of intersections, terminations, changes in joint direction or planes, and transition to other expansion joint systems depicting how components interconnect with each other and adjacent construction to allow movement and achieve waterproof continuity.

C. Samples: For each exposed product and for each color specified, 6 inches in size.

1.3 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each fire-barrier provided as part of a roof-expansion-joint assembly, for tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Installer of roofing membrane.

1.5 WARRANTY

A. Special Warranty: Manufacturer and Installer agree to repair or replace roof expansion joints and components that leak, deteriorate beyond normal weathering, or otherwise fail in materials or workmanship within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Warranty on Painted Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace roof expansion joints that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Fluoropolymer Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes to prevent buckling, opening of joints, hole elongation, overstressing of components, failure of joint seals, failure of connections, and other detrimental effects.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 FLANGED BELLOWS-TYPE ROOF EXPANSION JOINTS

A. Flanged Bellows-Type Roof Expansion Joint : Factory-fabricated, continuous, waterproof, joint cover consisting of exposed membrane bellows laminated to flexible, closed-cell support foam, and secured along each edge to 3- to 4-inch- wide metal flange.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Architectural Art Manufacturing; a division of Pittcon Architectural Metals, LLC.
b. Balco; a CSW Industrials Company.
c. Construction Specialties, Inc.
d. Johns Manville; a Berkshire Hathaway company.
e. MM Systems Corporation.
f. Nystrom, Inc.

g. Watson Bowman Acme Corp.
h. inpro Corporation.

2. Source Limitations: Obtain flanged bellows-type roof expansion joints approved by roofing manufacturer and that are part of roofing membrane warranty.
3. Joint Movement Capability: Plus and minus As indicated on Drawings.
4. Bellows: EPDM flexible membrane, nominal 60 mils thick.
5. Flanges: Aluminum, 0.032 inch thick.
6. Configuration: Angle formed to fit curbs as indicated on Drawings.
7. Corner, Intersection, and Transition Units: Provide factory-fabricated units for corner and joint intersections and horizontal and vertical transitions including those to other building expansion joints.
8. Cover Membrane: EPDM flexible membrane, factory laminated to bellows and covering entire joint assembly and curbs.

   a. Color: Match Roof Location.

9. Accessories: Provide splicing units, adhesives, and other components as recommended by roof-expansion-joint manufacturer for complete installation.
10. Secondary Seal: Continuous, waterproof membrane within joint and attached to substrate on sides of joint below the primary bellows assembly.

    a. Thermal Insulation: Fill space above secondary seal with manufacturer's standard, factory-installed mineral-fiber insulation; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively, per ASTM E84.

B. Materials:

1. Galvanized-Steel Sheet: ASTM A653/A653M, hot-dip zinc-coating designation G90.
2. Stainless Steel Sheet: ASTM A240/A240M or ASTM A666, Type 304.
3. Aluminum Sheet: ASTM B209, mill finish, with temper to suit forming operations and performance required.

   a. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious or preservative-treated wood materials.

4. EPDM Membrane: ASTM D4637/D4637M, type standard with manufacturer for application.
5. Neoprene Membrane: Neoprene sheet recommended by EPDM manufacturer for resistance to hydrocarbons, non-aromatic solvents, grease, and oil; and as standard with roof-expansion-joint manufacturer for application.
6. PVC Membrane: ASTM D4434/D4434M, type standard with manufacturer for application.

2.3 MISCELLANEOUS MATERIALS

A. Adhesives: As recommended by roof-expansion-joint manufacturer.

B. Fasteners: Manufacturer's recommended fasteners, suitable for application and designed to withstand design loads.

1. Exposed Fasteners: Gasketed. Use screws with hex washer heads matching color of material being fastened.

C. Mineral-Fiber Blanket: ASTM C665.

D. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joint openings, substrates, and expansion-control joint systems that interface with roof expansion joints, for suitable conditions where roof expansion joints will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions for handling and installing roof expansion joints.

1. Anchor roof expansion joints securely in place, with provisions for required movement. Use fasteners, protective coatings, sealants, and miscellaneous items as required to complete roof expansion joints.
2. Install roof expansion joints true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
3. Provide for linear thermal expansion of roof-expansion-joint materials.
4. Provide uniform profile of roof expansion joint throughout its length; do not stretch or squeeze membranes.
5. Provide uniform, neat seams.
6. Install roof expansion joints to fit substrates and to result in watertight performance.

B. Directional Changes: Install factory-fabricated units at directional changes to provide continuous, uninterrupted, and watertight joints.

C. Transitions to Other Expansion-Control Joint Assemblies: Coordinate installation of roof expansion joints with other exterior expansion-control joint assemblies specified in Section 07 95 13.16 "Exterior Expansion Joint Cover Assemblies" to result in watertight performance. Install factory-fabricated units at transitions between roof expansion joints and exterior expansion-control joint systems.

D. Splices: Splice roof expansion joints to provide continuous, uninterrupted, and waterproof joints.

1. Install waterproof splices and prefabricated end dams to prevent leakage of secondary-seal membrane.

E. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended by manufacturer.

END OF SECTION 07 71 29

SECTION 07 72 00 - ROOF ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Manufactured units for the following applications:

1. Pipe portals.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for roof cants, nailers, blocking, and other pressure-preservative-treated wood.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of roof accessory.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For roof accessories.

1. Include plans, elevations, keyed details, and attachments to other work. Indicate dimensions, loadings, and special conditions. Distinguish between plant- and field-assembled work.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Roof plans, drawn to scale, and coordinating penetrations and roof-mounted items. Show the following:

1. Size and location of roof accessories specified in this Section.
2. Method of attaching roof accessories to roof or building structure.
3. Other roof-mounted items, including mechanical and electrical equipment, ductwork, piping, and conduit.
4. Required clearances.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roof accessories.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Do not store roof accessories in contact with other materials that might cause staining, denting, or other surface damage. Store roof accessories in accordance with manufacturer's instructions.

B. Store materials off ground in dry location and in accordance with manufacturer's instructions in well-ventilated area.

C. Store and protect roof accessories from nicks, scratches, and blemishes.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify profiles and tolerances of roof-accessory substrates by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.7 COORDINATION

A. Coordinate layout and installation of roof accessories with roofing membrane and base flashing and interfacing and adjoining construction to provide a leakproof, weathertight, secure, and noncorrosive installation.

PART 2 - PRODUCTS

2.1 PIPE PORTALS

A. Curb-Mounted Pipe Portal: Insulated roof-curb units with welded or mechanically fastened and sealed corner joints, straight sides, and integrally formed deck-mounting flange at perimeter bottom; with weathertight curb cover with single or multiple collared openings and pressure-sealed conically shaped EPDM protective rubber caps sized for piping indicated, with stainless steel snaplock swivel clamps.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Portals Plus; Duravent Group.
b. Roof Products and Systems (RPS); Duravent Group.
c. MIRO Industries Inc.

2.2 METAL MATERIALS

A. Aluminum Sheet: ASTM B209/B209M, manufacturer's standard alloy for finish required, with temper to suit forming operations and performance required.

1. Mill Finish: As manufactured.

B. Aluminum Extrusions and Tubes: ASTM B221, manufacturer's standard alloy and temper for type of use, finished to match assembly where used; otherwise mill finished.

C. Stainless Steel Sheet and Shapes: ASTM A240/A240M or ASTM A666, Type 304.

2.3 MISCELLANEOUS MATERIALS

A. Provide materials and types of fasteners, protective coatings, sealants, and other miscellaneous items required by manufacturer for a complete installation.

B. Wood Nailers: Softwood lumber, pressure treated with waterborne preservatives for aboveground use, acceptable to authorities having jurisdiction, containing no arsenic or chromium, and complying with AWPA C2; not less than 1-1/2 inches thick.

C. Fasteners: Roof accessory manufacturer's recommended fasteners, designed to comply with performance requirements, suitable for application and metals being fastened. Match finish of exposed fasteners with finish of material being fastened. Provide nonremovable fastener heads to exterior exposed fasteners. Furnish the following unless otherwise indicated:

1. Fasteners for Metallic-Coated Steel Sheet: Series 300 stainless steel or hot-dip zinc-coated steel in accordance with ASTM A153/A153M or ASTM F2329/F2329M.
2. Fasteners for Aluminum Sheet: Aluminum or Series 300 stainless steel.

D. Gaskets: Manufacturer's standard tubular or fingered design of neoprene, EPDM, PVC, or silicone or a flat design of foam rubber, sponge neoprene, or cork.

E. Elastomeric Sealant: ASTM C920, elastomeric [polyurethane] [silicone] polymer sealant as recommended by roof accessory manufacturer for installation indicated; low modulus; of type, grade, class, and use classifications required to seal joints and remain watertight.

F. Butyl Sealant: ASTM C1311, single-component, solvent-release butyl rubber sealant; polyisobutylene plasticized; heavy bodied for expansion joints with limited movement.

G. Bituminous Coating: Cold-applied asphalt emulsion complying with ASTM D1187/D1187M.

H. Asphalt Roofing Cement: ASTM D4586/D4586M, asbestos free, of consistency required for application.

2.4 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM/NOMMA AMP 500, "Metal Finishes Manual for Architectural and Metal Products" for recommendations for applying and designating finishes.

B. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

C. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, to verify actual locations, dimensions, and other conditions affecting performance of the Work.

B. Verify that substrate is sound, dry, smooth, clean, sloped for drainage, and securely anchored.

C. Verify dimensions of roof openings for roof accessories.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Install roof accessories in accordance with manufacturer's written instructions.

1. Install roof accessories level; plumb; true to line and elevation; and without warping, jogs in alignment, buckling, or tool marks.
2. Anchor roof accessories securely in place so they are capable of resisting indicated loads.
3. Use fasteners, separators, sealants, and other miscellaneous items as required to complete installation of roof accessories and fit them to substrates.
4. Install roof accessories to resist exposure to weather without failing, rattling, leaking, or loosening of fasteners and seals.

B. Metal Protection: Protect metals against galvanic action by separating dissimilar metals from contact with each other or with corrosive substrates by painting contact surfaces with bituminous coating or by other permanent separation as recommended in writing by manufacturer's written installation instructions.

1. Coat concealed side of uncoated aluminum roof accessories with bituminous coating where in contact with wood, ferrous metal, or cementitious construction.
2. Bed flanges in thick coat of asphalt roofing cement where required by manufacturers of roof accessories for waterproof performance.

3.3 INSTALLATION OF ROOF ACCESSORIES

A. Preformed Flashing-Sleeve and Flashing-Pipe Portal: Secure flashing sleeve to roof membrane in accordance with flashing-sleeve manufacturer's written instructions; flash sleeve flange to surrounding roof membrane in accordance with roof membrane manufacturer's instructions.

3.4 CLEANING AND PROTECTION

A. On completion of installation, clean exposed surfaces in according with manufacturer's written instructions. Clean off excess sealants.

B. Remove temporary protective coverings and strippable films as roof accessories are installed. On completion of installation, clean finished surfaces, including removing unused fasteners, metal filings, pop rivet stems, and pieces of flashing. Maintain roof accessories in a clean condition during construction.

C. Replace roof accessories that have been damaged or that cannot be successfully repaired by finish touchup or similar minor repair procedures, as determined by Architect.

END OF SECTION 07 72 00

SECTION 07 81 00 - APPLIED FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes: Sprayed fire-resistive materials.

1.2 DEFINITIONS

A. SFRM: Sprayed fire-resistive materials.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: Framing plans or schedules, or both, indicating the following:

1. Extent of applied fire protection for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum applied fire protection material thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of sprayed fire-resistive material after application.

1.4 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of applied fire protection material for tests performed by a qualified testing agency.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by applied fire protection material manufacturer as experienced and with sufficient trained staff to install manufacturer's products in accordance with specified requirements.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not apply applied fire protection when ambient or substrate temperature is 44 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain applied fire protection for each fire-resistance design from single source.

2.2 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide applied fire protection, including auxiliary materials, in accordance with requirements of each fire-resistance design and manufacturer's written instructions.

B. Fire-Resistance Design: Indicated on Drawings, tested in accordance with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

C. VOC Content: For field applications, coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 50 g/L.
3. Primers, Sealers, and Undercoaters: 100 g/L.

D. Low-Emitting Materials: For field applications, coatings shall comply with the requirements of the California Department of Public Health's "Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions from Indoor Sources Using Environmental Chambers."

E. Asbestos: Provide products containing no detectable asbestos.

2.3 SPRAYED FIRE-RESISTIVE MATERIALS

A. Sprayed Fire-Resistive Material: Manufacturer's standard, factory-mixed, lightweight, dry formulation, complying with indicated fire-resistance design, and mixed with water at Project site to form a slurry or mortar before conveyance and application or conveyed in a dry state and mixed with atomized water at place of application.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. GCP Applied Technologies Inc.; Monokote Z146
b. Isolatek International.; Fendolite M-II

c. Southwest Fireproofing Products Co.; Type 7HD

2. Bond Strength: Minimum 430-lbf/sq. ft. cohesive and adhesive strength based on field testing in accordance with ASTM E736/E736M.
3. Density: Not less than density specified in the approved fire-resistance design, in accordance with ASTM E605/E605M.
4. Thickness: As required for fire-resistance design indicated, measured in accordance with requirements of fire-resistance design or ASTM E605/E605M, whichever is thicker, but not less than 0.375 inch.
5. Combustion Characteristics: ASTM E136.
6. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

   a. Flame-Spread Index: 10 or less.
   b. Smoke-Developed Index: 10 or less.

7. Corrosion Resistance: No evidence of corrosion in accordance with ASTM E937/E937M.
8. Deflection: No cracking, spalling, or delamination in accordance with ASTM E759/E759.
9. Effect of Impact on Bonding: No cracking, spalling, or delamination in accordance with ASTM E760/E760M.
10. Air Erosion: Maximum weight loss of 0.025 g/sq. ft. in 24 hours in accordance with ASTM E859/E859M.
11. Fungal Resistance: Treat products with manufacturer's standard antimicrobial formulation to result in no growth on specimens per ASTM G21 or rating of 10 in accordance with ASTM D3274 when tested in accordance with ASTM D3273.
12. Finish: Spray-textured finish. Apply separate, colored topcoat after finishing.

    a. Color: As selected by Architect from manufacturer's full range.

2.4 AUXILIARY MATERIALS

A. Provide auxiliary materials that are compatible with sprayed fire-resistive material and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved in writing by sprayed fire-resistive material manufacturer and complying with one or both of the following requirements:

   1. Primer and substrate are identical to those tested in required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.
   2. Primer's bond strength in required fire-resistance design complies with specified bond strength for sprayed fire-resistive material and with requirements in UL's "Product iQ" online directory or in the listings of another qualified testing agency acceptable to authorities having jurisdiction, based on a series of bond tests in accordance with ASTM E736/E736M.

C. Bonding Agent: Product approved in writing by sprayed fire-resistive material manufacturer and complying with requirements in UL's "Product iQ" online directory or in the listings of another qualified testing agency acceptable to authorities having jurisdiction.

D. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by sprayed fire-resistive material manufacturer.

E. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by sprayed fire-resistive material manufacturer. Include pins and attachment.

F. Sealer: Transparent-drying, water-dispersible, tinted protective coating recommended in writing by sprayed fire-resistive material manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and in accordance with each fire-resistance design.

1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of applied fire protection with substrates under conditions of normal use or fire exposure.
2. Verify that objects penetrating applied fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Verify that substrates receiving applied fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.

B. Verify that concrete work on steel deck is complete before beginning Work.

C. Verify that roof construction, installation of rooftop HVAC equipment, and other related work are complete before beginning Work.

D. Conduct tests in accordance with sprayed fire-resistive material manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

E. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

F. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of applied fire protection materials during application.

B. Clean substrates of substances that could impair bond of applied fire protection.

C. Prime substrates where included in fire-resistance design and where recommended in writing by sprayed fire-resistive material manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive applied fire protection.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of applied fire protection. Remove minor projections and fill voids that would telegraph through applied fire protection after application.

3.3 APPLICATION

A. Construct applied fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, sealers, topcoats, finishing, and other materials and procedures affecting applied fire protection Work.

B. Comply with sprayed fire-resistive material manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fire protection with other construction to minimize need to cut or remove applied fire protection.

1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.

D. Metal Decks:

1. Do not apply fire protection to underside of metal deck substrates until concrete topping, if any, is completed.
2. Do not apply fire protection to underside of metal roof deck until roofing is completed; prohibit roof traffic during application and drying of fire protection.

E. Install auxiliary materials as required, as detailed, and in accordance with fire-resistance design and sprayed fire-resistive material manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by sprayed fire-resistive material manufacturer.

F. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by sprayed fire-resistive material manufacturer.

G. Extend applied fire protection in full thickness over entire area of each substrate to be protected.

H. Install body of applied fire protection in a single course unless otherwise recommended in writing by sprayed fire-resistive material manufacturer.

I. For applications over encapsulant materials, including lockdown (post-removal) encapsulants, apply fire protection that differs in color from that of encapsulant over which it is applied.

J. Where sealers are used, apply products that are tinted to differentiate them from applied fire protection over which they are applied.

K. Provide a uniform finish complying with description indicated for each type of applied fire protection material and matching finish approved for required mockups.

L. Cure applied fire protection in accordance with sprayed fire-resistive material manufacturer's written instructions.

M. Do not install enclosing or concealing construction until after applied fire protection has been inspected, tested, and corrections have been made to deficient applications.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

1. Test and inspect as required by the IBC, Subsection 1705.15, "Sprayed Fire-Resistant Materials."

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fire protection for the next area until test results for previously completed applications of fire protection show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Applied fire protection will be considered defective if it does not pass tests and inspections.

1. Remove and replace applied fire protection that does not pass tests and inspections, and retest.
2. Apply additional applied fire protection, in accordance with manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING

A. Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.6 PROTECTION

A. Protect applied fire protection from damage resulting from construction operations or other causes in accordance with manufacturer's and Installer's written instructions, so applied fire protection is without damage or deterioration at time of Substantial Completion.

3.7 REPAIRS

A. As installation of other adjacent construction proceeds, inspect applied fire protection and repair damaged areas due to work of other trades before concealing it with other construction.

B. Repair applied fire protection using same method and materials as original installation or using manufacturer's recommended trowel-applied repair product.

END OF SECTION 07 81 00

SECTION 07 81 23 - INTUMESCENT FIRE PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Mastic and intumescent fire-resistive coatings.

B. Related Requirements:

1. Section 07 81 00 "Applied Fire Protection" for sprayed fire-resistive materials (SFRM).

1.2 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review products, design ratings, restrained and unrestrained conditions, thicknesses, and other performance requirements.

1.3 ACTION SUBMITTALS

A. Product Data:

1. Mastic and intumescent fire-resistive coatings.
2. Substrate primers.
3. Reinforcing fabric.
4. Reinforcing mesh.
5. Topcoat.

B. Shop Drawings: Framing plans or schedules, or both, indicating the following:

1. Extent of fire protection for each construction and fire-resistance rating.
2. Applicable fire-resistance design designations of a qualified testing and inspecting agency acceptable to authorities having jurisdiction.
3. Minimum mastic and intumescent fire-resistive coating thicknesses needed to achieve required fire-resistance rating of each structural component and assembly.
4. Treatment of mastic and intumescent fire-resistive coating after application.

C. Samples: For each exposed product and for each color and texture specified, in manufacturer's standard dimensions in size.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A firm or individual certified, licensed, or otherwise qualified by mastic and intumescent fire-resistive coating manufacturer as experienced and with sufficient trained staff to install manufacturer's products in accordance with specified requirements.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not apply fire protection when ambient or substrate temperature is 50 deg F or lower unless temporary protection and heat are provided to maintain temperature at or above this level for 24 hours before, during, and for 24 hours after product application.

B. Ventilation: Ventilate building spaces during and after application of fire protection, providing complete air exchanges in accordance with manufacturer's written instructions. Use natural means or, if they are inadequate, forced-air circulation until fire protection dries thoroughly.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Assemblies: Provide fire protection, including auxiliary materials, in accordance with requirements of each fire-resistance design and manufacturer's written instructions.

B. Source Limitations: Obtain fire protection for each fire-resistance design from single source.

C. Fire-Resistance Design: Indicated on Drawings, tested in accordance with ASTM E119 or UL 263; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Steel members are to be considered unrestrained unless specifically noted otherwise.

D. VOC Content: For field applications, coatings shall comply with VOC content limits of authorities having jurisdiction and the following VOC content limits:

1. Flat Paints and Coatings: 50 g/L.
2. Nonflat Paints and Coatings: 150 g/L.
3. Primers, Sealers, and Undercoaters: 200 g/L.

E. Asbestos: Provide products containing no detectable asbestos.

2.2 MASTIC AND INTUMESCENT FIRE-RESISTIVE COATINGS

A. Mastic and Intumescent Fire-Resistive Coating: Manufacturer's standard, factory-mixed formulation, and complying with indicated fire-resistance design.

1. Manufacturers: Subject to compliance with requirements, provide products by the following:

    a. Albi Manufacturing; a division of StanChem, Inc.
    b. Carboline Company; a subsidiary of RPM International.
    c. Contego International Inc.
    d. FlameOff Coatings, Inc.
    e. Hilti, Inc.
    f. International Protective Coatings; AkzoNobel.
    g. Isolatek International.
    h. PPG Paints; PPG Industries, Inc.
    i. Sherwin-Williams Company (The).

2. Application: Designated for "interior general purpose" use by a qualified testing agency acceptable to authorities having jurisdiction.
3. Thickness: As required for fire-resistance design indicated, measured in accordance with requirements of fire-resistance design.
4. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.
5. Finish: As selected by Architect from manufacturer's standard finishes.

    a. Color and Gloss: Match Architect's sample As selected by Architect from manufacturer's full range.

2.3 AUXILIARY MATERIALS

A. Provide auxiliary materials that are compatible with mastic and intumescent fire-resistive coating and substrates and are approved by UL or another testing and inspecting agency acceptable to authorities having jurisdiction for use in fire-resistance designs indicated.

B. Substrate Primers: Primers approved by mastic and intumescent fire-resistive coating manufacturer and complying with required fire-resistance design by UL or another testing and inspecting agency acceptable to authorities having jurisdiction.

C. Reinforcing Fabric: Glass- or carbon-fiber fabric of type, weight, and form required to comply with fire-resistance designs indicated; approved and provided by mastic and intumescent fire-resistive coating manufacturer.

D. Reinforcing Mesh: Metallic mesh reinforcement of type, weight, and form required to comply with fire-resistance design indicated; approved and provided by mastic and intumescent fire-resistive coating manufacturer. Include pins and attachment.

E. Topcoat: Suitable for application over mastic and intumescent fire-resistive coating; of type recommended in writing by mastic and intumescent fire-resistive coating manufacturer for each fire-resistance design.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for substrates and other conditions affecting performance of the Work and in accordance with each fire-resistance design.

1. Verify that substrates are free of dirt, oil, grease, release agents, rolling compounds, mill scale, loose scale, incompatible primers, paints, and encapsulants, or other foreign substances capable of impairing bond of fire protection with substrates under conditions of normal use or fire exposure.
2. Verify that objects penetrating fire protection, including clips, hangers, support sleeves, and similar items, are securely attached to substrates.
3. Verify that substrates receiving fire protection are not obstructed by ducts, piping, equipment, or other suspended construction that will interfere with fire protection application.

B. Conduct tests in accordance with mastic and intumescent fire-resistive coating manufacturer's written instructions to verify that substrates are free of substances capable of interfering with bond.

C. Prepare written report, endorsed by Installer, listing conditions detrimental to performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Cover other work subject to damage from fallout or overspray of fire protection materials during application.

B. Clean substrates of substances that could impair bond of fire protection.

C. Prime substrates where included in fire-resistance design and where recommended in writing by mastic and intumescent fire-resistive coating manufacturer unless compatible shop primer has been applied and is in satisfactory condition to receive fire protection.

D. For applications visible on completion of Project, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of fire protection. Remove minor projections and fill voids that would telegraph through fire-resistive products after application.

3.3 APPLICATION

A. Construct fire protection assemblies that are identical to fire-resistance design indicated and products as specified, tested, and substantiated by test reports; for thickness, primers, topcoats, finishing, and other materials and procedures affecting fire protection Work.

B. Comply with mastic and intumescent fire-resistive coating manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey, and apply fire protection; as applicable to particular conditions of installation and as required to achieve fire-resistance ratings indicated.

C. Coordinate application of fire protection with other construction to minimize need to cut or remove fire protection.

1. Do not begin applying fire protection until clips, hangers, supports, sleeves, and other items penetrating fire protection are in place.
2. Defer installing ducts, piping, and other items that would interfere with applying fire protection until application of fire protection is completed.

D. Install auxiliary materials as required, as detailed, and in accordance with fire-resistance design and mastic and intumescent fire-resistive coating manufacturer's written instructions for conditions of exposure and intended use. For auxiliary materials, use attachment and anchorage devices of type recommended in writing by mastic and intumescent fire-resistive coating manufacturer.

E. Spray apply fire protection to maximum extent possible. After the spraying operation in each area, complete the coverage by trowel application or other placement method recommended in writing by mastic and intumescent fire-resistive coating manufacturer.

F. Extend fire protection in full thickness over entire area of each substrate to be protected.

G. Install body of fire protection in a single course unless otherwise recommended in writing by mastic and intumescent fire-resistive coating manufacturer.

H. Provide a uniform finish complying with description indicated for each type of fire protection material and matching finish approved for required mockups.

I. Cure fire protection in accordance with mastic and intumescent fire-resistive coating manufacturer's written instructions.

J. Do not install enclosing or concealing construction until after fire protection has been applied, inspected, and tested and corrections have been made to deficient applications.

K. Finishes: Where indicated, apply fire protection to produce the following finishes:

1. Manufacturer's Standard Finishes: Finish in accordance with manufacturer's written instructions for each finish selected.
2. Spray-Textured Finish: Finish left as spray applied with no further treatment.
3. Rolled, Spray-Textured Finish: Even finish produced by rolling spray-applied finish with a damp paint roller to remove drippings and excessive roughness.

3.4 FIELD QUALITY CONTROL

A. Special Inspections: Engage a qualified special inspector to perform the following special inspections:

B. Perform the tests and inspections of completed Work in successive stages. Do not proceed with application of fire protection for the next area until test results for previously completed applications of fire protection show compliance with requirements. Tested values must equal or exceed values as specified and as indicated and required for approved fire-resistance design.

C. Fire protection will be considered defective if it does not pass tests and inspections.

1. Remove and replace fire protection that does not pass tests and inspections, and retest.
2. Apply additional fire protection, per manufacturer's written instructions, where test results indicate insufficient thickness, and retest.

D. Prepare test and inspection reports.

3.5 CLEANING

A. Cleaning: Immediately after completing spraying operations in each containable area of Project, remove material overspray and fallout from surfaces of other construction and clean exposed surfaces to remove evidence of soiling.

3.6 PROTECTION

A. Protect fire protection, in accordance with advice of manufacturer and Installer, from damage resulting from construction operations or other causes, so fire protection is without damage or deterioration at time of Substantial Completion.

3.7 REPAIRS

A. As installation of other construction proceeds, inspect fire protection and repair damaged areas and fire protection removed due to work of other trades.

B. Repair fire protection damaged by other work before concealing it with other construction.

C. Repair fire protection by reapplying it using same method as original installation or using manufacturer's recommended trowel-applied product.

END OF SECTION 07 81 23

SECTION 07 92 00 - JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Nonstaining silicone joint sealants.
2. Mildew-resistant joint sealants.
3. Latex joint sealants.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Nonstaining silicone joint sealants.
2. Mildew-resistant joint sealants.
3. Latex joint sealants.

B. Samples for Initial Selection: Manufacturer's standard color charts consisting of strips of cured sealants showing the full range of colors available for each product exposed to view.

C. Samples for Verification: For each type and color of joint sealant required, provide Samples with joint sealants in 1/2-inch- wide joints formed between two 6-inch- long strips of material matching the appearance of exposed surfaces adjacent to joint sealants.

D. Joint-Sealant Schedule: Include the following information:

1. Joint-sealant application, joint location, and designation.
2. Joint-sealant manufacturer and product name.
3. Joint-sealant formulation.
4. Joint-sealant color.

1.3 INFORMATIONAL SUBMITTALS

A. Preconstruction Laboratory Test Schedule: Include the following information for each joint sealant and substrate material to be tested:

1. Joint-sealant location and designation.
2. Manufacturer and product name.
3. Type of substrate material.
4. Proposed test.
5. Number of samples required.

B. Preconstruction Laboratory Test Reports: For each joint sealant and substrate material to be tested from sealant manufacturer, indicating the following:

1. Materials forming joint substrates and joint-sealant backings have been tested for compatibility and adhesion with joint sealants.
2. Interpretation of test results and written recommendations for primers and substrate preparation are needed for adhesion.

C. Preconstruction Field-Adhesion-Test Reports: Indicate which sealants and joint preparation methods resulted in optimum adhesion to joint substrates based on testing specified in "Preconstruction Testing" Article.

D. Field Quality-Control Reports: For field-adhesion-test reports, for each sealant application tested.

1.4 CLOSEOUT SUBMITTALS

A. Manufacturers' special warranties.

B. Installer's special warranties.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Authorized representative who is trained and approved by manufacturer.

B. Testing Agency Qualifications: Qualified in accordance with ASTM C1021 to conduct the testing indicated.

1.6 MOCKUPS

A. Install sealant in mockups of assemblies specified in other Sections that are indicated to receive joint sealants specified in this Section. Use materials and installation methods specified in this Section.

1.7 PRECONSTRUCTION TESTING

A. Preconstruction Laboratory Testing: Submit to joint-sealant manufacturers, for testing indicated below, samples of materials that will contact or affect joint sealants.

1. Adhesion Testing: Use ASTM C794 to determine whether priming and other specific joint preparation techniques are required to obtain rapid, optimum adhesion of joint sealants to joint substrates.
2. Compatibility Testing: Use ASTM C1087 to determine sealant compatibility when in contact with glazing and gasket materials.
3. Stain Testing: Use ASTM C1248 to determine stain potential of sealant when in contact with masonry substrates.
4. Submit manufacturer's recommended number of pieces of each type of material, including joint substrates, joint-sealant backings, and miscellaneous materials.
5. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.

6. For materials failing tests, obtain joint-sealant manufacturer's written instructions for corrective measures, including use of specially formulated primers.
7. Testing will not be required if joint-sealant manufacturers submit data that are based on previous testing, not older than 24 months, of sealant products for adhesion to, staining of, and compatibility with joint substrates and other materials matching those submitted.

B. Preconstruction Field-Adhesion Testing: Before installing sealants, field test their adhesion to Project joint substrates as follows:

1. Locate test joints where indicated on Project or, if not indicated, as directed by Architect.
2. Conduct field tests for each kind of sealant and joint substrate.
3. Notify Architect seven days in advance of dates and times when test joints will be erected.
4. Arrange for tests to take place with joint-sealant manufacturer's technical representative present.
5. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.

    a. For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

6. Report whether sealant failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. For sealants that fail adhesively, retest until satisfactory adhesion is obtained.
7. Evaluation of Preconstruction Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing, in absence of other indications of noncompliance with requirements, will be considered satisfactory. Do not use sealants that fail to adhere to joint substrates during testing.

1.8 FIELD CONDITIONS

A. Do not proceed with installation of joint sealants under the following conditions:

1. When ambient and substrate temperature conditions are outside limits permitted by joint-sealant manufacturer or are below 40 deg F.
2. When joint substrates are wet.
3. Where joint widths are less than those allowed by joint-sealant manufacturer for applications indicated.
4. Where contaminants capable of interfering with adhesion have not yet been removed from joint substrates.

1.9 WARRANTY

A. Special Installer's Warranty: Installer agrees to repair or replace joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Two years from date of Substantial Completion.

B. Special Manufacturer's Warranty: Manufacturer agrees to furnish joint sealants to repair or replace those joint sealants that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Warranty Period: Five years from date of Substantial Completion.

C. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain joint sealants from single manufacturer for each sealant type.

2.2 JOINT SEALANTS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.3 NONSTAINING SILICONE JOINT SEALANTS

A. Nonstaining Joint Sealants: No staining of substrates when tested in accordance with ASTM C1248.

B. Silicone, Nonstaining, S, NS, 50, NT: Nonstaining, single-component, nonsag, plus 50 percent and minus 50 percent movement capability, nontraffic-use, neutral-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 50, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. GE Construction Sealants; Momentive Performance Materials Inc.; SilPruf NB.
b. Pecora Corporation.; 895NST.
c. Sika Corporation.; Bondaflex Sil 295 FPS NB.
d. The Dow Chemical Company.; 795

e. Tremco Incorporated.; Spectrem 3.

2.4 MILDEW-RESISTANT JOINT SEALANTS

A. Mildew-Resistant Joint Sealants: Formulated for prolonged exposure to humidity with fungicide to prevent mold and mildew growth.

B. Silicone, Mildew Resistant, Acid Curing, S, NS, 25, NT: Mildew-resistant, single-component, nonsag, plus 25 percent and minus 25 percent movement capability, nontraffic-use, acid-curing silicone joint sealant; ASTM C920, Type S, Grade NS, Class 25, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   a. GE Construction Sealants; Momentive Performance Materials Inc.; SCS1700 Sanitary.
   b. May National Associates, Inc.; a subsidiary of Sika Corporation U.S.; Bondaflex Sil 100 WF.
   c. Tremco Incorporated.; Tremsil 200.

2.5 LATEX JOINT SEALANTS

A. Acrylic Latex: Acrylic latex or siliconized acrylic latex, ASTM C834, Type OP, Grade NF.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

   a. BASF Construction Chemicals - Building Systems; Sonolac.
   b. Pecora Corporation.; AC-20
   c. Tremco Incorporated.; Tremflex 834.

2.6 JOINT-SEALANT BACKING

A. Sealant Backing Material, General: Nonstaining; compatible with joint substrates, sealants, primers, and other joint fillers; and approved for applications indicated by sealant manufacturer based on field experience and laboratory testing.

B. Cylindrical Sealant Backings: ASTM C1330, Type C (closed-cell material with a surface skin), and of size and density to control sealant depth and otherwise contribute to producing optimum sealant performance.

C. Bond-Breaker Tape: Polyethylene tape or other plastic tape recommended by sealant manufacturer for preventing sealant from adhering to rigid, inflexible joint-filler materials or joint surfaces at back of joint. Provide self-adhesive tape where applicable.

2.7 MISCELLANEOUS MATERIALS

A. Primer: Material recommended by joint-sealant manufacturer where required for adhesion of sealant to joint substrates indicated, as determined from preconstruction joint-sealant-substrate tests and field tests.

B. Cleaners for Nonporous Surfaces: Chemical cleaners acceptable to manufacturers of sealants and sealant backing materials, free of oily residues or other substances capable of staining or harming joint substrates and adjacent nonporous surfaces in any way, and formulated to promote optimum adhesion of sealants to joint substrates.

C. Masking Tape: Nonstaining, nonabsorbent material compatible with joint sealants and surfaces adjacent to joints.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine joints indicated to receive joint sealants, with Installer present, for compliance with requirements for joint configuration, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Cleaning of Joints: Clean out joints immediately before installing joint sealants to comply with joint-sealant manufacturer's written instructions and the following requirements:

1. Remove all foreign material from joint substrates that could interfere with adhesion of joint sealant, including dust, paints (except for permanent, protective coatings tested and approved for sealant adhesion and compatibility by sealant manufacturer), old joint sealants, oil, grease, waterproofing, water repellents, water, surface dirt, and frost.
2. Clean porous joint substrate surfaces by brushing, grinding, mechanical abrading, or a combination of these methods to produce a clean, sound substrate capable of developing optimum bond with joint sealants. Remove loose particles remaining after cleaning operations above by vacuuming or blowing out joints with oil-free compressed air. Porous joint substrates include the following:

    a. Concrete.
    b. Masonry.
    c. Unglazed surfaces of ceramic tile.
    d. Exterior insulation and finish systems.

3. Remove laitance and form-release agents from concrete.
4. Clean nonporous joint substrate surfaces with chemical cleaners or other means that do not stain, harm substrates, or leave residues capable of interfering with adhesion of joint sealants. Nonporous joint substrates include the following:

    a. Metal.
    b. Glass.
    c. Porcelain enamel.
    d. Glazed surfaces of ceramic tile.

B. Joint Priming: Prime joint substrates where recommended by joint-sealant manufacturer or as indicated by preconstruction joint-sealant-substrate tests or prior experience. Apply primer to comply with joint-sealant manufacturer's written instructions. Confine primers to areas of joint-sealant bond; do not allow spillage or migration onto adjoining surfaces.

C. Masking Tape: Use masking tape where required to prevent contact of sealant or primer with adjoining surfaces that otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove sealant smears. Remove tape immediately after tooling without disturbing joint seal.

3.3 INSTALLATION OF JOINT SEALANTS

A. General: Comply with joint-sealant manufacturer's written installation instructions for products and applications indicated, unless more stringent requirements apply.

B. Sealant Installation Standard: Comply with recommendations in ASTM C1193 for use of joint sealants as applicable to materials, applications, and conditions indicated.

C. Install sealant backings of type indicated to support sealants during application and at position required to produce cross-sectional shapes and depths of installed sealants relative to joint widths that allow optimum sealant movement capability.

1. Do not leave gaps between ends of sealant backings.
2. Do not stretch, twist, puncture, or tear sealant backings.
3. Remove absorbent sealant backings that have become wet before sealant application, and replace them with dry materials.

D. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

E. Install sealants using proven techniques that comply with the following and at the same time backings are installed:

1. Place sealants so they directly contact and fully wet joint substrates.
2. Completely fill recesses in each joint configuration.
3. Produce uniform, cross-sectional shapes and depths relative to joint widths that allow optimum sealant movement capability.

F. Tooling of Nonsag Sealants: Immediately after sealant application and before skinning or curing begins, tool sealants in accordance with requirements specified in subparagraphs below to form smooth, uniform beads of configuration indicated; to eliminate air pockets; and to ensure contact and adhesion of sealant with sides of joint.

1. Remove excess sealant from surfaces adjacent to joints.
2. Use tooling agents that are approved in writing by sealant manufacturer and that do not discolor sealants or adjacent surfaces.
3. Provide concave joint profile in accordance with Figure 8A in ASTM C1193 unless otherwise indicated.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Tests and Inspections:

1. Field-Adhesion Testing: Field test joint-sealant adhesion to joint substrates as follows:

a. Extent of Testing: Test completed and cured sealant joints as follows:

1) Perform 10 tests for the first 1000 ft. of joint length for each kind of sealant and joint substrate.
2) Perform one test for each 1000 ft. of joint length thereafter or one test per each floor per elevation.

b. Test Method: Test joint sealants in accordance with Method A, Tail Procedure, in ASTM C1521.

1) For joints with dissimilar substrates, verify adhesion to each substrate separately; extend cut along one side, verifying adhesion to opposite side. Repeat procedure for opposite side.

c. Inspect tested joints and report on the following:

1) Whether sealants filled joint cavities and are free of voids.
2) Whether sealant dimensions and configurations comply with specified requirements.
3) Whether sealants in joints connected to pulled-out portion failed to adhere to joint substrates or tore cohesively. Include data on pull distance used to test each kind of product and joint substrate. Compare these results to determine if adhesion complies with sealant manufacturer's field-adhesion hand-pull test criteria.

d. Record test results in a field-adhesion-test log. Include dates when sealants were installed, names of persons who installed sealants, test dates, test locations, whether joints were primed, adhesion results and percent elongations, sealant material, sealant configuration, and sealant dimensions.

e. Repair sealants pulled from test area by applying new sealants following same procedures used originally to seal joints. Ensure that original sealant surfaces are clean and that new sealant contacts original sealant.

2. Evaluation of Field-Adhesion-Test Results: Sealants not evidencing adhesive failure from testing or noncompliance with other indicated requirements will be considered satisfactory. Remove sealants that fail to adhere to joint substrates during testing or to comply with other requirements. Retest failed applications until test results prove sealants comply with indicated requirements.

C. Prepare test and inspection reports.

3.5 CLEANING

A. Clean off excess sealant or sealant smears adjacent to joints as the Work progresses by methods and with cleaning materials approved in writing by manufacturers of joint sealants and of products in which joints occur.

3.6 PROTECTION

A. Protect joint sealants during and after curing period from contact with contaminating substances and from damage resulting from construction operations or other causes so sealants are without deterioration or damage at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, cut out, remove, and repair damaged or deteriorated joint sealants immediately so installations with repaired areas are indistinguishable from original work.

3.7 JOINT-SEALANT SCHEDULE

A. Joint-Sealant Application: Exterior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Joints between plant-precast architectural concrete units.
    b. Control and expansion joints in unit masonry.
    c. Joints between metal panels.
    d. Joints between different materials listed above.
    e. Perimeter joints between materials listed above and frames of doors and windows.
    f. Control and expansion joints in ceilings and other overhead surfaces.

2. Joint Sealant: Silicone, nonstaining, S, NS, 50, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

B. Joint-Sealant Application: Interior joints in vertical surfaces and horizontal nontraffic surfaces not subject to significant movement.

1. Joint Locations:

    a. Control joints on exposed interior surfaces of exterior walls.
    b. Perimeter joints between interior wall surfaces and frames of interior doors,windows and elevator entrances.

2. Joint Sealant: Acrylic latex.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

C. Joint-Sealant Application: Mildew-resistant interior joints in vertical surfaces and horizontal nontraffic surfaces.

1. Joint Locations:

    a. Joints between plumbing fixtures and adjoining walls, floors, and counters.
    b. Tile control and expansion joints where indicated.
    c. Other joints as indicated on Drawings.

2. Joint Sealant: Silicone, mildew resistant, acid curing, S, NS, 25, NT.
3. Joint-Sealant Color: As selected by Architect from manufacturer's full range of colors.

END OF SECTION 07 92 00

SECTION 07 95 13.13 - INTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Wall expansion joint covers.
2. Ceiling expansion joint covers.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

1. Wall expansion joint covers.
2. Ceiling expansion joint covers.

B. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Expansion Joint Design Criteria :

1. Type of Movement: Wind sway.

    a. Nominal Joint Width: As indicated on Drawings.

2.3 WALL EXPANSION JOINT COVERS

A. Interior Type W1: Elastomeric-Seal Wall Joint Cover

1. Manufacturers: Subject to compliance with requirements, provide one of the following:

    a. Balco, Inc.; GCWC-4.
    b. Construction Specialties, Inc.; FWFC-400.
    c. InPro Corporation; 611-A09-100.

2. Application: Wall to corner.
3. Nominal joint width: 4 inches.
4. Color: To be selected by Architect from manufacturer's full range.

2.4 CEILING EXPANSION JOINT COVERS

A. Interior Type C1: Elastomeric-Seal Ceiling Joint Cover

1. Manufacturers: Subject to compliance with requirements, provide one of the following:

    a. Balco, Inc.
    b. Construction Specialties, Inc.
    c. InPro Corporation; 115 Series, A18.

2. Application: Wall to suspended acoustical tile ceiling system.
3. Nominal joint width: 4 inches.
4. Color: To be selected by Architect from manufacturer's full range.

2.5 MATERIALS

A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304 for plates, sheet, and strips.

C. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.

D. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

E. Nonmetallic, Shrinkage-Resistant Grout: ASTM C1107/C1107M, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

2.6 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

2.7 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

2.8 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.

B. Manufacturer's stainless steel attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.

1. Repair or grout block out as required for continuous frame support using nonmetallic, shrinkage-resistant grout.
2. Install frames in continuous contact with adjacent surfaces.

    a. Shimming is not permitted.

3. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
4. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
5. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
6. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Installation: Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

E. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

3.4 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections. Where necessary due to heavy construction traffic, remove and properly store cover plates or seals and install temporary protection over expansion joint cover assemblies. Reinstall cover plates or seals prior to Substantial Completion.

END OF SECTION 07 95 13.13

SECTION 07 95 13.16 - EXTERIOR EXPANSION JOINT COVER ASSEMBLIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Exterior expansion joint covers.

B. Related Requirements:

1. Section 07 71 29 "Manufactured Roof Expansion Joints" for factory-fabricated roof expansion joint cover assemblies.
2. Section 07 91 00 "Preformed Joint Seals" for preformed foam and extruded-silicone joint seals.

1.2 ACTION SUBMITTALS

A. Product Data: Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for expansion joint cover assemblies.

1. Exterior expansion joint covers.

B. Shop Drawings: For each expansion joint cover assembly.

1. Include plans, elevations, sections, details, splices, block-out requirement, attachments to other work, and line diagrams showing entire route of each expansion joint.
2. Where expansion joint cover assemblies change planes, provide isometric or clearly detailed drawing depicting how components interconnect.

C. Expansion Joint Cover Assembly Schedule: Prepared by or under the supervision of the supplier. Include the following information in tabular form:

1. Manufacturer and model number for each expansion joint cover assembly.
2. Expansion joint cover assembly location cross-referenced to Drawings.
3. Nominal, minimum, and maximum joint width.
4. Movement direction.
5. Materials, colors, and finishes.
6. Product options.

1.3 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each fire-resistance-rated expansion joint cover assembly, for tests performed by manufacturer and witnessed by a qualified testing agency.

PART 2 - PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Furnish units in longest practicable lengths to minimize field splicing.

B. Include factory-fabricated closure materials and transition pieces, T-joints, corners, curbs, cross-connections, and other accessories as required to provide continuous expansion joint cover assemblies.

2.2 PERFORMANCE REQUIREMENTS

A. Expansion Joint Design Criteria :

1. Type of Movement: Wind sway.

a. Nominal Joint Width: As indicated on Drawings.

2.3 EXTERIOR EXPANSION JOINT COVERS

A. Exterior Type E1: Elastomeric-Seal Wall Joint Cover

1. Manufacturers: Subject to compliance with requirements, provide one of the following: Basis of Design.

a. InPro Corporation; 615 Series Flush Mount Exterior Expansion Joint

2. Application: Wall to wall.
3. Nominal joint width: 2 inches.
4. Color: To be selected by Architect from manufacturer's full range.

2.4 MATERIALS

A. Aluminum: ASTM B221, Alloy 6063-T5 for extrusions; ASTM B209, Alloy 6061-T6 for sheet and plate.

1. Apply manufacturer's standard protective coating on aluminum surfaces to be placed in contact with cementitious materials.

B. Stainless Steel: ASTM A240/A240M or ASTM A666, Type 304 for plates, sheet, and strips.

C. Elastomeric Seals: Manufacturer's standard preformed elastomeric membranes or extrusions to be installed in metal frames.

D. Moisture Barrier: Manufacturer's standard, flexible elastomeric material.

2.5 ALUMINUM FINISHES

A. Mill finish.

B. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

2.6 STAINLESS STEEL FINISHES

A. Surface Preparation: Remove tool and die marks and stretch lines, or blend into finish.

B. Polished Finishes: Grind and polish surfaces to produce uniform finish, free of cross scratches.

1. Run grain of directional finishes with long dimension of each piece.
2. When polishing is completed, passivate and rinse surfaces. Remove embedded foreign matter and leave surfaces chemically clean.
3. Directional Satin Finish: No. 4.

C. Bright, Cold-Rolled, Unpolished Finish: No. 2B.

2.7 ACCESSORIES

A. Moisture Barriers: Manufacturer's standard continuous, waterproof membrane within joint and attached to substrate on sides of joint.

1. Provide where indicated on Drawings.

B. Manufacturer's stainless steel attachment devices. Include anchors, clips, fasteners, set screws, spacers, and other accessories compatible with material in contact, as indicated or required for complete installations.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces where expansion joint cover assemblies will be installed for installation tolerances and other conditions affecting performance of the Work.

B. Notify Architect where discrepancies occur that will affect proper expansion joint cover assembly installation and performance.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to expansion joint cover assembly manufacturer's written instructions.

B. Coordinate and furnish anchorages, setting drawings, and instructions for installing expansion joint cover assemblies. Provide fasteners of metal, type, and size to suit type of construction indicated and to provide for secure attachment of expansion joint cover assemblies.

3.3 INSTALLATION

A. Comply with manufacturer's written instructions for storing, handling, and installing expansion joint cover assemblies and materials unless more stringent requirements are indicated.

B. Metal Frames: Perform cutting, drilling, and fitting required to install expansion joint cover assemblies.

1. Install in true alignment and proper relationship to joints and adjoining finished surfaces measured from established lines and levels.
2. Adjust for differences between actual structural gap and nominal design gap due to ambient temperature at time of installation.
3. Cut and fit ends to accommodate thermal expansion and contraction of metal without buckling of frames.
4. Install frames in continuous contact with adjacent surfaces.

    a. Shimming is not permitted.

5. Locate anchors at interval recommended by manufacturer, but not less than 3 inches from each end and not more than 24 inches o.c.

C. Elastomeric Seals: Install elastomeric seals and membranes in frames to comply with manufacturer's written instructions. Install with minimum number of end joints.

1. Provide in continuous lengths for straight sections.
2. Seal transitions. Vulcanize or heat-weld field-spliced joints as recommended by manufacturer.
3. Mechanically lock seals into frames or adhere to frames with adhesive or pressure-sensitive tape as recommended by manufacturer.

D. Preformed Foam Joint Seals: Install in compliance with manufacturer's written instructions. Install with minimum number of end joints.

1. Install each length of seal immediately after removing protective wrapping.
2. Firmly secure compressed joint seals to joint gap side to obtain full bond using exposed pressure-sensitive adhesive or field-applied adhesive as recommended by manufacturer.
3. Do not pull or stretch material. Produce seal continuity at splices, ends, turns, and intersections of joints.

4. For applications at low ambient temperatures, heat foam joint seal material in compliance with manufacturer's written instructions.

E. Install with hairline mitered corners where expansion joint cover assemblies change direction or abut other materials.

F. Terminate exposed ends of expansion joint cover assemblies with field- or factory-fabricated termination devices.

G. Moisture Barrier Drainage: If indicated, provide drainage fitting and connect to drains.

3.4 CONNECTIONS

A. Transition to Roof Expansion Joint Covers: Coordinate installation of exterior wall and soffit expansion joint covers with roof expansion joint covers specified in Section 07 71 29 "Manufactured Roof Expansion Joints."[Install factory-fabricated units at transition between exterior walls and soffits and roof expansion joint cover assemblies.]

3.5 PROTECTION

A. Do not remove protective covering until finish work in adjacent areas is complete. When protective covering is removed, clean exposed metal surfaces to comply with manufacturer's written instructions.

B. Protect the installation from damage by work of other Sections.

END OF SECTION 07 95 13.16

SECTION 08 11 13 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Section Includes hollow-metal work.

B. Related Requirements:

1. Section 08 14 16 "Flush Wood Doors" for wood doors.
2. Section 08 71 00 "Door Hardware" for door hardware for doors.
3. Section 08 80 00 "Glazing" for glazing within hollow metal frames.

1.2 DEFINITIONS

A. Minimum Thickness: Minimum thickness of base metal without coatings in accordance with NAAMM-HMMA 803 or ANSI/SDI A250.8.

1.3 COORDINATION

A. Coordinate anchorage installation for hollow-metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Coordinate requirements for installation of door hardware, electrified door hardware, and access control and security systems.

1.4 ACTION SUBMITTALS

A. Product Data Submittals: For each product.

1. Include construction details, material descriptions, core descriptions, fire-resistance ratings, temperature-rise ratings, and finishes.

B. Shop Drawings: Include the following:

1. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
2. Locations of reinforcement and preparations for hardware.
3. Details of each different wall opening condition.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.

7. Details of moldings, removable stops, and glazing.

C. Product Schedule: For hollow-metal doors and frames, prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with final door hardware schedule.

1.5 INFORMATIONAL SUBMITTALS

A. Product Test Reports: For each type of fire-rated hollow-metal door and frame assembly fire-rated borrowed-lite assembly for tests performed by a qualified testing agency indicating compliance with performance requirements.

B. Oversize Construction Certification: For assemblies required to be fire-rated and exceeding limitations of labeled assemblies.

C. Field quality-control reports.

1.6 CLOSEOUT SUBMITTALS

A. Record Documents: For fire-rated doors, list of door numbers and applicable room name and number to which door accesses.

1.7 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies is to meet the qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies is to meet the qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow-metal doors and frames palletized, packaged, or crated to provide protection during transit and Project-site storage. Do not use nonvented plastic.

1. Provide additional protection to prevent damage to factory-finished units.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow-metal doors and frames vertically under cover at Project site with head up. Place on minimum 4-inch- high wood blocking. Provide minimum 1/4-inch space between each stacked door to permit air circulation.

PART 2 - PRODUCTS

2.1 HOLLOW METAL DOORS AND FRAMES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Ceco Door; AADG, Inc.; ASSA ABLOY.
2. Curries, AADG, Inc.; ASSA ABLOY Group.
3. LaForce, LLC.
4. Philipp Manufacturing Co (The).
5. Premier Products, Inc.
6. Republic Doors and Frames; a Allegion brand.
7. Steelcraft; Allegion plc.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

B. Fire-Rated, Borrowed-Lite Assemblies: Assemblies complying with NFPA 80 and listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing in accordance with NFPA 257 or UL 9.

C. Thermally Rated Door Assemblies: Provide door assemblies with U-factor of not more than 0.40 deg Btu/F x h x sq. ft. when tested in accordance with ASTM C1363 or ASTM E1423.

2.3 INTERIOR STANDARD STEEL DOORS AND FRAMES

A. Construct hollow-metal doors and frames to comply with standards indicated for materials, fabrication, hardware locations, hardware reinforcement, tolerances, and clearances, and as specified.

B. Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 2; ANSI/SDI A250.4, Level B. Provide at all locations unless noted otherwise.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Uncoated steel sheet, minimum thickness of 0.042 inch.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Core: Manufacturer's standard .
g. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated and temperature-rise-rated doors.

2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Full profile welded.

3. Exposed Finish: Prime.

C. Extra-Heavy-Duty Doors and Frames: ANSI/SDI A250.8, Level 3; ANSI/SDI A250.4, Level A. Provide at stairwells; toilet rooms; Janitorial and Storage rooms; and mechanical rooms.

1. Doors:

a. Type: As indicated in the Door and Frame Schedule on Drawings.
b. Thickness: 1-3/4 inches.
c. Face: Uncoated steel sheet, minimum thickness of 0.053 inch.
d. Edge Construction: Model 1, Full Flush.
e. Edge Bevel: Provide manufacturer's standard beveled or square edges.
f. Core: Manufacturer's standard .
g. Fire-Rated Core: Manufacturer's standard laminated mineral board core for fire-rated and temperature-rise-rated doors.

2. Frames:

a. Materials: Uncoated steel sheet, minimum thickness of 0.053 inch.
b. Sidelite and Transom Frames: Fabricated from same thickness material as adjacent door frame.
c. Construction: Face welded.

3. Exposed Finish: Prime.

2.4 FRAME ANCHORS

A. Jamb Anchors:

1. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated.
2. Quantity: Minimum of three anchors per jamb, with one additional anchor for frames with no floor anchor. Provide one additional anchor for each 24 inches of frame height above 7 feet.
3. Postinstalled Expansion Anchor: Minimum 3/8-inch- diameter bolts with expansion shields or inserts, with manufacturer's standard pipe spacer.

B. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.

C. Floor Anchors for Concrete Slabs with Underlayment: Adjustable-type anchors with extension clips, allowing not less than 2-inch height adjustment. Terminate bottom of frames at top of underlayment.

D. Material: ASTM A879/A879M, Commercial Steel (CS), 04Z coating designation; mill phosphatized.

1. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M; hot-dip galvanized in accordance with ASTM A153/A153M, Class B.

2.5 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Commercial Steel (CS), Type B; free of scale, pitting, or surface defects; pickled and oiled.

C. Inserts, Bolts, and Fasteners: Hot-dip galvanized in accordance with ASTM A153/A153M.

D. Power-Actuated Fasteners in Concrete: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hollow-metal frames of type indicated.

E. Mineral-Fiber Insulation: ASTM C665, Type I (blankets without membrane facing); consisting of fibers manufactured from slag or rock wool; with maximum flame-spread and smoke-developed indexes of 25 and 50, respectively; passing ASTM E136 for combustion characteristics.

F. Glazing: Comply with requirements in Section 08 80 00 "Glazing."

2.6 FABRICATION

A. Door Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted or as required to comply with published listing of qualified testing agency.

B. Hollow-Metal Frames: Fabricate in one piece except where handling and shipping limitations require multiple sections. Where frames are fabricated in sections, provide alignment plates or angles at each joint, fabricated of metal of same or greater thickness as frames.

1. Sidelite and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by welding.
2. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated.
3. Door Silencers: Except on weather-stripped frames, drill stops to receive door silencers as follows. Keep holes clear during construction.

a. Single-Door Frames: Drill stop in strike jamb to receive three door silencers.

b. Double-Door Frames: Drill stop in head jamb to receive two door silencers.

C. Hardware Preparation: Factory prepare hollow-metal doors and frames to receive templated mortised hardware, and electrical wiring; include cutouts, reinforcement, mortising, drilling, and tapping in accordance with ANSI/SDI A250.6, the Door Hardware Schedule on Drawings, and templates.

1. Reinforce doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.
2. Comply with BHMA A156.115 for preparing hollow-metal doors and frames for hardware.

D. Glazed Lites: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with mitered hairline joints.

1. Provide stops and moldings flush with face of door, and with square stops unless otherwise indicated.
2. Multiple Glazed Lites: Provide fixed and removable stops and moldings so that each glazed lite is capable of being removed independently.
3. Provide fixed frame moldings on outside of exterior and on secure side of interior doors and frames. Provide loose stops and moldings on inside of hollow-metal doors and frames.
4. Coordinate rabbet width between fixed and removable stops with glazing and installation types indicated.
5. Provide stops for installation with countersunk flat- or oval-head machine screws spaced uniformly not more than 9 inches o.c. and not more than 2 inches o.c. from each corner.

2.7 STEEL FINISHES

A. Prime Finish: Clean, pretreat, and apply manufacturer's standard primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead- and chromate-free primer complying with ANSI/SDI A250.10; recommended by primer manufacturer for substrate; compatible with substrate and field-applied coatings despite prolonged exposure.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove welded-in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces. Touch up factory-applied finishes where spreaders are removed.

B. Drill and tap doors and frames to receive nontemplated, mortised, and surface-mounted door hardware.

3.2 INSTALLATION

A. Install hollow-metal doors and frames plumb, rigid, properly aligned, and securely fastened in place. Comply with approved Shop Drawings and with manufacturer's written instructions.

B. Hollow-Metal Frames: Comply with ANSI/SDI A250.11 or NAAMM-HMMA 840 as required by standards specified.

1. Set frames accurately in position; plumbed, aligned, and braced securely until permanent anchors are set. After wall construction is complete, remove temporary braces without damage to completed Work.

a. Where frames are fabricated in sections, field splice at approved locations by welding face joint continuously; grind, fill, dress, and make splice smooth, flush, and invisible on exposed faces. Touch-up finishes.
b. Install frames with removable stops located on secure side of opening.

2. Fire-Rated Openings: Install frames in accordance with NFPA 80.
3. Floor Anchors: Secure with postinstalled expansion anchors.

a. Floor anchors may be set with power-actuated fasteners instead of postinstalled expansion anchors if so indicated and approved on Shop Drawings.

4. Solidly pack mineral-fiber insulation inside frames.
5. In-Place Concrete or Masonry Construction: Secure frames in place with postinstalled expansion anchors. Countersink anchors, and fill and make smooth, flush, and invisible on exposed faces.
6. Installation Tolerances: Adjust hollow-metal frames to the following tolerances:

a. Squareness: Plus or minus 1/16 inch, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
b. Alignment: Plus or minus 1/16 inch, measured at jambs on a horizontal line parallel to plane of wall.
c. Twist: Plus or minus 1/16 inch, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
d. Plumbness: Plus or minus 1/16 inch, measured at jambs at floor.

C. Hollow-Metal Doors: Fit and adjust hollow-metal doors accurately in frames, within clearances specified below.

1. Non-Fire-Rated Steel Doors: Comply with ANSI/SDI A250.8.
2. Fire-Rated Doors: Install doors with clearances in accordance with NFPA 80.
3. Smoke-Control Doors: Install doors in accordance with NFPA 105.

D. Glazing: Comply with installation requirements in Section 08 80 00 "Glazing" and with hollow-metal manufacturer's written instructions.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 REPAIR

A. Prime-Coat Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat and apply touchup of compatible air-drying, rust-inhibitive primer.

END OF SECTION 08 11 13

SECTION 08 14 16 - FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core five-ply flush wood veneer-faced doors for transparent finish.
2. Light frames and louvers.

B. Related Requirements:

1. Section 08 80 00 "Glazing" for glass view panels in flush wood doors.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Solid-core five-ply flush wood veneer-faced doors for transparent finish.
2. Light frames and louvers.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each type of door; construction details not covered in Product Data; and the following:

1. Door schedule indicating door and frame location, type, size, fire protection rating, and swing.
2. Door elevations, dimension and locations of hardware, lite and louver cutouts, and glazing thicknesses.
3. Details of frame for each frame type, including dimensions and profile.
4. Details of electrical raceway and preparation for electrified hardware, access control systems, and security systems.
5. Dimensions and locations of blocking for hardware attachment.
6. Dimensions and locations of mortises and holes for hardware.
7. Clearances and undercuts.
8. Requirements for veneer matching.
9. Doors to be factory finished and application requirements.

C. Samples for Initial Selection: For plastic-laminate door faces factory-finished doors.

D. Samples for Verification:

1. Factory finishes applied to actual door face materials, approximately 8 by 10 inches, for each material and finish.
2. Frames for light openings, 6 inches long, for each material, type, and finish required.

1.3 INFORMATIONAL SUBMITTALS

A. Field quality-control reports.

B. Sample Warranty: For special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Special warranties.

1.5 QUALITY ASSURANCE

A. Fire-Rated Door Inspector Qualifications: Inspector for field quality-control inspections of fire-rated door assemblies complies with qualifications set forth in NFPA 80, Section 5.2.3.1 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

B. Egress Door Inspector Qualifications: Inspector for field quality-control inspections of egress door assemblies complies with qualifications set forth in NFPA 101, Section 7.2.1.15.4 and the following:

1. DHI's Fire and Egress Door Assembly Inspector (FDAI) certification.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of referenced standard and manufacturer's written instructions.

B. Package doors individually in plastic bags or cardboard cartons.

C. Mark each door on bottom rail with opening number used on Shop Drawings.

1.7 FIELD CONDITIONS

A. Environmental Limitations:

1. Do not deliver or install doors until building is enclosed and weathertight, wet work is complete, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Delamination of veneer.

b. Warping (bow, cup, or twist) more than 1/4 inch in a 42-by-84-inch section.
c. Telegraphing of core construction in face veneers exceeding 0.01 inch in a 3-inch span.

2. Warranty also includes installation and finishing that may be required due to repair or replacement of defective doors.
3. Warranty Period for Solid-Core Interior Doors: Life of installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain flush wood doors from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Wood Door and Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency acceptable to authorities having jurisdiction, for fire-protection ratings and temperature-rise limits indicated on Drawings, based on testing at positive pressure in accordance with UL 10C or NFPA 252.

1. Oversize Fire-Rated Door Assemblies: For units exceeding sizes of tested assemblies, provide certification by a qualified testing agency that doors comply with standard construction requirements for tested and labeled fire-rated door assemblies except for size.
2. Temperature-Rise Limit: At vertical exit enclosures and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F above ambient after 30 minutes of standard fire-test exposure.

B. Smoke- and Draft-Control Door Assemblies: Listed and labeled for smoke and draft control by a qualified testing agency acceptable to authorities having jurisdiction, based on testing in accordance with UL 1784 and installed in compliance with NFPA 105.

2.3 FLUSH WOOD DOORS AND FRAMES, GENERAL

A. Quality Standard: In addition to requirements specified, comply with ANSI/WDMA I.S. 1A.

1. The Contract Documents contain requirements that are more stringent than the referenced quality standard. Comply with the Contract Documents in addition to those of the referenced quality standard.

2.4 SOLID-CORE FIVE-PLY FLUSH WOOD VENEER-FACED DOORS FOR TRANSPARENT FINISH

A. Interior Doors, Solid-Core Five-Ply Veneer-Faced :

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Algoma Hardwoods, Inc.
    b. Eggers Industries.
    c. Graham Wood Doors.
    d. Marshfield Door Systems, Inc.
    e. VT Industries, Inc.

2. Performance Grade by Location:

    a. ANSI/WDMA I.S. 1A Extra Heavy Duty: Classrooms, public toilets, janitor's closets, mechanical and storage rooms, assembly spaces, and exits .
    b. ANSI/WDMA I.S. 1A Heavy Duty: All other locations.

3. ANSI/WDMA I.S. 1A Quality Grade: Custom.
4. Faces: Single-ply wood veneer not less than 1/50 inch thick.

    a. Species: White oak.
    b. Cut: Rift cut.
    c. Match between Veneer Leaves: Book match.
    d. Assembly of Veneer Leaves on Door Faces: Running match.
    e. Pair and Set Match: Provide for doors hung in same opening or separated only by mullions.
    f. Room Match:

        1) Match door faces within each separate room or area of building. Corridor-door faces do not need to match where they are separated by 20 feet or more.

    g. Transom Match: Continuous match.

5. Exposed Vertical and Top Edges: Applied wood edges of same species as faces and covering edges of crossbands - Architectural Woodwork Standards edge Type D.

    a. Fire-Rated Single Doors: Provide edge construction with intumescent seals concealed by outer stile. Comply with specified requirements for exposed vertical edges.
    b. Fire-Rated Pairs of Doors:

        1) Provide formed-steel edges and astragals with intumescent seals.

            a) Finish steel edges and astragals with baked enamel same color as doors.

    c. Mineral-Core Doors: At hinge stiles, provide laminated-edge construction with improved screw-holding capability and split resistance. Comply with specified requirements for exposed edges.

1) Screw-Holding Capability: 550 lbf in accordance with WDMA T.M. 10.

6. Core for Non-Fire-Rated Doors:

a. WDMA I.S. 10 structural composite lumber.

1) Screw Withdrawal, Door Face: 550 lbf.
2) Screw Withdrawal, Vertical Door Edge: 400 lbf.

7. Core for Fire-Rated Doors: As required to achieve fire-protection rating indicated on Drawings.

a. Blocking for Mineral-Core Doors: Provide composite blocking with improved screw-holding capability approved for use in doors of fire-protection ratings indicated on Drawings as needed to eliminate through-bolting hardware.

8. Construction: Five plies, hot-pressed bonded (vertical and horizontal edging is bonded to core), with entire unit abrasive planed before veneering.

2.5 LIGHT FRAMES AND LOUVERS

A. Wood Beads for Light Openings in Wood Doors: Provide manufacturer's standard wood beads unless otherwise indicated.

1. Wood Species: Same species as door faces .
2. Profile: Recessed tapered beads .
3. At wood-core doors with 20-minute fire-protection ratings, provide wood beads and metal glazing clips approved for such use.

B. Wood-Veneered Beads for Light Openings in Fire-Rated Doors: Manufacturer's standard wood-veneered noncombustible beads matching veneer species of door faces and approved for use in doors of fire-protection rating indicated on Drawings. Include concealed metal glazing clips where required for opening size and fire-protection rating indicated.

2.6 FABRICATION

A. Factory fit doors to suit frame-opening sizes indicated.

1. Comply with clearance requirements of referenced quality standard for fitting unless otherwise indicated.
2. Comply with NFPA 80 requirements for fire-rated doors.

B. Factory machine doors for hardware that is not surface applied.

1. Locate hardware to comply with DHI-WDHS-3.
2. Comply with final hardware schedules, door frame Shop Drawings, ANSI/BHMA-156.115-W, and hardware templates.

3. Coordinate with hardware mortises in metal frames, to verify dimensions and alignment before factory machining.
4. For doors scheduled to receive electrified locksets, provide factory-installed raceway and wiring to accommodate specified hardware.
5. Metal Astragals: Factory machine astragals and formed-steel edges for hardware for pairs of fire-rated doors.

C. Transom and Side Panels:

1. Fabricate matching panels with same construction, exposed surfaces, and finish as specified for associated doors.
2. Finish bottom edges of transoms and top edges of rabbeted doors same as door stiles.
3. Fabricate door and transom panels with full-width, solid-lumber, rabbeted, meeting rails.
4. Provide factory-installed spring bolts for concealed attachment into jambs of metal door frames.

D. Openings: Factory cut and trim openings through doors.

1. Light Openings: Trim openings with moldings of material and profile indicated.
2. Glazing: Factory install glazing in doors indicated to be factory finished. Comply with applicable requirements in Section 08 80 00 "Glazing."

2.7 FACTORY FINISHING

A. Comply with referenced quality standard for factory finishing.

1. Complete fabrication, including fitting doors for openings and machining for hardware that is not surface applied, before finishing.
2. Finish faces, all four edges, edges of cutouts, and mortises.
3. Stains and fillers may be omitted on top and bottom edges, edges of cutouts, and mortises.

B. Factory finish doors.

C. Transparent Finish:

1. ANSI/WDMA I.S. 1A Grade: Custom.

a. TR-6 Catalyzed Polyurethane.

2. Staining: Match Architect's sample .
3. Sheen: Satin .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine doors and installed door frames, with Installer present, before hanging doors.

1. Verify that installed frames comply with indicated requirements for type, size, location, and swing characteristics and have been installed with level heads and plumb jambs.
2. Reject doors with defects.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Hardware: For installation, see Section 08 71 00 "Door Hardware."

B. Install doors to comply with manufacturer's written instructions and referenced quality standard, and as indicated.

C. Install frames level, plumb, true, and straight.

1. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.
2. Anchor frames to anchors or blocking built in or directly attached to substrates.
    a. Secure with countersunk, concealed fasteners and blind nailing.
    b. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
        1) For factory-finished items, use filler matching finish of items being installed.
3. Install smoke- and draft-control doors in accordance with NFPA 105.

D. Job-Fitted Doors:

1. Align and fit doors in frames with uniform clearances and bevels as indicated below.
    a. Do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors.
2. Machine doors for hardware.
3. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.
4. Clearances:
    a. Provide 1/8 inch at heads, jambs, and between pairs of doors.
    b. Provide 1/8 inch from bottom of door to top of decorative floor finish or covering unless otherwise indicated on Drawings.
    c. Where threshold is shown or scheduled, provide 1/4 inch from bottom of door to top of threshold unless otherwise indicated.
    d. Comply with NFPA 80 for fire-rated doors.
5. Bevel non-fire-rated doors 1/8 inch in 2 inches at lock and hinge edges.
6. Bevel fire-rated doors 1/8 inch in 2 inches at lock edge; trim stiles and rails only to extent permitted by labeling agency.

E. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

F. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

3.3 FIELD QUALITY CONTROL

A. Inspection Agency: Owner will engage a qualified inspector to perform inspections and to furnish reports to Architect.

B. Inspections:

1. Fire-Rated Door Inspections: Inspect each fire-rated door in accordance with NFPA 80, Section 5.2.
2. Egress Door Inspections: Inspect each door equipped with panic hardware, each door equipped with fire exit hardware, each door located in an exit enclosure, each electrically controlled egress door, and each door equipped with special locking arrangements in accordance with NFPA 101, Section 7.2.1.15.

C. Repair or remove and replace installations where inspections indicate that they do not comply with specified requirements.

D. Reinspect repaired or replaced installations to determine if replaced or repaired door assembly installations comply with specified requirements.

E. Prepare and submit separate inspection report for each fire-rated door assembly indicating compliance with each item listed in NFPA 80 and NFPA 101.

3.4 ADJUSTING

A. Operation: Rehang or replace doors that do not swing or operate freely.

B. Finished Doors: Replace doors that are damaged or that do not comply with requirements. Doors may be repaired or refinished if Work complies with requirements and shows no evidence of repair or refinishing.

END OF SECTION 08 14 16

SECTION 08 41 13 - ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Aluminum-framed entrance and storefront systems.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Aluminum-framed entrance and storefront systems.

B. Product Data Submittals: For each product.

1. Construction details, material descriptions, dimensions of individual components and profiles, and finishes.
2. Operating characteristics, electrical characteristics, and furnished accessories.

C. Shop Drawings:

1. Plans, elevations, sections, full-size details, and attachments to other work.
2. Details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
3. Full-size isometric details of each type of vertical-to-horizontal intersection of aluminum-framed entrance and storefront systems, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

4. Connection to and continuity with adjacent thermal, weather, air, and vapor barriers.
5. Point-to-point wiring diagrams showing the following:

a. Power requirements for each electrically operated door hardware.
b. Location and types of switches, signal device, conduit sizes, and number and size of wires.

6. Signed and sealed by the qualified professional engineer responsible for their preparation.

D. Samples for Verification: Actual sample of finished products for each type of exposed finish.

1. Size: Manufacturers' standard size.

E. Delegated Design Submittals: For aluminum-framed entrances and storefront systems, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3 INFORMATIONAL SUBMITTALS

A. Field Quality-Control Reports: For aluminum-framed entrance and storefront systems.

B. Qualification Statements:

1. For Installer.

1.4 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For aluminum-framed entrance and storefront systems.

1.5 QUALITY ASSURANCE

A. Installer Qualifications:

1. Entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Delegated Design Engineer Qualifications: A professional engineer who is legally qualified to practice in state where Project is located and who is experienced in providing engineering services of the type indicated.

C. Testing Agency Qualifications: Qualified in accordance with ASTM E699 for testing indicated and accredited by IAS or ILAC Mutual Recognition Arrangement as complying with ISO/IEC 17025 and acceptable to Owner and Architect.

D. Product Options: Information on Drawings and in Specifications establishes requirements for aesthetic effects and performance characteristics of assemblies. Aesthetic effects are indicated by dimensions, arrangements, alignment, and profiles of components and assemblies as they relate to sightlines, to one another, and to adjoining construction.

1. Do not change intended aesthetic effects, as judged solely by Architect, except with Architect's approval. If changes are proposed, submit comprehensive explanatory data to Architect for review.

1.6 PRECONSTRUCTION TESTING

A. Preconstruction Adhesion and Compatibility Testing: Submit to structural glazing sealant manufacturer, for testing indicated below, Samples of each glazing material type, tape sealant, gasket, glazing accessory, and glass-framing member that is in close proximity to or is touching the structural or nonstructural sealants of a structural glazed system.

1. Compatibility: Test materials or components using ASTM C1087.
2. Adhesion: Test for adhesion or lack of adhesion of a structural sealant to the surface of another material or component using ASTM C1135.
3. Submit no fewer than [eight] <Insert number> pieces of each type of material, including joint substrates, shims, joint-sealant backings, secondary seals, and miscellaneous materials.
4. Schedule sufficient time for testing and analyzing results to prevent delaying the Work.
5. For materials failing tests, obtain sealant manufacturer's written instructions for corrective measures, including the use of specially formulated primers.
6. Testing will not be required if data based on previous testing of current sealant products match those submitted.

1.7 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of aluminum-framed entrance and storefront systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures, including .
b. Faulty operation of .
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.

2. Warranty Period: 10 years from date of Substantial Completion.

B. Special Finish Warranty, Factory-Applied Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of factory-applied finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.
b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: 20 years from date of Substantial Completion.

C. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D 4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain all components of aluminum-framed entrance and storefront system, including framing and accessories, from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design aluminum-framed entrance and storefront systems.

B. General Performance: Comply with performance requirements specified, as determined by testing of aluminum-framed entrance and storefront systems representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Aluminum-framed entrance and storefront systems to withstand movements of supporting structure, including, but not limited to, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.

a. Operable Units: Provide a minimum 1/16-inch clearance between framing members and operable units.

3. Cantilever Deflection: Limited to 2L/175 at unsupported cantilevers.

E. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, storefront assemblies, including entrance doors, do not evidence deflection exceeding specified limits.
2. When tested at 150 percent of positive and negative wind-load design pressures, storefront assemblies, including entrance doors and anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10seconds.

F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas, including entrance doors, when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

G. Energy Performance: Certified and labeled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.38 Btu/sq. ft. x h x deg F0.36 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
b. Operable Glazing and Framing Areas: U-factor for the system of not more than 0.45 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
c. Entrance Doors: U-factor of not more than 0.63 as determined in accordance with NFRC 100.

2. Solar Heat-Gain Coefficient (SHGC):

a. Fixed glazing and framing areas with projection factor less than 0.2 shall have a solar heat gain coefficient of no greater than 0.38 for vertical fenestration oriented within 45 degrees of true north; and a solar heat gain coefficient 0.40 for all other orientations, as determined according to NFRC 200.
b. Fixed glazing and framing areas with a projection factor equal to or greater than 0.2 and less than 0.5 shall have a solar heat gain coefficient of no greater than 0.46 for vertical fenestration oriented within 45 degrees of true north; and a solar heat gain coefficient of 0.48 for all other orientations, as determined according to NFRC 200.
c. Fixed glazing and framing areas with projection factor greater than 0.5 shall have a solar heat gain coefficient of no greater than 0.61 for all orientations as determined according to NFRC 200.

3. Air Leakage:

a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.
b. Entrance Doors: Air leakage of not more than 1.0 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

4. Condensation Resistance Factor (CRF):

a. Fixed Glazing and Framing Areas: CRF for the system of not less than 70 as determined in accordance with AAMA 1503.
b. Entrance Doors: CRF of not less than 68 as determined in accordance with AAMA 1503.

H. Noise Reduction: Test in accordance with ASTM E90, with ratings determined by ASTM E1332, as follows.

1. Outdoor-Indoor Transmission Class: Minimum 26.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.

a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
b. Low Exterior Ambient-Air Temperature: 0 deg F.
c. Interior Ambient-Air Temperature: 75 deg F.

2.3 ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Basis of Design YKK; YES60 TU

1. EFCO Corporation.
2. Kawneer Company, Inc.; Arconic Corporation.
3. Pittco Architectural Metals, Inc.
4. Tubelite Inc.
5. YKK AP America Inc.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Exterior Systems:

a. Profile: 2 inch by 6 inch system.
b. Exterior Framing Construction: Thermally broken .

c. Glazing System: Retained mechanically with gaskets on four sides.
d. Glazing Plane: Front.
e. Finish: Color anodic finish.

2. Interior Systems:

a. Profile: 2 inch by 4 1/2 inch system.
b. Framing Construction: Nonthermal.
c. Glazing System: Retained mechanically with gaskets on four sides .
d. Glazing Plane: Front.
e. Finish: Color anodic finish.

3. Fabrication Method: Field-fabricated stick system.
4. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
5. Steel Reinforcement: As required by manufacturer.

C. Backer Plates: Manufacturer's standard, continuous backer plates for framing members, if not integral, where framing abuts adjacent construction.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Entrance Doors: Manufacturer's standard glazed entrance doors for manual-swing or automatic operation.

1. Door Construction: 1-3/4-inch overall thickness, with minimum 0.125-inch- thick, extruded-aluminum tubular rail and stile members. Mechanically fasten corners with reinforcing brackets that are deeply penetrated and fillet welded or that incorporate concealed tie rods.

a. Thermal Construction: High-performance plastic connectors separate aluminum members exposed to the exterior from members exposed to the interior.

2. Door Design: As indicated.
3. Glazing Stops and Gaskets: Beveled, snap-on, extruded-aluminum stops and preformed gaskets.

a. Provide nonremovable glazing stops on outside of door.

4. Finish: Match adjacent storefront framing finish.

2.4 ENTRANCE DOOR HARDWARE

~~2.~~ Entrance Door Hardware: Hardware not specified in this Section is specified in Section 08 71 00 "Door Hardware."

2.5 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: Manufacturer's standard sealed-corner pressure-glazing system of black, resilient elastomeric glazing gaskets, setting blocks, and shims or spacers.

C. Glazing Sealants: As recommended by manufacturer.

2.6 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.7 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads, finished to match framing system, fabricated from 300 series stainless steel.

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials .

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

E. Rigid PVC filler.

2.8 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.
5. Provisions for field replacement of glazing from exterior for panes accessible at grade, and panes where interior access is not possible; interior for panes higher than one story above grade.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.

D. Mechanically Glazed Framing Members: Fabricate for flush glazing without projecting stops.

E. Storefront Framing: Fabricate components for assembly using screw-spline system.

F. Entrance Door Frames: Reinforce as required to support loads imposed by door operation and for installing entrance door hardware.

1. At interior and exterior doors, provide compression weather stripping at fixed stops.

G. Entrance Doors: Reinforce doors as required for installing entrance door hardware.

1. At pairs of exterior doors, provide sliding-type weather stripping retained in adjustable strip and mortised into door edge.
2. At exterior doors, provide weather sweeps applied to door bottoms.

H. Entrance Door Hardware Installation: Factory install entrance door hardware to the greatest extent possible. Cut, drill, and tap for factory-installed entrance door hardware before applying finishes.

I. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.9 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF ALUMINUM-FRAMED ENTRANCE AND STOREFRONT SYSTEMS

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Seal perimeter and other joints watertight unless otherwise indicated.

G. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with materials recommended by manufacturer for this purpose or by installing nonconductive spacers.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

H. Set continuous sill members and flashing in full sealant bed, as specified in Section 07 92 00 "Joint Sealants," to produce weathertight installation.

I. Install joint filler behind sealant as recommended by sealant manufacturer.

J. Install components plumb and true in alignment with established lines and grades.

K. Install operable units level and plumb, securely anchored, and without distortion. Adjust weather-stripping contact and hardware movement to produce proper operation.

L. Install entrance doors to produce smooth operation and tight fit at contact points.

1. Exterior Doors: Install to produce weathertight enclosure and tight fit at weather stripping.
2. Field-Installed Entrance Door Hardware: Install surface-mounted entrance door hardware in accordance with entrance door hardware manufacturers' written instructions using concealed fasteners to greatest extent possible.

M. Install glazing as specified in Section 08 80 00 "Glazing."

3.3 ERECTION TOLERANCES

A. Install aluminum-framed entrance and storefront systems to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests.

B. Tests: Perform the following tests on representative areas of aluminum-framed entrance and storefront systems.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect to be tested in accordance with AAMA 501.2 and to not evidence water penetration.

    a. Perform a minimum of three tests in areas as directed by Architect.

2. Air Leakage: ASTM E783 at 1.5 times the rate specified for laboratory testing in "Performance Requirements" Article but not more than 0.09 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft..

    a. Perform a minimum of three tests in areas as directed by Architect.

C. Inspection Agency: Engage a qualified inspector to perform inspections.

D. Inspections:

1. Egress Door Inspections: Inspect each aluminum-framed entrance door equipped with panic hardware, located in an exit enclosure, electrically controlled, and equipped with special locking arrangements, in accordance with NFPA 101, Ch. 7 "Means of Egress," Section "Means of Egress Components," Article "Inspection of Door Openings."

E. Aluminum-framed entrance and storefront systems will be considered defective if they do not pass tests and inspections.

F. Prepare test and inspection reports.

END OF SECTION 08 41 13

SECTION 08 44 13 - GLAZED ALUMINUM CURTAIN WALLS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Glazed aluminum curtain wall systems:

a. Conventionally glazed.
b. Two-sided, structural-sealant-glazed.

B. Related Requirements:

1. Section 07 92 00 "Joint Sealants" for installation of joint sealants installed with glazed aluminum curtain walls and for sealants to the extent not specified in this Section.
2. Section 08 80 00 "Glazing" for curtain wall glazing.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: For glazed aluminum curtain walls. Include plans, elevations, sections, full-size details, and attachments to other work.

1. Include details of provisions for assembly expansion and contraction and for draining moisture occurring within the assembly to the exterior.
2. Include full-size isometric details of each type of vertical-to-horizontal intersection of glazed aluminum curtain walls, showing the following:

a. Joinery, including concealed welds.
b. Anchorage.
c. Expansion provisions.
d. Glazing.
e. Flashing and drainage.

3. Show connection to and continuity with adjacent thermal, weather, air, and vapor barriers.

C. Samples for Verification: For each type of exposed finish required, in manufacturer's standard sizes.

D. Delegated-Design Submittal: For glazed aluminum curtain walls, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For glazed aluminum curtain walls to include in maintenance manuals.

B. Maintenance Data for Structural Sealant: For structural-sealant-glazed curtain walls to include in maintenance manuals. Include ASTM C1401 recommendations for post-installation-phase quality-control program.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer and that employs a qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AGM) contractors.

B. Structural-Sealant Glazing: Comply with ASTM C1401 for design and installation of structural-sealant-glazed curtain wall assemblies.

1.6 WARRANTY

A. Special Assembly Warranty: Installer agrees to repair or replace components of glazed aluminum curtain wall that do not comply with requirements or that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.
b. Noise or vibration created by wind and thermal and structural movements.
c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
d. Water penetration through fixed glazing and framing areas.
e. Failure of operating components.

2. Warranty Period: Two years from date of Substantial Completion.

B. Special Finish Warranty, Anodized Finishes: Standard form in which manufacturer agrees to repair finishes or replace aluminum that shows evidence of deterioration of anodized finishes within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Delta E units when tested in accordance with ASTM D2244.

b. Chalking in excess of a No. 8 rating when tested in accordance with ASTM D4214.
c. Cracking, peeling, or chipping.

2. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazed aluminum curtain walls.

B. General Performance: Comply with performance requirements specified, as determined by testing of glazed aluminum curtain walls representing those indicated for this Project without failure due to defective manufacture, fabrication, installation, or other defects in construction.

1. Glazed aluminum curtain walls shall withstand movements of supporting structure, including, but not limited to, story drift, twist, column shortening, long-term creep, and deflection from uniformly distributed and concentrated live loads.
2. Failure also includes the following:

a. Thermal stresses transferring to building structure.
b. Glass breakage.
c. Noise or vibration created by wind and thermal and structural movements.
d. Loosening or weakening of fasteners, attachments, and other components.
e. Failure of operating units.

C. Structural Loads:

1. Wind Loads: As indicated on Drawings.
2. Other Design Loads: As indicated on Drawings.

D. Deflection of Framing Members Supporting Glass: At design wind load, as follows:

1. Deflection Normal to Wall Plane: Limited to 1/175 of clear span for spans of up to 13 feet 6 inches and to 1/240 of clear span plus 1/4 inch for spans of greater than 13 feet 6 inches.
2. Deflection Parallel to Glazing Plane: Limited to amount not exceeding that which reduces glazing bite to less than 75 percent of design dimension and that which reduces edge clearance between framing members and glazing or other fixed components to less than 1/8 inch.
3. Cantilever Deflection: Limited to 2l/175 at unsupported cantilevers.

E. Structural: Test in accordance with ASTM E330/E330M as follows:

1. When tested at positive and negative wind-load design pressures, assemblies do not evidence deflection exceeding specified limits.

2. When tested at 150 percent of positive and negative wind-load design pressures, assemblies, including anchorage, do not evidence material failures, structural distress, or permanent deformation of main framing members exceeding 0.2 percent of span.
3. Test Durations: As required by design wind velocity, but not less than 10 seconds.

F. Water Penetration under Static Pressure: Test in accordance with ASTM E331 as follows:

1. No evidence of water penetration through fixed glazing and framing areas when tested in accordance with a minimum static-air-pressure differential of 20 percent of positive wind-load design pressure, but not less than 6.24 lbf/sq. ft..

G. Interstory Drift: Accommodate design displacement of adjacent stories indicated.

1. Design Displacement: As indicated on Drawings.
2. Test Performance: Complying with criteria for passing based on building occupancy type when tested in accordance with AAMA 501.4 at design displacement and 1.5 times the design displacement.

H. Energy Performance: Certified and labelled by manufacturer for energy performance as follows:

1. Thermal Transmittance (U-factor):

a. Fixed Glazing and Framing Areas: U-factor for the system of not more than 0.36 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
b. Operable Glazing and Framing Areas: U-factor for the system of not more than 0.41 Btu/sq. ft. x h x deg F as determined in accordance with NFRC 100.
c. Entrance Doors: U-factor of not more than 0.68 Btu/sq. ft. x h x deg F (3.86 W/sq. m x K) as determined in accordance with NFRC 100.

2. Solar Heat Gain Coefficient (SHGC):

a. Fixed glazing and framing areas with projection factor less than 0.2 shall have a solar heat gain coefficient of no greater than 0.53 for vertical fenestration oriented within 45 degrees of true north; and a solar heat gain coefficient 0.40 for all other orientations, as determined according to NFRC 200.
b. Fixed glazing and framing areas with a projection factor equal to or greater than 0.2 and less than 0.5 shall have a solar heat gain coefficient of no greater than 0.58 for vertical fenestration oriented within 45 degrees of true north; and a solar heat gain coefficient of 0.48 for all other orientations, as determined according to NFRC 200.
c. Fixed glazing and framing areas with projection factor greater than 0.5 shall have a solar heat gain coefficient of no greater than 0.64 for all orientations as determined according to NFRC 200.

3. Air Leakage:

a. Fixed Glazing and Framing Areas: Air leakage for the system of not more than 0.06 cfm/sq. ft. at a static-air-pressure differential of 1.57 lbf/sq. ft. when tested in accordance with ASTM E283.

4. Condensation Resistance Factor (CRF):

    a. Fixed Glazing and Framing Areas: CRF for the system of not less than 55 as determined in accordance with AAMA 1503.
    b. Entrance Doors: CRF of not less than 57 as determined in accordance with AAMA 1503.

I. Thermal Movements: Allow for thermal movements resulting from ambient and surface temperature changes:

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.
2. Thermal Cycling: No buckling; stress on glass; sealant failure; excess stress on framing, anchors, and fasteners; or reduction of performance when tested in accordance with AAMA 501.5.

    a. High Exterior Ambient-Air Temperature: That which produces an exterior metal-surface temperature of 180 deg F.
    b. Low Exterior Ambient-Air Temperature: 0 deg F.

J. Structural-Sealant Joints:

K. Structural Sealant: ASTM C1184. Capable of withstanding tensile and shear stresses imposed by structural-sealant-glazed curtain walls without failing adhesively or cohesively. When tested for preconstruction adhesion and compatibility, cohesive failure of sealant shall occur before adhesive failure.

1. Adhesive failure occurs when sealant pulls away from substrate cleanly, leaving no sealant material behind.
2. Cohesive failure occurs when sealant breaks or tears within itself but does not separate from each substrate, because sealant-to-substrate bond strength exceeds sealant's internal strength.

2.2 SOURCE LIMITATIONS

A. Obtain all components of curtain-wall system and storefront system, including framing and entrances and accessories, from single manufacturer.

2.3 GLAZED ALUMINUM CURTAIN WALL SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Basis of Design: YKK; YCW 750 OGP and YCW 750 SSG

1. EFCO Corporation.
2. Kawneer North America, an Arconic company.
3. Professional Grade Aluminum Corporation.
4. Tubelite Inc.
5. YKK AP America Inc.

B. Framing Members: Manufacturer's extruded- or formed-aluminum framing members of thickness required and reinforced as required to support imposed loads.

1. Construction: Thermally broken.
2. Glazing System: Retained mechanically with gaskets on two sides and structural sealant on two sides.
3. Glazing Plane: Front.
4. Finish: Color anodic finish.
5. System: Stick system.
6. Aluminum: Alloy and temper recommended by manufacturer for type of use and finish indicated.
7. Steel Reinforcement: As required by manufacturer.

C. Pressure Caps: Manufacturer's standard aluminum components that mechanically retain glazing.

1. Include snap-on aluminum trim that conceals fasteners.

D. Brackets and Reinforcements: Manufacturer's standard high-strength aluminum with nonstaining, nonferrous shims for aligning system components.

E. Entrance Door Systems: Comply with Section 08 41 13 "Aluminum-Framed Entrances and Storefronts".

2.4 GLAZING

A. Glazing: Comply with Section 08 80 00 "Glazing."

B. Glazing Gaskets: ASTM C509 or ASTM C864. Manufacturer's standard.

1. Color: Black.

C. Glazing Sealants: As recommended by manufacturer.

D. Structural Glazing Sealants: ASTM C1184, chemically curing silicone formulation that is compatible with system components with which it comes into contact, specifically formulated and tested for use as structural sealant and approved by structural-sealant manufacturer for use in curtain-wall assembly indicated.

1. Color: Black.

E. Weatherseal Sealants: ASTM C920 for Type S; Grade NS; Class 25; Uses NT, G, A, and O; chemically curing silicone formulation that is compatible with structural sealant and other system components with which it comes into contact; recommended by structural-sealant, weatherseal-sealant, and structural-sealant-glazed curtain-wall manufacturers for this use.

1. Color: Match structural sealant.

2.5 MATERIALS

A. Sheet and Plate: ASTM B209.

B. Extruded Bars, Rods, Profiles, and Tubes: ASTM B221.

C. Structural Profiles: ASTM B308/B308M.

D. Steel Reinforcement:

1. Structural Shapes, Plates, and Bars: ASTM A36/A36M.
2. Cold-Rolled Sheet and Strip: ASTM A1008/A1008M.
3. Hot-Rolled Sheet and Strip: ASTM A1011/A1011M.

E. Steel Reinforcement Primer: Manufacturer's standard zinc-rich, corrosion-resistant primer complying with SSPC-PS Guide No. 12.00; applied immediately after surface preparation and pretreatment. Select surface preparation methods in accordance with recommendations in SSPC-SP COM, and prepare surfaces in accordance with applicable SSPC standard.

2.6 ACCESSORIES

A. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding fasteners and accessories compatible with adjacent materials.

1. Use self-locking devices where fasteners are subject to loosening or turning out from thermal and structural movements, wind loads, or vibration.
2. Reinforce members as required to receive fastener threads.
3. Use exposed fasteners with countersunk Phillips screw heads[, finished to match framing system][, fabricated from 300 series stainless steel].

B. Anchors: Three-way adjustable anchors with minimum adjustment of 1 inch that accommodate fabrication and installation tolerances in material and finish compatible with adjoining materials and recommended by manufacturer.

C. Concealed Flashing: Manufacturer's standard corrosion-resistant, nonstaining, nonbleeding flashing compatible with adjacent materials.

D. Bituminous Paint: Cold-applied asphalt-mastic paint containing no asbestos, formulated for 30-mil thickness per coat.

2.7 FABRICATION

A. Form or extrude aluminum shapes before finishing.

B. Weld in concealed locations to greatest extent possible to minimize distortion or discoloration of finish. Remove weld spatter and welding oxides from exposed surfaces by descaling or grinding.

C. Fabricate components that, when assembled, have the following characteristics:

1. Profiles that are sharp, straight, and free of defects or deformations.
2. Accurately fitted joints with ends coped or mitered.
3. Physical and thermal isolation of glazing from framing members.
4. Accommodations for thermal and mechanical movements of glazing and framing to maintain required glazing edge clearances.

5. Provisions for field replacement of glazing from interior for vision glass and exterior for spandrel glazing or metal panels.
6. Fasteners, anchors, and connection devices that are concealed from view to greatest extent possible.
7. Components curved to indicated radii.

D. Fabricate components to resist water penetration as follows:

1. Internal guttering system or other means to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.
2. Pressure-equalized system or double barrier design with primary air and vapor barrier at interior side of glazed aluminum curtain wall and secondary seal weeped and vented to exterior.

E. Curtain-Wall Framing: Fabricate components for assembly using shear-block system.

F. Factory-Assembled Frame Units:

1. Rigidly secure nonmovement joints.
2. Prepare surfaces that are in contact with structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.
3. Seal joints watertight unless otherwise indicated.
4. Install glazing to comply with requirements in Section 08 80 00 "Glazing."
5. Install structural glazing.

    a. Set glazing into framing in accordance with sealant manufacturer and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.
    b. Set glazing with proper orientation so that coatings face exterior or interior as specified.
    c. Apply structural silicone sealant to completely fill cavity, in accordance with sealant manufacturers written instructions with the framing and glazing in a fully supported position.
    d. Brace or stiffen framing and glazing in such a manner to prevent undue stresses on the glass edge seal and structural joints or movement of the glazing, until sealant is fully cured in accordance with manufacturer's recommendations.
    e. After structural sealant has completely cured, insert backer rod between lites of glass as recommended by sealant manufacturer.
    f. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.
    g. Clean and protect glass as indicated in Section 08 80 00 "Glazing."
    h. Retain bracing or stiffening until erected to prevent racking of units during transportation and erection.

G. After fabrication, clearly mark components to identify their locations in Project in accordance with Shop Drawings.

2.8 ALUMINUM FINISHES

A. Color Anodic Finish: AAMA 611, AA-M12C22A42/A44, Class I, 0.018 mm or thicker.

1. Color: Black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION, GENERAL

A. Comply with manufacturer's written instructions.

B. Do not install damaged components.

C. Fit joints to produce hairline joints free of burrs and distortion.

D. Rigidly secure nonmovement joints.

E. Install anchors with separators and isolators to prevent metal corrosion and electrolytic deterioration and to prevent impeding movement of moving joints.

F. Where welding is required, weld components in concealed locations to minimize distortion or discoloration of finish. Protect glazing surfaces from welding.

G. Seal joints watertight unless otherwise indicated.

H. Metal Protection:

1. Where aluminum is in contact with dissimilar metals, protect against galvanic action by painting contact surfaces with primer, applying sealant or tape, or installing nonconductive spacers as recommended by manufacturer for this purpose.
2. Where aluminum is in contact with concrete or masonry, protect against corrosion by painting contact surfaces with bituminous paint.

I. Install components to drain water passing joints, condensation occurring within framing members, and moisture migrating within glazed aluminum curtain wall to exterior.

J. Install components plumb and true in alignment with established lines and grades.

3.3 INSTALLATION OF GLAZING

A. Install glazing as specified in Section 08 80 00 "Glazing."

3.4 INSTALLATION OF STRUCTURAL GLAZING

A. Prepare surfaces that will contact structural sealant in accordance with sealant manufacturer's written instructions, to ensure compatibility and adhesion. Preparation includes, but is not limited to, cleaning and priming surfaces.

B. Set glazing into framing in accordance with sealant manufacturer's and framing manufacturer's written instructions and standard practice. Use a spacer or backer as recommended by manufacturer.

C. Set glazing with proper orientation, so that coatings face exterior or interior as specified.

D. Hold glazing in place using temporary retainers of type and spacing recommended by manufacturer, until structural sealant joint has cured.

E. Apply structural sealant to completely fill cavity, in accordance with sealant manufacturer's and framing manufacturer's written instructions and in compliance with local codes.

F. Apply structural sealant at temperatures indicated by sealant manufacturer for type of sealant.

G. Allow structural sealant to cure in accordance with manufacturer's recommendations.

H. Clean and protect glass as indicated in Section 08 80 00 "Glazing."

3.5 INSTALLATION OF WEATHERSEAL SEALANT

A. After structural sealant has completely cured, remove temporary retainers and insert backer rod between lites of glass, as recommended by sealant manufacturer.

B. Install weatherseal sealant to completely fill cavity, in accordance with sealant manufacturer's written instructions, to produce weatherproof joints.

3.6 ERECTION TOLERANCES

A. Install glazed aluminum curtain walls to comply with the following maximum tolerances:

1. Plumb: 1/8 inch in 10 feet; 1/4 inch in 40 feet.
2. Level: 1/8 inch in 20 feet; 1/4 inch in 40 feet.
3. Alignment:

    a. Where surfaces abut in line or are separated by reveal or protruding element up to 1/2 inch wide, limit offset from true alignment to 1/16 inch.
    b. Where surfaces are separated by reveal or protruding element from 1/2 to 1 inch wide, limit offset from true alignment to 1/8 inch.
    c. Where surfaces are separated by reveal or protruding element of 1 inch wide or more, limit offset from true alignment to 1/4 inch.

4. Location: Limit variation from plane to 1/8 inch in 12 feet; 1/2 inch over total length.

3.7 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Test Area: Perform tests on representative areas of glazed aluminum curtain walls.

C. Field Quality-Control Testing: Perform the following test on representative areas of glazed aluminum curtain walls.

1. Water-Spray Test: Before installation of interior finishes has begun, areas designated by Architect shall be tested in accordance with AAMA 501.2 and shall not evidence water penetration.

a. Perform a minimum of two tests in areas as directed by Architect.
b. Perform tests in each test area as directed by Architect. Perform at least three tests, prior to 10, 35, and 70 percent completion.

D. Glazed aluminum curtain walls will be considered defective if they do not pass tests and inspections.

E. Prepare test and inspection reports.

END OF SECTION 08 44 13

SECTION 08 80 00 - GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Glass products.
2. Laminated glass.
3. Insulating glass.
4. Glazing sealants.
5. Glazing tapes.
6. Miscellaneous glazing materials.

B. Related Requirements:

1. Section 06 42 16 "Flush Wood Doors"
2. Section 08 41 13 "Aluminum-Framed Entrances and Storefronts."

1.2 DEFINITIONS

A. Glass Manufacturers: Firms that produce primary glass, fabricated glass, or both, as defined in referenced glazing publications.

B. Glass Thicknesses: Indicated by thickness designations in millimeters in accordance with ASTM C1036.

C. IBC: International Building Code.

D. Interspace: Space between lites of an insulating-glass unit.

1.3 COORDINATION

A. Coordinate glazing channel dimensions to provide necessary bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances to achieve proper safety margins for glazing retention under each design load case, load case combination, and service condition.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Glass Samples: For each type of glass product other than clear monolithic vision glass; 12 inches square.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: A qualified glazing contractor for this Project who is certified under the North American Contractor Certification Program (NACC) for Architectural Glass & Metal (AG&M) contractors and who employs glazing technicians certified under the Architectural Glass and Metal Technician (AGMT) certification program.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect glazing materials in accordance with manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

B. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes.

1. Do not install glazing sealants when ambient and substrate temperature conditions are outside limits permitted by sealant manufacturer or are below 40 deg F.

1.8 WARRANTY

A. Manufacturer's Special Warranty for Coated-Glass Products: Manufacturer agrees to replace coated-glass units that deteriorate within specified warranty period. Deterioration of coated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning coated glass contrary to manufacturer's written instructions. Defects include peeling, cracking, and other indications of deterioration in coating.

1. Warranty Period: 10 years from date of Substantial Completion.

B. Manufacturer's Special Warranty for Laminated Glass: Manufacturer agrees to replace laminated-glass units that deteriorate within specified warranty period. Deterioration of laminated glass is defined as defects developed from normal use that are not attributed to glass breakage or to maintaining and cleaning laminated glass contrary to manufacturer's written instructions. Defects include edge separation, delamination materially obstructing vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

1. Warranty Period: 10 years from date of Substantial Completion.

C. Manufacturer's Special Warranty for Insulating Glass: Manufacturer agrees to replace insulating-glass units that deteriorate within specified warranty period. Deterioration of insulating glass is defined as failure of hermetic seal under normal use that is not attributed to glass breakage or to maintaining and cleaning insulating glass contrary to manufacturer's written instructions. Evidence of failure is obstruction of vision by dust, moisture, or film on interior surfaces of glass.

1. Warranty Period: 10 years from date of Substantial Completion.

D. Manufacturer's Special Warranty for Heat-Soaked Tempered Glass: Manufacturer agrees to replace heat-soaked tempered glass units that spontaneously break due to nickel sulfide (NiS) inclusions at a rate exceeding 0.3 percent within specified warranty period. Coverage for any other cause is excluded.

1. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations for Glass: Obtain glass from single source from single manufacturer.

B. Source Limitations for Glazing Accessories: For each product and installation method, obtain from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. General: Installed glazing systems shall withstand normal thermal movement and wind and impact loads (where applicable) without failure, including loss or glass breakage attributable to defective manufacture, fabrication, or installation; failure of sealants or gaskets to remain watertight and airtight; deterioration of glazing materials; or other defects in construction.

B. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design glazing.

C. Structural Performance: Glazing shall withstand the following design loads within limits and under conditions indicated determined in accordance with the IBC and ASTM E1300:

1. Design Wind Pressures: Determine design wind pressures applicable to Project in accordance with ASCE/SEI 7, based on heights above grade indicated on Drawings.

a. Wind Design Data: As indicated on Drawings.

2. Design Snow Loads: As indicated on Drawings.
3. Maximum Lateral Deflection: For glass supported on all four edges, limit center-of-glass deflection at design wind pressure to not more than 1/50 times the short-side length or 1 inch, whichever is less.

4. Thermal Loads: Design glazing to resist thermal stress breakage induced by differential temperature conditions and limited air circulation within individual glass lites and insulated glazing units.

D. Safety Glazing: Where safety glazing is indicated, provide glazing that complies with 16 CFR 1201, Category II.

E. Thermal and Optical Performance Properties: Provide glass with performance properties specified, as indicated in manufacturer's published test data, based on procedures indicated below:

1. For monolithic-glass lites, properties are based on units with lites 6 mm thick.
2. For laminated-glass lites, properties are based on products of construction indicated.
3. For insulating-glass units, properties are based on units of thickness indicated for overall unit and for each lite.
4. U-Factors: Center-of-glazing values, in accordance with NFRC 100 and based on most current non-beta version of LBL's WINDOW computer program, expressed as Btu/sq. ft. x h x deg F.
5. SHGC and Visible Transmittance: Center-of-glazing values, in accordance with NFRC 200 and based on most current non-beta version of LBL's WINDOW computer program.
6. Visible Reflectance: Center-of-glazing values, in accordance with NFRC 300.

2.3 GLASS PRODUCTS, GENERAL

A. Glazing Publications: Comply with published recommendations of glass product manufacturers and organizations below unless more stringent requirements are indicated. See these publications for glazing terms not otherwise defined in this Section or in referenced standards.

1. AAMA Publications: AAMA GDSG-1, "Glass Design for Sloped Glazing," and AAMA TIR A7, "Sloped Glazing Guidelines."
2. IGMA Publication for Insulating Glass: SIGMA TM-3000, "North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial and Residential Use."

B. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or manufacturer. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.

C. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.

D. Thickness: Where glass thickness is indicated, it is a minimum. Provide glass that complies with performance requirements and is not less than thickness indicated.

1. Minimum Glass Thickness for Exterior Lites: 6 mm.

E. Strength: Where annealed float glass is indicated, provide annealed float glass, heat-strengthened float glass, or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where heat-strengthened float glass is indicated, provide heat-strengthened float glass or fully tempered float glass as needed to comply with "Performance Requirements" Article. Where fully tempered float glass is indicated, provide fully tempered float glass.

2.4 GLASS PRODUCTS

A. Clear Annealed Float Glass: ASTM C1036, Type I, Class 1 (clear), Quality-Q3.

B. Fully Tempered Float Glass: ASTM C1048, Kind FT (fully tempered), Condition A (uncoated) unless otherwise indicated, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3.

1. Fabrication Process: By horizontal (roller-hearth) process with roll-wave distortion parallel to bottom edge of glass as installed unless otherwise indicated.
2. Heat soak panes of insulating glass units.

C. Ceramic-Coated Vision Glass: ASTM C1048, Condition C, Type I, Class 1 (clear) or Class 2 (tinted) as indicated, Quality-Q3; and complying with Specification No. 95-1-31 in NGA's "Engineering Standards Manual."

D. Ceramic-Coated Spandrel Glass: ASTM C1048, Type I, Condition B, Quality-Q3.

2.5 LAMINATED GLASS

A. Laminated Glass: ASTM C1172. Use materials that have a proven record of no tendency to bubble, discolor, or lose physical and mechanical properties after fabrication and installation.

2.6 INSULATING GLASS

A. Insulating-Glass Units: Factory-assembled units consisting of sealed lites of glass separated by a dehydrated interspace, qualified in accordance with ASTM E2190.

1. Sealing System: Dual seal, with manufacturer's standard primary and secondary sealants.
2. Perimeter Spacer: Manufacturer's standard spacer material and construction .

2.7 GLAZING SEALANTS

A. General:

1. Compatibility: Compatible with one another and with other materials they contact, including glass products, seals of insulating-glass units, and glazing channel substrates, under conditions of service and application, as demonstrated by sealant manufacturer based on testing and field experience.

2. Suitability: Comply with sealant and glass manufacturers' written instructions for selecting glazing sealants suitable for applications indicated and for conditions existing at time of installation.
3. Colors of Exposed Glazing Sealants: As selected by Architect from manufacturer's full range of industry colors.

B. Neutral-Curing Silicone Glazing Sealant, Class 50: Complying with ASTM C920, Type S, Grade NS, Use NT.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. GE Construction Sealants; Momentive Performance Materials Inc.
b. May National Associates, Inc.; a subsidiary of Sika Corporation.
c. Pecora Corporation.
d. Sika Corporation.
e. The Dow Chemical Company.
f. Tremco Incorporated.

2.8 GLAZING TAPES

A. Back-Bedding Mastic Glazing Tapes: Preformed, butyl-based, 100 percent solids elastomeric tape; nonstaining and nonmigrating in contact with nonporous surfaces; with or without spacer rod as recommended in writing by tape and glass manufacturers for application indicated; and complying with ASTM C1281 and AAMA 800 for products indicated below:

1. AAMA 806.3 tape, for glazing applications in which tape is subject to continuous pressure.
2. AAMA 807.3 tape, for glazing applications in which tape is not subject to continuous pressure.

B. Expanded Cellular Glazing Tapes: Closed-cell, PVC foam tapes; factory coated with adhesive on both surfaces; and complying with AAMA 800 for the following types:

1. AAMA 810.1, Type 1, for glazing applications in which tape acts as primary sealant.
2. AAMA 810.1, Type 2, for glazing applications in which tape is used in combination with a full bead of liquid sealant.

2.9 MISCELLANEOUS GLAZING MATERIALS

A. General: Provide products of material, size, and shape complying with referenced glazing standard, recommended in writing by manufacturers of glass and other glazing materials for application indicated, and with a proven record of compatibility with surfaces contacted in installation.

B. Cleaners, Primers, and Sealers: Types recommended by sealant or gasket manufacturer.

C. Setting Blocks:

1. Type recommended in writing by sealant or glass manufacturer.

D. Spacers:

1. Type recommended in writing by sealant or glass manufacturer.

E. Edge Blocks:

1. Type recommended in writing by sealant or glass manufacturer.

F. Cylindrical Glazing Sealant Backing: ASTM C1330, Type O (open-cell material), of size and density to control glazing sealant depth and otherwise produce optimum glazing sealant performance.

2.10 FABRICATION OF GLAZING UNITS

A. Fabricate glazing units in sizes required to fit openings indicated for Project, with edge and face clearances, edge and surface conditions, and bite complying with written instructions of product manufacturer and referenced glazing publications, to comply with system performance requirements.

1. Allow for thermal movements from ambient and surface temperature changes acting on glass framing members and glazing components.

a. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

B. Clean-cut or flat-grind vertical edges of butt-glazed monolithic lites to produce square edges with slight chamfers at junctions of edges and faces.

C. Grind smooth and polish exposed glass edges and corners.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing, glazing channels, and stops, with Installer present, for compliance with the following:

1. Manufacturing and installation tolerances, including those for size, squareness, and offsets at corners.
2. Presence and functioning of weep systems.
3. Minimum required face and edge clearances.
4. Effective sealing between joints of glass-framing members.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean glazing channels and other framing members receiving glass immediately before glazing. Remove coatings not firmly bonded to substrates.

B. Examine glazing units to locate exterior and interior surfaces. Label or mark units as needed so that exterior and interior surfaces are readily identifiable. Do not use materials that leave visible marks in the completed Work.

3.3 GLAZING, GENERAL

A. Comply with combined written instructions of manufacturers of glass, sealants, gaskets, and other glazing materials, unless more stringent requirements are indicated, including those in referenced glazing publications.

B. Protect glass edges from damage during handling and installation. Remove damaged glass from Project site and legally dispose of off Project site. Damaged glass includes glass with edge damage or other imperfections that, when installed, could weaken glass, impair performance, or impair appearance.

C. Apply primers to joint surfaces where required for adhesion of sealants, as determined by preconstruction testing.

D. Install setting blocks in sill rabbets, sized and located to comply with referenced glazing publications, unless otherwise required by glass manufacturer. Set blocks in thin course of compatible sealant suitable for heel bead.

E. Do not exceed edge pressures stipulated by glass manufacturers for installing glass lites.

F. Provide spacers for glass lites where length plus width is larger than 50 inches.

1. Locate spacers directly opposite each other on both inside and outside faces of glass. Install correct size and spacing to preserve required face clearances, unless gaskets and glazing tapes are used that have demonstrated ability to maintain required face clearances and to comply with system performance requirements.
2. Provide 1/8-inch- minimum bite of spacers on glass and use thickness equal to sealant width. With glazing tape, use thickness slightly less than final compressed thickness of tape.

G. Provide edge blocking where indicated or needed to prevent glass lites from moving sideways in glazing channel, as recommended in writing by glass manufacturer and in accordance with requirements in referenced glazing publications.

H. Set glass lites in each series with uniform pattern, draw, bow, and similar characteristics.

I. Set glass lites with proper orientation so that coatings face exterior or interior as specified.

J. Where wedge-shaped gaskets are driven into one side of channel to pressurize sealant or gasket on opposite side, provide adequate anchorage so gasket cannot walk out when installation is subjected to movement.

K. Square cut wedge-shaped gaskets at corners and install gaskets in a manner recommended by gasket manufacturer to prevent corners from pulling away; seal corner joints and butt joints with sealant recommended in writing by gasket manufacturer.

3.4 TAPE GLAZING

A. Position tapes on fixed stops so that, when compressed by glass, their exposed edges are flush with or protrude slightly above sightline of stops.

B. Install tapes continuously, but not necessarily in one continuous length. Do not stretch tapes to make them fit opening.

C. Cover vertical framing joints by applying tapes to heads and sills first, then to jambs. Cover horizontal framing joints by applying tapes to jambs, then to heads and sills.

D. Place joints in tapes at corners of opening with adjoining lengths butted together, not lapped. Seal joints in tapes with compatible sealant approved by tape manufacturer.

E. Do not remove release paper from tape until right before each glazing unit is installed.

F. Apply heel bead of elastomeric sealant.

G. Center glass lites in openings on setting blocks, and press firmly against tape by inserting dense compression gaskets formed and installed to lock in place against faces of removable stops. Start gasket applications at corners and work toward centers of openings.

H. Apply cap bead of elastomeric sealant over exposed edge of tape.

3.5 GASKET GLAZING (DRY)

A. Cut compression gaskets to lengths recommended by gasket manufacturer to fit openings exactly, with allowance for stretch during installation.

B. Insert soft compression gasket between glass and frame or fixed stop so it is securely in place with joints miter cut and bonded together at corners.

C. Installation with Pressure-Glazing Stops: Center glass lites in openings on setting blocks, and press firmly against soft compression gasket. Install dense compression gaskets and pressure-glazing stops, applying pressure uniformly to compression gaskets. Compress gaskets to produce a weathertight seal without developing bending stresses in glass. Seal gasket joints with sealant recommended in writing by gasket manufacturer.

D. Install gaskets so they protrude past face of glazing stops.

3.6 SEALANT GLAZING (WET)

A. Install continuous spacers, or spacers combined with cylindrical sealant backing, between glass lites and glazing stops to maintain glass face clearances and to prevent sealant from extruding into glass channel and blocking weep systems until sealants cure. Secure spacers or spacers and backings in place and in position to control depth of installed sealant relative to edge clearance for optimum sealant performance.

B. Force sealants into glazing channels to eliminate voids and to ensure complete wetting or bond of sealant to glass and channel surfaces.

C. Tool exposed surfaces of sealants to provide a substantial wash away from glass.

3.7 CLEANING AND PROTECTION

A. Immediately after installation, remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less than once a month, for buildup of dirt, scum, alkaline deposits, or stains.

1. If, despite such protection, contaminating substances do contact with glass, remove substances immediately as recommended in writing by glass manufacturer. Remove and replace glass that cannot be cleaned without damage to coatings.

C. Remove and replace glass that is damaged during construction period.

D. Wash glass on both exposed surfaces not more than four days before date scheduled for inspections that establish date of Substantial Completion. Wash glass as recommended in writing by glass manufacturer.

3.8 LAMINATED GLASS SCHEDULE

A. Clear Laminated Glass Type (GL-04): Two plies of fully tempered float glass.

1. Basis-of-Design Product: Viracon Laminated Acoustical Glass.
2. Minimum Thickness of Each Glass Ply: 1/4 inch.
3. Interlayer Thickness: 0.060 inch.
4. Overall Thickness: 9/16 inch.
5. STC: 39 min.
6. Safety glazing required.

3.9 INSULATING GLASS SCHEDULE

A. Low-E-Coated, Clear Insulating Glass Type (GL-10):

1. Basis-of-Design Product: Vitro Architectural Glass Solarban 70.
2. Overall Unit Thickness: 1 inch.
3. Minimum Thickness of Each Glass Lite: 1/4 inch.
4. Outdoor Lite: Fully tempered float glass.
5. Interspace Content: Argon.
6. Indoor Lite: Fully tempered float glass.
7. Low-E Coating: Sputtered on second surface.
8. Winter Nighttime U-Factor: 0.30 maximum.
9. Summer Daytime U-Factor: 0.28 maximum.
10. SGHC: 0.34 maximum.

B. Ceramic-Coated, Low-E, Insulating Spandrel Glass Type (GL-11):

1. Basis-of-Design Product: Vitro Architectural Glass; Solarban 70.
2. Coating Color: As selected by Architect from manufacturer's full range.
3. Overall Unit Thickness: 1 inch.
4. Minimum Thickness of Each Glass Lite: 1/4 inch.
5. Outdoor Lite: Clear fully tempered float glass.
6. Interspace Content: Argon.
7. Indoor Lite: Clear fully tempered float glass.
8. Ceramic Frit Pattern:

    a. Provide 100% acid etched finished on surface 3.

9. Low-E Coating: Sputtered on second surface.
10. Winter Nighttime U-Factor: 0.30 maximum.
11. Summer Daytime U-Factor: 0.28 maximum.

END OF SECTION 08 80 00

SECTION 09 05 61.13 - MOISTURE VAPOR EMISSION CONTROL

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Fluid-applied, resin-based, membrane-forming systems that control the moisture-vapor-emission rate of high-moisture, interior concrete to prepare it for floor covering installation.

1.3 DEFINITIONS

A. MVE: Moisture vapor emission.

B. MVER: Moisture vapor emission rate.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each MVE-control system, for tests performed by manufacturer and witnessed by a qualified testing agency.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Employs factory-trained personnel who are available for consultation and Project-site inspection.

B. Installer Qualifications: An authorized representative who is trained and approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating directions for storage and mixing with other components.

1.8 FIELD CONDITIONS

A. Environmental Limitations: Comply with MVE-control system manufacturer's written instructions for substrate and ambient temperatures, humidity, ventilation, and other conditions affecting system installation.

1. Store system components in a temperature-controlled environment and protected from weather and at ambient temperature of not less than 65 deg F and not more than 85 deg F at least 48 hours before use.
2. Maintain ambient temperature and relative humidity in installation areas within range recommended in writing by MVE-control system manufacturer, but not less than 65 deg F or more than 85 deg F and not less than 40 or more than 60 percent relative humidity, for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.
3. Install MVE-control systems where concrete surface temperatures will remain a minimum of 5 deg F higher than the dew point for ambient temperature and relative humidity conditions in installation areas for 48 hours before installation, during installation, and for 48 hours after installation unless longer period is recommended in writing by manufacturer.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. MVE-Control System Capabilities: Capable of suppressing MVE without failure where installed on concrete that exhibits the following conditions:

1. MVER: Maximum 25 lb of water/1000 sq. ft. when tested according to ASTM F1869.
2. Relative Humidity: Maximum 90 percent when tested according to ASTM F2170 using in situ probes.

B. Water-Vapor Transmission: Through MVE-control system, maximum 0.06 perm when tested according to ASTM E96/E96M.

C. Tensile Bond Strength: For MVE-control system, greater than 200 psi with failure in the concrete according to ASTM D7234.

2.2 MVE-CONTROL SYSTEM

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. ARDEX Americas.
2. BASF Corp. - Construction Chemicals.
3. H.B. Fuller Construction Products Inc. / TEC.
4. LATICRETE SUPERCAP, LLC.
5. MAPEI Corporation.
6. USG Corporation.

B. MVE-Control System: ASTM F3010-qualified, fluid-applied, two-component, epoxy-resin, membrane-forming system; formulated for application on concrete substrates to reduce MVER to level required for installation of floor coverings indicated and acceptable to manufacturers of floor covering products indicated, including adhesives.

1. Substrate Primer: Provide MVE-control system manufacturer's concrete-substrate primer if required for system indicated by substrate conditions.
2. Cementitious Underlayment Primer: If required for subsequent installation of cementitious underlayment products, provide MVE-control system manufacturer's primer to ensure adhesion of products to MVE-control system.

2.3 ACCESSORIES

A. Patching and Leveling Material: Moisture-, mildew-, and alkali-resistant product recommended in writing by MVE-control system manufacturer and with minimum of 3000-psi compressive strength after 28 days when tested according to ASTM C109/C109M.

B. Crack-Filling Material: Resin-based material recommended in writing by MVE-control system manufacturer for sealing concrete substrate crack repair.

C. Cementitious Underlayment: If required to maintain manufacturer's warranty, provide MVE-control system manufacturer's hydraulic cement-based underlayment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of system indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Preinstallation Testing:

1. Testing Agency: Engage a qualified testing agency to perform tests.

2. Alkalinity Testing: Perform pH testing according to ASTM F710. Install MVE-control system in areas where pH readings are less than 7.0 and in areas where pH readings are greater than 8.5.
3. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Install MVE-control system in locations where concrete substrate MVER exceeds 3 lb of water/1000 sq. ft. in 24 hours.
    b. Internal Relative Humidity Test: Using in situ probes, ASTM F2170. Install MVE-control system in locations where concrete substrates exhibit relative humidity level greater than 75 percent.

4. Tensile-Bond-Strength Testing: For typical locations indicated to receive installation of MVE-control system, install minimum 100-sq. ft. area of MVE-control system to prepared concrete substrate and test according to ASTM D7234.

    a. Proceed with installation only where tensile bond strength is greater than 200 psi with failure in the concrete.

B. Concrete Substrates: Prepare and clean substrates according to MVE-control system manufacturer's written instructions to ensure adhesion of system to concrete.

1. Remove coatings and other substances that are incompatible with MVE-control system and that contain soap, wax, oil, or silicone, using mechanical methods recommended in writing by MVE-control system manufacturer. Do not use solvents.
2. Provide concrete surface profile complying with ICRI 310.2R CSP 3 by shot blasting using apparatus that abrades the concrete surface with shot, contains the dispensed shot within the apparatus, and recirculates the shot by vacuum pickup.
3. After shot blasting, repair damaged and deteriorated concrete according to MVE-control system manufacturer's written instructions.
4. Protect substrate voids and joints to prevent resins from flowing into or leaking through them.
5. Fill surface depressions and irregularities with patching and leveling material.
6. Fill surface cracks, grooves, control joints, and other nonmoving joints with crack-filling material.
7. Allow concrete to dry, undisturbed, for period recommended in writing by MVE-control system manufacturer after surface preparation, but not less than 24 hours.
8. Before installing MVE-control systems, broom sweep and vacuum prepared concrete.

C. Protect walls, floor openings, electrical openings, door frames, and other obstructions during installation.

3.3 INSTALLATION

A. Install MVE-control system according to ASTM F3010 and manufacturer's written instructions to produce a uniform, monolithic surface free of surface deficiencies such as pin holes, fish eyes, and voids.

1. Install primers as required to comply with manufacturer's written instructions.

B. Do not apply MVE-control system across substrate expansion, isolation, and other moving joints.

C. Apply system, including component coats if any, in thickness recommended in writing by MVE-control system manufacturer for MVER indicated by preinstallation testing.

D. Cure MVE-control system components according to manufacturer's written instructions. Prevent contamination or other damage during installation and curing processes.

E. After curing, examine MVE-control system for surface deficiencies. Repair surface deficiencies according to manufacturer's written instructions.

F. Install cementitious underlayment over cured membrane if required to maintain manufacturer's warranty and in thickness required to maintain the warranty.

3.4 FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform installation inspections.

B. Installation Inspections: Inspect substrate preparation and installation of system components to ensure compliance with manufacturer's written instructions and to ensure that a complete MVE-control system is installed without deficiencies.

1. Verify that surface preparation meets requirements.
2. Verify that component coats and complete MVE-control-system film thicknesses comply with manufacturer's written instructions.
3. Verify that MVE-control-system components and installation areas that evidence deficiencies are repaired according to manufacturer's written instructions.

C. MVE-control system will be considered defective if it does not pass inspections.

3.5 PROTECTION

A. Protect MVE-control system from damage, wear, dirt, dust, and other contaminants before floor covering installation. Use protective methods and materials, including temporary coverings, recommended in writing by MVE-control system manufacturer.

B. Do not allow subsequent preinstallation examination and testing for floor covering installation to damage, puncture, or otherwise compromise the MVE-control system membrane.

END OF SECTION 09 05 61.13

SECTION 09 21 16.23 - GYPSUM BOARD SHAFT WALL ASSEMBLIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Gypsum board shaft wall assemblies.

1.3 ACTION SUBMITTALS

A. Product Data: For each component of gypsum board shaft wall assembly.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and support them on risers on a flat platform to prevent sagging.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Comply with gypsum-shaftliner-board manufacturer's written instructions.

B. Do not install finish panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: Provide materials and construction identical to those of assemblies tested according to ASTM E90 and classified according to ASTM E413 by a testing and inspecting agency.

2.2 GYPSUM BOARD SHAFT WALL ASSEMBLIES

A. Fire-Resistance Rating: As indicated on Drawings .

B. STC Rating: 51, minimum .

C. Gypsum Shaftliner Board:

1. Moisture- and Mold-Resistant Type X: ASTM C1396/C1396M; manufacturer's proprietary fire-resistive liner panels with ASTM D3273 mold-resistance score of 10 as rated according to ASTM D3274, 1 inch thick, and with double beveled long edges.

a. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1) CertainTeed Corporation.
2) Georgia-Pacific Gypsum LLC.
3) National Gypsum Company.
4) USG Corporation.

D. Non-Load-Bearing Steel Framing, General: Complying with ASTM C645 requirements for metal unless otherwise indicated and complying with requirements for fire-resistance-rated assembly indicated.

1. Protective Coating: ASTM A653/A653M, G60, hot-dip galvanized unless otherwise indicated.

E. Studs: Manufacturer's standard profile for repetitive, corner, and end members as follows:

1. Depth: As indicated .
2. Minimum Base-Metal Thickness: 0.033 inch .

F. Runner Tracks: Manufacturer's standard J-profile track with manufacturer's standard long-leg length, but at least 2 inches long and matching studs in depth.

1. Minimum Base-Metal Thickness: Matching steel studs .

G. Finish Panels: Gypsum board as specified in Section 09 29 00 "Gypsum Board." .

~~2.~~ Sound Attenuation Blankets: As specified in Section 09 29 00 "Gypsum Board."

2.3 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with shaft wall manufacturer's written instructions.

B. Trim Accessories: Cornerbead, edge trim, and control joints of material and shapes as specified in Section 09 29 00 "Gypsum Board" that comply with gypsum board shaft wall assembly manufacturer's written instructions for application indicated.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

D. Track Fasteners: Power-driven fasteners of size and material required to withstand loading conditions imposed on shaft wall assemblies without exceeding allowable design stress of track, fasteners, or structural substrates in which anchors are embedded.

1. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E488/E488M conducted by a qualified testing agency.
2. Power-Actuated Anchors: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with allowable load capacities calculated according to ICC-ES AC70, greater than or equal to the design load, as determined by testing per ASTM E1190 conducted by a qualified testing agency.

E. Reinforcing: Galvanized-steel reinforcing strips with minimum thickness of base metal (uncoated).

F. Acoustical Sealant: Section 07 92 19 "Acoustical Joint Sealants."

G. Gypsum Board Cants:

1. Gypsum Board Panels: As specified in Section 09 29 00 "Gypsum Board," Type X, 1/2- or 5/8-inch panels.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install gypsum board shaft wall assemblies to comply with requirements of fire-resistance-rated assemblies indicated and manufacturer's written installation instructions.

B. Do not bridge building expansion joints with shaft wall assemblies; frame both sides of expansion joints with furring and other support.

C. Install supplementary framing in gypsum board shaft wall assemblies around openings and as required for blocking, bracing, and support of gravity and pullout loads of fixtures, equipment, services, heavy trim, furnishings, wall-mounted door stops, and similar items that cannot be supported directly by shaft wall assembly framing.

1. Reinforcing: Provide where items attach directly to shaft wall assembly as indicated on Drawings; accurately position and secure behind at least one layer of face panel.

D. Penetrations: At penetrations in shaft wall, maintain fire-resistance rating of shaft wall assembly by installing supplementary steel framing around perimeter of penetration and fire protection behind boxes containing wiring devices, elevator call buttons and floor indicators, and similar items.

E. Isolate perimeter of gypsum panels from building structure to prevent cracking of panels while maintaining continuity of fire-rated construction.

F. Control Joints: Install control joints according to ASTM C840 and in specific locations approved by Architect while maintaining fire-resistance rating of gypsum board shaft wall assemblies.

G. Sound-Rated Shaft Wall Assemblies: Seal gypsum board shaft walls with acoustical sealant at perimeter of each assembly where it abuts other work and at joints and penetrations within each assembly.

H. Gypsum Board Cants: At projections into shaft exceeding 4 inches, install gypsum board cants covering tops of projections.

1. Slope cant panels at least 75 degrees from horizontal. Set base edge of panels in adhesive and secure top edges to shaft walls at 24 inches o.c. with screws fastened to shaft wall framing.
2. Where non-load-bearing steel framing is required to support gypsum board cants, install framing at 24 inches o.c. and extend studs from the projection to shaft wall framing.

I. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.3 PROTECTION

A. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

B. Remove and replace panels that are wet, moisture damaged, or mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, and irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 21 16.23

SECTION 09 22 16 - NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Framing systems.
2. Grid suspension systems.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Framing systems.
2. Grid suspension systems.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Notify manufacturer of damaged materials received prior to installation.

B. Deliver materials in manufacturer's original, unopened, undamaged containers with identification labels intact.

C. Protect cold-formed metal framing from corrosion, deformation, and other damage during delivery, storage, and handling as required by AISI S202, "Code of Standard Practice for Cold-Formed Steel Structural Framing."

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For fire-resistance-rated assemblies that incorporate non-load-bearing steel framing, provide materials and construction identical to those tested in assembly indicated, in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated on Drawings, in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

C. Design framing systems to accommodate deflection of primary building structure and construction tolerances and to withstand design loads with a maximum deflection of 3/4 inches.

2.2 FRAMING SYSTEMS

A. Framing Members, General: Comply with ASTM C645 for conditions indicated.

1. Steel Sheet Components: Comply with ASTM C645 requirements for metal unless otherwise indicated
2. Protective Coating: Comply with ASTM C645 ; ASTM A653/A653M, G40; or coating with equivalent corrosion resistance. Galvannealed products are unacceptable.

a. Coating demonstrates equivalent corrosion resistance with an evaluation report acceptable to authorities having jurisdiction.

B. Studs and Track: ASTM C645 .

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. ClarkDietrich.
b. Marino\\WARE.
c. MRI Steel Framing, LLC.

2. Minimum Base-Steel Thickness: 0.0329 inch.
3. Depth: As indicated on Drawings .

C. Slip-Type Head Joints: Where indicated, provide one of the following as required to not eliminate channel bridging at the top of the wall:

1. Double-Track System: Top outer tracks, inside track with 2-inch- deep flanges in thickness not less than indicated for studs and fastened to studs, and outer track sized to friction-fit over inner track.
2. Deflection Track: Steel sheet top track manufactured to prevent cracking of finishes applied to interior partition framing resulting from deflection of structure above; in thickness not less than indicated for studs and in width to accommodate depth of studs.

D. Flat Strap and Backing Plate: Steel sheet for blocking and bracing in length and width indicated.

1. Minimum Base-Steel Thickness: 0.0329 inch .

E. Hat-Shaped, Rigid Furring Channels:

1. Minimum Base-Steel Thickness: 0.0329 inch .
2. Depth: As indicated on Drawings .

F. Resilient Furring Channels: 1/2-inch- deep, steel sheet members designed to reduce sound transmission.

1. Configuration: Asymmetrical .

G. Cold-Rolled Furring Channels: 0.053-inch uncoated-steel thickness, with minimum 1/2-inch- wide flanges.

1. Depth: As indicated on Drawings .
2. Furring Brackets: Adjustable, corrugated-edge-type steel sheet with minimum uncoated-steel thickness of 0.0329 inch.
3. Tie Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper, 0.062-inch-diameter wire, or double strand of 0.048-inch- diameter wire.

H. Z-Shaped Furring: With slotted or nonslotted web, face flange of 1-1/4 inches, wall attachment flange of 3/4 inch, minimum uncoated-steel thickness of 0.0179 inch, and depth required to fit insulation thickness indicated.

2.3 GRID SUSPENSION SYSTEMS

A. Grid Suspension Systems for Gypsum Board Ceilings: ASTM C645, direct-hung system composed of main beams and cross-furring members that interlock.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Armstrong Ceiling & Wall Solutions.
b. Certainteed; SAINT-GOBAIN.
c. Rockfon; ROCKWOOL International.
d. USG Corporation.

2.4 AUXILIARY MATERIALS

A. General: Provide auxiliary materials that comply with referenced installation standards.

1. Fasteners for Steel Framing: Of type, material, size, corrosion resistance, holding power, and other properties required to fasten steel members to substrates.

B. Isolation Strip at Exterior Walls: Provide the following:

1. Foam Gasket: Adhesive-backed, closed-cell vinyl foam strips that allow fastener penetration without foam displacement, 1/8 inch thick, in width to suit steel stud size.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates, with Installer present, and including welded hollow-metal frames, cast-in anchors, and structural framing, for compliance with requirements and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Suspended Assemblies: Coordinate installation of suspension systems with installation of overhead structure to ensure that inserts and other provisions for anchorages to building structure have been installed to receive hangers at spacing required to support the Work and that hangers will develop their full strength.

1. Furnish concrete inserts and other devices indicated to other trades for installation in advance of time needed for coordination and construction.

3.3 INSTALLATION, GENERAL

A. Installation Standard: ASTM C754.

1. Gypsum Board Assemblies: Also comply with requirements in ASTM C840 that apply to framing installation.

B. Install framing and accessories plumb, square, and true to line, with connections securely fastened.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

3.4 INSTALLATION OF FRAMING SYSTEMS

A. Install framing system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.

1. Single-Layer Application: 16 inches o.c. unless otherwise indicated.
2. Multilayer Application: 16 inches o.c. unless otherwise indicated.
3. Tile Backing Panels: As required by horizontal deflection performance requirements unless otherwise indicated.

B. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

C. Install studs so flanges within framing system point in same direction.

D. Install tracks at floors and overhead supports. Extend framing full height to structural supports or substrates above suspended ceilings except where partitions are indicated to terminate at suspended ceilings. Continue framing around ducts that penetrate partitions above ceiling.

1. Slip-Type Head Joints: Where framing extends to overhead structural supports, install to produce joints at tops of framing systems that prevent axial loading of finished assemblies.
2. Door Openings: Screw vertical studs at jambs to jamb anchor clips on door frames; install track section (for cripple studs) at head and secure to jamb studs.

    a. Install two studs at each jamb unless otherwise indicated.
    b. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2-inch clearance from jamb stud to allow for installation of control joint in finished assembly.
    c. Extend jamb studs through suspended ceilings and attach to underside of overhead structure.

3. Other Framed Openings: Frame openings other than door openings the same as required for door openings unless otherwise indicated. Install framing below sills of openings to match framing required above door heads.
4. Fire-Resistance-Rated Partitions: Install framing to comply with fire-resistance-rated assembly indicated and support closures and to make partitions continuous from floor to underside of solid structure.
5. Sound-Rated Partitions: Install framing to comply with sound-rated assembly indicated.
6. Curved Partitions:

    a. Bend track to uniform curve and locate straight lengths so they are tangent to arcs.
    b. Begin and end each arc with a stud, and space intermediate studs equally along arcs. On straight lengths of no fewer than two studs at ends of arcs, place studs 6 inches o.c.

E. Direct Furring:

1. Screw to wood framing.
2. Attach to concrete or masonry with stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.

F. Z-Shaped Furring Members:

1. Erect insulation, specified in Section 07 21 00 "Thermal Insulation," vertically and hold in place with Z-shaped furring members spaced 24 inches o.c.
2. Except at exterior corners, securely attach narrow flanges of furring members to wall with concrete stub nails, screws designed for masonry attachment, or powder-driven fasteners spaced 24 inches o.c.
3. At exterior corners, attach wide flange of furring members to wall with short flange extending beyond corner; on adjacent wall surface, screw-attach short flange of furring channel to web of attached channel. At interior corners, space second member no more than 12 inches from corner and cut insulation to fit.

G. Installation Tolerance: Install each framing member so fastening surfaces vary not more than 1/8 inch from the plane formed by faces of adjacent framing.

3.5 INSTALLATION OF GRID SUSPENSION SYSTEMS

A. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

3.6 FIELD QUALITY CONTROL

A. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION 09 22 16

SECTION 09 29 00 - GYPSUM BOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Interior gypsum board.

B. Related Requirements:

1. Section 09 21 16.23 "Gypsum Board Shaft Wall Assemblies" for metal shaft-wall framing, gypsum shaft liners, and other components of shaft-wall assemblies.
2. Section 09 22 16 "Non-Structural Metal Framing" for non-structural steel framing and suspension systems that support gypsum board panels.

1.2 ACTION SUBMITTALS

A. Product Data: For the following:

1. Gypsum board, Type X.
2. Gypsum ceiling board.
3. Mold-resistant gypsum board.
4. Interior trim.
5. Joint treatment materials.
6. Laminating adhesive.
7. Sound-attenuation blankets.

1.3 DELIVERY, STORAGE AND HANDLING

A. Store materials inside under cover and keep them dry and protected against weather, condensation, direct sunlight, construction traffic, and other potential causes of damage. Stack panels flat and supported on risers on a flat platform to prevent sagging.

1.4 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C840 requirements or gypsum board manufacturer's written instructions, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.

2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain each type of gypsum panel and joint finishing material from single source with resources to provide products of consistent quality in appearance and physical properties.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E119 by an independent testing agency.

B. STC-Rated Assemblies: For STC-rated assemblies, provide materials and construction identical to those tested in assembly indicated in accordance with ASTM E90 and classified in accordance with ASTM E413 by an independent testing agency.

2.3 GYPSUM BOARD, GENERAL

A. Size: Provide maximum lengths and widths available that will minimize joints in each area and that correspond with support system indicated.

2.4 INTERIOR GYPSUM BOARD

A. Gypsum Board, Type X: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Certainteed; SAINT-GOBAIN.
    b. Georgia-Pacific Gypsum LLC.
    c. Gold Bond Building Products, LLC provided by National Gypsum Company.
    d. USG Corporation.

2. Thickness: 5/8 inch.
3. Long Edges: Tapered and featured (rounded or beveled) for prefilling.

B. Gypsum Ceiling Board: ASTM C1396/C1396M.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

    a. Certainteed; SAINT-GOBAIN.
    b. Georgia-Pacific Gypsum LLC.

c. Gold Bond Building Products, LLC provided by National Gypsum Company.
d. USG Corporation.

2. Thickness: 1/2 inch.
3. Long Edges: Tapered.

C. Mold-Resistant Gypsum Board: ASTM C1396/C1396M. With moisture- and mold-resistant core and paper surfaces.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Certainteed; SAINT-GOBAIN.
b. Georgia-Pacific Gypsum LLC.
c. Gold Bond Building Products, LLC provided by National Gypsum Company.
d. USG Corporation.

2. Core: 5/8 inch, Type X.
3. Long Edges: Tapered.
4. Mold Resistance: ASTM D3273, score of 10 as rated in accordance with ASTM D3274.

a. Georgia-Pacific Gypsum LLC.
b. James Hardie Building Products, Inc.

2.5 TRIM ACCESSORIES

A. Interior Trim: ASTM C1047.

1. Material: Galvanized or aluminum-coated steel sheet, rolled zinc, plastic, or paper-faced galvanized-steel sheet Galvanized or aluminum-coated steel sheet or rolled zinc Plastic Paper-faced galvanized-steel sheet.
2. Shapes:

a. Cornerbead.
b. LC-Bead: J-shaped; exposed long flange receives joint compound.
c. U-Bead: J-shaped; exposed short flange does not receive joint compound.
d. Expansion (control) joint.
e. Wall Reveal: 1/2-inch high by 5/8-inch depth.

2.6 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C475/C475M.

B. Joint Tape:

1. Interior Gypsum Board: Paper.

C. Joint Compound for Interior Gypsum Board: For each coat, use formulation that is compatible with other compounds applied on previous or for successive coats.

1. Prefilling: At open joints, rounded or beveled panel edges, and damaged surface areas, use setting-type taping compound.
2. Embedding and First Coat: For embedding tape and first coat on joints, fasteners, and trim flanges, use setting-type taping compound.

    a. Use setting-type compound for installing paper-faced metal trim accessories.

3. Fill Coat: For second coat, use drying-type, all-purpose compound.
4. Finish Coat: For third coat, use drying-type, all-purpose compound.
5. Skim Coat: For final coat of Level 5 finish, use setting-type, sandable topping compound .

2.7 AUXILIARY MATERIALS

A. Provide auxiliary materials that comply with referenced installation standards and manufacturer's written instructions.

B. Laminating Adhesive: Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

C. Steel Drill Screws: ASTM C1002 unless otherwise indicated.

1. Use screws complying with ASTM C954 for fastening panels to steel members from 0.033 to 0.112 inch thick.
2. For fastening cementitious backer units, use screws of type and size recommended by panel manufacturer.

D. Sound-Attenuation Blankets: ASTM C665, Type I (blankets without membrane facing) produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.

1. Fire-Resistance-Rated Assemblies: Comply with mineral-fiber requirements of assembly.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and substrates including welded hollow-metal frames and support framing, with Installer present, for compliance with requirements and other conditions affecting performance of the Work.

B. Examine panels before installation. Reject panels that are wet, moisture damaged, and mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION AND FINISHING OF PANELS, GENERAL

A. Comply with ASTM C840.

B. Install ceiling panels across framing to minimize the number of abutting end joints and to avoid abutting end joints in central area of each ceiling. Stagger abutting end joints of adjacent panels not less than one framing member.

C. Install panels with face side out. Butt panels together for a light contact at edges and ends with not more than 1/16 inch of open space between panels. Do not force into place.

D. Locate edge and end joints over supports, except in ceiling applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Do not place tapered edges against cut edges or ends. Stagger vertical joints on opposite sides of partitions. Do not make joints other than control joints at corners of framed openings.

E. Form control and expansion joints with space between edges of adjoining gypsum panels.

F. Cover both faces of support framing with gypsum panels in concealed spaces (above ceilings, etc.), except in chases braced internally.

1. Unless concealed application is indicated or required for sound, fire, air, or smoke ratings, coverage may be accomplished with scraps of not less than 8 sq. ft. in area.
2. Fit gypsum panels around ducts, pipes, and conduits.
3. Where partitions intersect structural members projecting below underside of floor/roof slabs and decks, cut gypsum panels to fit profile formed by structural members; allow 1/4- to 3/8-inch- wide joints to install sealant.

G. Isolate perimeter of gypsum board applied to non-load-bearing partitions at structural abutments. Provide 1/4- to 1/2-inch- wide spaces at these locations and trim edges with edge trim where edges of panels are exposed. Seal joints between edges and abutting structural surfaces with acoustical sealant.

H. Attachment to Steel Framing: Attach panels so leading edge or end of each panel is attached to open (unsupported) edges of stud flanges first.

I. STC-Rated Assemblies: Seal construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant. Install acoustical sealant at both faces of partitions at perimeters and through penetrations. Comply with ASTM C919 and with manufacturer's written instructions for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.

J. Install sound attenuation blankets before installing gypsum panels unless blankets are readily installed after panels have been installed on one side.

3.3 INSTALLATION OF INTERIOR GYPSUM BOARD

A. Install interior gypsum board in the following locations:

1. Type X: Vertical surfaces unless otherwise indicated.
2. Ceiling Type: Ceiling surfaces.
3. Mold-Resistant Type: Vertical surfaces behind plumbing fixtures, for a minimum distance of three feet on each side from the edge of the fixture.

B. Single-Layer Application:

1. On ceilings, apply gypsum panels before wall/partition board application to greatest extent possible and at right angles to framing unless otherwise indicated.
2. On partitions/walls, apply gypsum panels vertically (parallel to framing) unless otherwise indicated or required by fire-resistance-rated assembly, and minimize end joints.

    a. Stagger abutting end joints not less than one framing member in alternate courses of panels.
    b. At stairwells and other high walls, install panels horizontally unless otherwise indicated or required by fire-resistance-rated assembly.

3. On Z-shaped furring members, apply gypsum panels vertically (parallel to framing) with no end joints. Locate edge joints over furring members.
4. Fastening Methods: Apply gypsum panels to supports with steel drill screws.

C. Multilayer Application:

1. On ceilings, apply gypsum board indicated for base layers before applying base layers on walls/partitions; apply face layers in same sequence. Apply base layers at right angles to framing members and offset face-layer joints one framing member, 16 inches minimum, from parallel base-layer joints, unless otherwise indicated or required by fire-resistance-rated assembly.
2. On partitions/walls, apply gypsum board indicated for base layers and face layers vertically (parallel to framing) with joints of base layers located over stud or furring member and face-layer joints offset at least one stud or furring member with base-layer joints unless otherwise indicated or required by fire-resistance-rated assembly. Stagger joints on opposite sides of partitions.
3. On Z-shaped furring members, apply base layer vertically (parallel to framing) and face layer either vertically (parallel to framing) or horizontally (perpendicular to framing) with vertical joints offset at least one furring member. Locate edge joints of base layer over furring members.
4. Fastening Methods: Fasten base layers and face layers separately to supports with screws.

D. Laminating to Substrate: Where gypsum panels are indicated as directly adhered to a substrate (other than studs, joists, furring members, or base layer of gypsum board), comply with gypsum board manufacturer's written instructions and temporarily brace or fasten gypsum panels until fastening adhesive has set.

3.4 INSTALLATION OF TRIM ACCESSORIES

A. General: For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Control Joints: Install control joints in accordance with ASTM C840 and in specific locations approved by Architect for visual effect.

C. Interior Trim: Install in the following locations:

1. Cornerbead: Use at outside corners.
2. LC-Bead: Use at exposed panel edges.
3. Wall Reveal: Where indicated on drawings.

3.5 FINISHING OF GYPSUM BOARD

A. General: Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration. Promptly remove residual joint compound from adjacent surfaces.

B. Prefill open joints, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except for trim products specifically indicated as not intended to receive tape.

D. Gypsum Board Finish Levels: Finish panels to levels indicated below and in accordance with ASTM C840:

1. Level 1: Ceiling plenum areas, concealed areas, and where indicated.
2. Level 2: Panels that are substrate for tile.
3. Level 4: At panel surfaces that will be exposed to view with gloss level 4 or lower paint finish.

    a. Primer and its application to surfaces are specified in Section 09 91 23 "Interior Painting."

4. Level 5: At panel surfaces that will be exposed to view with gloss level 5 or higher paint finish, and at panel surfaces to receive wall covering. Also apply where indicated on Drawings.

    a. Provide USG Tuff-Hide or comparable product by other acceptable manufacturers.

E. Cementitious Backer Units: Finish according to manufacturer's written instructions.

3.6 PROTECTION

A. Protect adjacent surfaces from drywall compound and promptly remove from floors and other non-drywall surfaces. Repair surfaces stained, marred, or otherwise damaged during drywall application.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.

1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

END OF SECTION 09 29 00

SECTION 09 51 13 - ACOUSTICAL PANEL CEILINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Acoustical panels (Ceiling Type x.)
2. Metal suspension system.
3. Metal edge moldings and trim.

B. Products furnished, but not installed under this Section, include anchors, clips, and other ceiling attachment devices to be cast in concrete.

1.2 ACTION SUBMITTALS

A. Product Data:

1. Acoustical panels.
2. Metal suspension system.
3. Metal edge moldings and trim.

B. Samples for Verification: For each component indicated and for each exposed finish required, prepared on Samples of sizes indicated below:

1. Acoustical Panels: Set of 6-inch- square Samples of each type, color, pattern, and texture.
2. Exposed Suspension-System Members, Moldings, and Trim: Set of 6-inch- long Samples of each type, finish, and color.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For finishes to include in maintenance manuals.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Acoustical Ceiling Units: Full-size panels equal to 2 percent of quantity installed.
2. Suspension-System Components: Quantity of each exposed component equal to 2 percent of quantity installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver acoustical panels, suspension-system components, and accessories to Project site and store them in a fully enclosed, conditioned space where they will be protected against damage from moisture, humidity, temperature extremes, direct sunlight, surface contamination, and other causes.

B. Before installing acoustical panels, permit them to reach room temperature and a stabilized moisture content.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install acoustical panel ceilings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

1. Pressurized Plenums: Operate ventilation system for not less than 48 hours before beginning acoustical panel ceiling installation.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Source Limitations for Ceiling System: Obtain each type of acoustical ceiling panel and its supporting suspension system from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: Class A in accordance with ASTM E1264.
2. Smoke-Developed Index: 50 or less.

2.3 ACOUSTICAL PANELS

A. Manufacturer Contacts:

1. Armstrong: Trish Albertini, 312-405-9871, talbertini@armstrongceilings.com.

B. Celing Type 1: For use with 15/16 inch grid.

1. Products:

a. Armstrong, Inc.; Cortega, with angled tegular edge.

2. Modular Size: 24 inches by 24 inches by 5/8 inches.
3. Color: White.
4. NRC: 0.70.

C. Celing Type 2: For use with 15/16 inch grid.

1. Products:

a. Armstrong, Inc.; Cirrus Second Look III, with Beveled tegular edge.

2. Modular Size: 24 inches by 48 inches by 3/4 inches.
3. Color: White.
4. NRC: 0.70.

D. Ceiling Type 8: For use with 15/16 inch grid.

1. Products:

a. Armstrong, Inc.; Match Existing ceiling tiles.

2. Modular Size: 24 inches by 24 inches; match existing.
3. Color: Black
4. Edge: Square Edge.

E. Ceiling Type 9: Ceiling Baffles.

1. Products:

a. GS Acoustics; aCapella Verse Baffles.

2. Modular Size: As Indicated on Drawings.
3. Color: As Selected by Architect.

2.4 METAL SUSPENSION SYSTEM

A. For acoustical panel tiles indicated for use with 15/16 inch grid.

1. Manufacturers:

a. Armstrong, Inc.; Prelude 15/16.

2. Structural Classification: Intermediate Duty.
3. Color:

a. White.
b. Black at Ceiling Type 8 to match existing.

2.5 ACCESSORIES

A. Attachment Devices: Size for five times the design load indicated in ASTM C635/C635M, Table 1, "Direct Hung," unless otherwise indicated. Comply with seismic design requirements.

1. Anchors in Concrete: Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to five times that imposed by ceiling construction, as determined by testing in accordance with ASTM E488/E488M or ASTM E1512 as applicable, conducted by a qualified testing and inspecting agency.

    a. Type: Postinstalled expansion anchors.
    b. Corrosion Protection, Carbon Steel: Components zinc plated in accordance with ASTM B633, Class SC 1 (mild) service condition.

B. Wire Hangers, Braces, and Ties: Provide wires as follows:

1. Zinc-Coated, Carbon-Steel Wire: ASTM A641/A641M, Class 1 zinc coating, soft temper.
2. Size: Wire diameter sufficient for its stress at three times hanger design load (ASTM C635/C635M, Table 1, "Direct Hung") will be less than yield stress of wire, but not less than 0.135-inch- diameter wire.

C. Provide perimeter "Teg Tabs" perimeter trim at tegular edge ceiling systems.

1. Size as required to match ceiling system.

2.6 METAL EDGE MOLDINGS AND TRIM

A. Roll-Formed, Sheet-Metal Edge Moldings and Trim: Type and profile indicated or, if not indicated, manufacturer's standard moldings for edges and penetrations that comply with seismic design requirements; formed from sheet metal of same material, finish, and color as that used for exposed flanges of suspension-system runners.

1. Edge moldings to fit acoustical panel edge details and suspension systems indicated and match width and configuration of exposed runners unless otherwise indicated.
2. For lay-in panels with reveal edge details, provide stepped edge molding that forms reveal of same depth and width as that formed between edge of panel and flange at exposed suspension member.
3. For circular penetrations of ceiling, provide edge moldings fabricated to diameter required to fit penetration exactly.
4. Perimeter metal trim:

    a. Provide 2-inch and 6-inch perimeter transition trim in white color where indicated on Drawings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, including structural framing to which acoustical panel ceilings attach or abut, with Installer present, for compliance with requirements specified in this and other Sections that affect ceiling installation and anchorage and with requirements for installation tolerances and other conditions affecting performance of acoustical panel ceilings.

B. Examine acoustical panels before installation. Reject acoustical panels that are wet, moisture damaged, or mold damaged.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Measure each ceiling area and establish layout of acoustical panels to balance border widths at opposite edges of each ceiling. Avoid using less-than-half-width panels at borders unless otherwise indicated, and comply with layout shown on reflected ceiling plans.

B. Layout openings for penetrations centered on the penetrating items.

3.3 INSTALLATION OF ACOUSTICAL PANEL CEILINGS

A. Install acoustical panel ceilings in accordance with ASTM C636/C636M and manufacturer's written instructions.

B. Suspend ceiling hangers from building's structural members and as follows:

1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structure or of ceiling suspension system.
2. Splay hangers only where required to miss obstructions; offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with location of hangers at spacings required to support standard suspension-system members, install supplemental suspension members and hangers in form of trapezes or equivalent devices.
4. Secure wire hangers to ceiling-suspension members and to supports above with a minimum of three tight turns. Connect hangers directly to structure or to inserts, eye screws, or other devices that are secure and appropriate for substrate and that will not deteriorate or otherwise fail due to age, corrosion, or elevated temperatures.
5. Do not support ceilings directly from permanent metal forms or floor deck. Fasten hangers to cast-in-place hanger inserts, postinstalled mechanical or adhesive anchors, or power-actuated fasteners that extend through forms into concrete.

6. When steel framing does not permit installation of hanger wires at spacing required, install carrying channels or other supplemental support for attachment of hanger wires.
7. Do not attach hangers to steel deck tabs.
8. Do not attach hangers to steel roof deck. Attach hangers to structural members.
9. Space hangers not more than 48 inches o.c. along each member supported directly from hangers unless otherwise indicated; provide hangers not more than 8 inches from ends of each member.
10. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced standards.

C. Secure bracing wires to ceiling suspension members and to supports with a minimum of four tight turns. Suspend bracing from building's structural members as required for hangers, without attaching to permanent metal forms, steel deck, or steel deck tabs. Fasten bracing wires into concrete with cast-in-place or postinstalled anchors.

D. Install edge moldings and trim of type indicated at perimeter of acoustical ceiling area and where necessary to conceal edges of acoustical panels.

1. Screw attach moldings to substrate at intervals not more than 16 inches o.c. and not more than 3 inches from ends. Miter corners accurately and connect securely.
2. Do not use exposed fasteners, including pop rivets, on moldings and trim.

E. Install suspension-system runners so they are square and securely interlocked with one another. Remove and replace dented, bent, or kinked members.

F. Install acoustical panels with undamaged edges and fit accurately into suspension-system runners and edge moldings. Scribe and cut panels at borders and penetrations to provide precise fit.

1. For square-edged panels, install panels with edges fully hidden from view by flanges of suspension-system runners and moldings.
2. For reveal-edged panels on suspension-system runners, install panels with bottom of reveal in firm contact with top surface of runner flanges.
3. For reveal-edged panels on suspension-system members with box-shaped flanges, install panels with reveal surfaces in firm contact with suspension-system surfaces and panel faces flush with bottom face of runners.
4. Paint cut edges of panel remaining exposed after installation; match color of exposed panel surfaces using coating recommended in writing for this purpose by acoustical panel manufacturer.
5. Protect lighting fixtures and air ducts in accordance with requirements indicated for fire-resistance-rated assembly.

3.4 ERECTION TOLERANCES

A. Suspended Ceilings: Install main and cross runners level to a tolerance of 1/8 inch in 12 feet, non-cumulative.

B. Moldings and Trim: Install moldings and trim to substrate and level with ceiling suspension system to a tolerance of 1/8 inch in 12 feet, non-cumulative.

3.5 CLEANING

A. Clean exposed surfaces of acoustical panel ceilings, including trim, edge moldings, and suspension-system members. Comply with manufacturer's written instructions for cleaning and touchup of minor finish damage.

B. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

END OF SECTION 09 51 13

SECTION 09 65 13 - RESILIENT BASE AND ACCESSORIES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Thermoset-rubber base (RB-x).
2. Rubber molding accessories (TRANS-x).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Samples: For each exposed product and for each color and texture specified, not less than 12 inches long.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, of each type, color, pattern, and size of resilient product installed.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store resilient products and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive resilient products during the following periods:

1. 48 hours before installation.
2. During installation.

3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Install resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 THERMOSET-RUBBER BASE (RB-x)

A. See Legends on 'Finish Plan' drawings for product information.

B. Product Standard: ASTM F 1861, Type TS (rubber, vulcanized thermoset), Group I (solid, homogeneous).

C. Thickness: 0.125 inch.

D. Height: 4 inches.

E. Lengths: Coils in manufacturer's standard length.

F. Outside Corners: Preformed.

G. Inside Corners: Job formed or preformed.

H. Colors: As indicated by manufacturer's designations.

2.2 RUBBER MOLDING ACCESSORY (TRANS-x)

A. See Legends on 'Finish Plan' drawings for product information.

B. Colors and Patterns: As indicated by manufacturer's designations.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient-product manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by resilient-product manufacturer for resilient products and substrate conditions indicated.

1. Adhesives shall have a VOC content of 50 g/L or less and 60 g/L or less for rubber stair treads.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient stair-tread manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient products.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

1. Installation of resilient products indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Prepare substrates according to manufacturer's written instructions to ensure adhesion of resilient products.

B. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

C. Do not install resilient products until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient products and installation materials into spaces where they will be installed.

D. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient products.

3.3 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:

1. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 3 inches in length.

a. Miter corners to minimize open joints.

3.4 RESILIENT ACCESSORY INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient accessories.

B. Resilient Molding Accessories: Butt to adjacent materials and tightly adhere to substrates throughout length of each piece. Install reducer strips at edges of floor covering that would otherwise be exposed.

3.5 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient products.

B. Perform the following operations immediately after completing resilient-product installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum horizontal surfaces thoroughly.
3. Damp-mop horizontal surfaces to remove marks and soil.

C. Protect resilient products from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from resilient stair treads before applying liquid floor polish.

1. Apply number of coat(s) recommended by manufacturer.

E. Cover resilient products subject to wear and foot traffic until Substantial Completion.

END OF SECTION 09 65 13

SECTION 09 65 16 - RESILIENT SHEET FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Unbacked vinyl sheet flooring.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient sheet flooring.

1. Include sheet flooring layouts, locations of seams, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples for Verification: For each type of resilient sheet flooring, in manufacturer's standard size, but not less than 6-by-9-inch sections of each color, texture, and pattern required.

1. For heat-welding bead, manufacturer's standard-size Samples, but not less than 9 inches long, of each color required.

D. Welded-Seam Samples: For seamless-installation technique indicated and for each resilient sheet flooring product, color, and pattern required; with seam running lengthwise and in center of 6-by-9-inch Sample applied to a rigid backing and prepared by Installer for this Project.

E. Product Schedule: For resilient sheet flooring. Use same designations indicated on Drawings.

1.4 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient sheet flooring to include in maintenance manuals.

1.6 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Resilient Sheet Flooring: Furnish not less than 10 linear feet for every 500 linear feet or fraction thereof, in roll form and in full roll width for each type, color, and pattern of flooring installed.

1.7 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for resilient sheet flooring installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by resilient sheet flooring manufacturer for installation techniques required.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Store resilient sheet flooring and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store rolls upright.

1.9 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 85 deg F, in spaces to receive resilient sheet flooring during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during resilient sheet flooring installation.

D. Close spaces to traffic for 48 hours after resilient sheet flooring installation.

E. Install resilient sheet flooring after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient sheet flooring, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 UNBACKED VINYL SHEET FLOORING

A. See Legengs on 'Finish Plan' drawings for product information.

B. Seamless-installation Method: Heat Welded.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by resilient sheet flooring manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by flooring and adhesive manufacturers to suit resilient sheet flooring and substrate conditions indicated.

C. Seamless-Installation Accessories:

1. Heat-Welding Bead: Manufacturer's solid-strand product for heat welding seams.

a. Colors: Match flooring.

D. Floor Polish: Provide protective, liquid floor-polish products recommended by resilient sheet flooring manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of resilient sheet flooring.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to resilient sheet flooring manufacturer's written instructions to ensure adhesion of resilient sheet flooring.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by resilient sheet flooring manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by resilient sheet flooring manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install resilient sheet flooring until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move flooring and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient sheet flooring.

3.3 RESILIENT SHEET FLOORING INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient sheet flooring.

B. Unroll resilient sheet flooring and allow it to stabilize before cutting and fitting.

C. Lay out resilient sheet flooring as follows:

1. Maintain uniformity of flooring direction.
2. Minimize number of seams; place seams in inconspicuous and low-traffic areas, at least 6 inches away from parallel joints in flooring substrates.
3. Match edges of flooring for color shading at seams.
4. Avoid cross seams.

D. Scribe and cut resilient sheet flooring to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

E. Extend resilient sheet flooring into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on resilient sheet flooring as marked on substrates. Use chalk or other nonpermanent marking device.

G. Install resilient sheet flooring on covers for telephone and electrical ducts and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of flooring installed on covers and adjoining flooring. Tightly adhere flooring edges to substrates that abut covers and to cover perimeters.

H. Adhere resilient sheet flooring to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

I. Seamless Installation:

1. Heat-Welded Seams: Comply with ASTM F 1516. Rout joints and heat weld with welding bead to fuse sections permanently into a seamless flooring installation. Prepare, weld, and finish seams to produce surfaces flush with adjoining flooring surfaces.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting resilient sheet flooring.

B. Perform the following operations immediately after completing resilient sheet flooring installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect resilient sheet flooring from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from flooring surfaces before applying liquid floor polish.

1. Apply coat(s) as recommeneded by manufacturer.

E. Cover resilient sheet flooring until Substantial Completion.

END OF SECTION 09 65 16

SECTION 09 65 19 - RESILIENT TILE FLOORING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Solid vinyl floor tile (LVT-x).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For each type of resilient floor tile.

1. Include floor tile layouts, edges, columns, doorways, enclosing partitions, built-in furniture, cabinets, and cutouts.
2. Show details of special patterns.

C. Samples: Full-size units of each color, texture, and pattern of floor tile required.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of floor tile to include in maintenance manuals.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials, from the same product run, that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Floor Tile: Furnish one box for every 50 boxes or fraction thereof, of each type, color, and pattern of floor tile installed.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for floor tile installation and seaming method indicated.

1. Engage an installer who employs workers for this Project who are trained or certified by floor tile manufacturer for installation techniques required.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Store floor tile and installation materials in dry spaces protected from the weather, with ambient temperatures maintained within range recommended by manufacturer, but not less than 50 deg F or more than 90 deg F. Store floor tiles on flat surfaces.

1.8 FIELD CONDITIONS

A. Maintain ambient temperatures within range recommended by manufacturer, but not less than 70 deg F or more than 95 deg F, in spaces to receive floor tile during the following periods:

1. 48 hours before installation.
2. During installation.
3. 48 hours after installation.

B. After installation and until Substantial Completion, maintain ambient temperatures within range recommended by manufacturer, but not less than 55 deg F or more than 95 deg F.

C. Close spaces to traffic during floor tile installation.

D. Close spaces to traffic for 48 hours after floor tile installation.

E. Install floor tile after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: For resilient floor tile, as determined by testing identical products according to ASTM E 648 or NFPA 253 by a qualified testing agency.

1. Critical Radiant Flux Classification: Class I, not less than 0.45 W/sq. cm.

2.2 SOLID VINYL FLOOR TILE (LVT-x)

A. See Legends on 'Finish Plan' drawings for product information.

B. Colors and Patterns: As indicated by manufacturer's designations.

2.3 INSTALLATION MATERIALS

A. Trowelable Leveling and Patching Compounds: Latex-modified, portland-cement-based or blended hydraulic-cement-based formulation provided or approved by floor tile manufacturer for applications indicated.

B. Adhesives: Water-resistant type recommended by floor tile and adhesive manufacturers to suit floor tile and substrate conditions indicated.

C. Floor Polish: Provide protective, liquid floor-polish products recommended by floor tile manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, with Installer present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

1. Verify that finishes of substrates comply with tolerances and other requirements specified in other Sections and that substrates are free of cracks, ridges, depressions, scale, and foreign deposits that might interfere with adhesion of floor tile.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare substrates according to floor tile manufacturer's written instructions to ensure adhesion of resilient products.

B. Concrete Substrates: Prepare according to ASTM F 710.

1. Verify that substrates are dry and free of curing compounds, sealers, and hardeners.
2. Remove substrate coatings and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, using mechanical methods recommended by floor tile manufacturer. Do not use solvents.
3. Alkalinity and Adhesion Testing: Perform tests recommended by floor tile manufacturer. Proceed with installation only after substrate alkalinity falls within range on pH scale recommended by manufacturer in writing, but not less than 5 or more than 9 pH.
4. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

a. Anhydrous Calcium Chloride Test: ASTM F 1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.

C. Fill cracks, holes, and depressions in substrates with trowelable leveling and patching compound; remove bumps and ridges to produce a uniform and smooth substrate.

D. Do not install floor tiles until materials are the same temperature as space where they are to be installed.

1. At least 48 hours in advance of installation, move resilient floor tile and installation materials into spaces where they will be installed.

E. Immediately before installation, sweep and vacuum clean substrates to be covered by resilient floor tile.

3.3 FLOOR TILE INSTALLATION

A. Comply with manufacturer's written instructions for installing floor tile.

B. Lay out floor tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths that equal less than one-half tile at perimeter.

1. Lay tiles in pattern indicated.

C. Scribe, cut, and fit floor tiles to butt neatly and tightly to vertical surfaces and permanent fixtures including built-in furniture, cabinets, pipes, outlets, and door frames.

D. Extend floor tiles into toe spaces, door reveals, closets, and similar openings. Extend floor tiles to center of door openings.

E. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on floor tiles as marked on substrates. Use chalk or other nonpermanent marking device.

F. Install floor tiles on covers for telephone and electrical ducts, building expansion-joint covers, and similar items in installation areas. Maintain overall continuity of color and pattern between pieces of tile installed on covers and adjoining tiles. Tightly adhere tile edges to substrates that abut covers and to cover perimeters.

G. Adhere floor tiles to substrates using a full spread of adhesive applied to substrate to produce a completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, and other surface imperfections.

3.4 CLEANING AND PROTECTION

A. Comply with manufacturer's written instructions for cleaning and protecting floor tile.

B. Perform the following operations immediately after completing floor tile installation:

1. Remove adhesive and other blemishes from surfaces.
2. Sweep and vacuum surfaces thoroughly.
3. Damp-mop surfaces to remove marks and soil.

C. Protect floor tile from mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period.

D. Floor Polish: Remove soil, adhesive, and blemishes from floor tile surfaces before applying liquid floor polish.

1. Apply number of coat(s) recommended by manufacturer.

E. Cover floor tile until Substantial Completion.

END OF SECTION 09 65 19

SECTION 09 68 13 - TILE CARPETING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Carpet tile (CPT-x).

B. Related Requirements:

1. Section 09 65 13 "Resilient Base and Accessories" for resilient wall base and accessories installed with carpet tile.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include manufacturer's written data on physical characteristics, durability, and fade resistance.
2. Include manufacturer's written installation recommendations for each type of substrate.

B. Shop Drawings: For carpet tile installation, showing the following:

1. Columns, doorways, enclosing walls or partitions, built-in cabinets, and locations where cutouts are required in carpet tiles.
2. Carpet tile type, color, and dye lot.
3. Type of subfloor.
4. Type of installation.
5. Pattern of installation.
6. Pattern type, location, and direction.
7. Pile direction.
8. Type, color, and location of insets and borders.
9. Type, color, and location of edge, transition, and other accessory strips.
10. Transition details to other flooring materials.

C. Samples for Verification: Actual sample of finished products for each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, pattern, and designation indicated on Drawings and in schedules.

1. Carpet Tile: Full-size Sample.

D. Product Schedule: For carpet tile. Use same designations indicated on Drawings.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For carpet tiles. Include the following:

1. Methods for maintaining carpet tile, including cleaning and stain-removal products and procedures and manufacturer's recommended maintenance schedule.
2. Precautions for cleaning materials and methods that could be detrimental to carpet tile.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Extra Stock Material: Furnish extra materials, from the same production run, to Owner that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Carpet Tile: Full-size units equal to 5 percent of amount installed for each type indicated, but no fewer than 10 full-size units.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: An authorized representative who is certified by the International Certified Floorcovering Installers Association at the Commercial II certification level.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with CRI 104.

1.7 FIELD CONDITIONS

A. Comply with CRI 104 for temperature, humidity, and ventilation limitations.

B. Environmental Limitations: Do not deliver or install carpet tiles until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, and ambient temperature and humidity conditions are maintained at levels planned for building occupants during the remainder of the construction period.

C. Do not install carpet tiles over concrete slabs until slabs have cured and are sufficiently dry to bond with adhesive and concrete slabs have pH range recommended in writing by carpet tile manufacturer.

D. Where demountable partitions or other items are indicated for installation on top of carpet tiles, install carpet tiles before installing these items.

1.8 WARRANTY

A. Special Warranty for Carpet Tiles: Manufacturer agrees to repair or replace components of carpet tile installation that fail in materials or workmanship within specified warranty period.

1. Warranty does not include deterioration or failure of carpet tile due to unusual traffic, failure of substrate, vandalism, or abuse.
2. Failures include, but are not limited to, the following:

a. More than 10 percent loss of face fiber, edge raveling, snags, and runs.
b. Loss of tuft-bind strength.
c. Excess static discharge.
d. Delamination.
e. Dimensional instability.

3. Warranty Period: 10 years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 CARPET TILE (CPT-x)

A. See Legends on 'Finish Plan' drawings for product information.

2.2 INSTALLATION ACCESSORIES

A. Trowelable Leveling and Patching Compounds: Latex-modified, hydraulic-cement-based formulation provided or recommended in writing by carpet tile manufacturer.

B. Adhesives: Water-resistant, mildew-resistant, nonstaining, pressure-sensitive types to suit products and subfloor conditions indicated, that comply with flammability requirements for installed carpet tile, and that are recommended in writing by carpet tile manufacturer for releasable installation.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for maximum moisture content, alkalinity range, installation tolerances, and other conditions affecting carpet tile performance.

B. Examine carpet tile for type, color, pattern, and potential defects.

C. Concrete Slabs: Verify that finishes comply with requirements specified in Section 03 30 00 "Cast-in-Place Concrete" and that surfaces are free of cracks, ridges, depressions, scale, and foreign deposits.

1. Moisture Testing: Perform tests so that each test area does not exceed 1000 sq. ft., and perform no fewer than three tests in each installation area and with test areas evenly spaced in installation areas.

    a. Anhydrous Calcium Chloride Test: ASTM F1869. Proceed with installation only after substrates have maximum moisture-vapor-emission rate of 3 lb of water/1000 sq. ft. in 24 hours.
    b. Perform additional moisture tests recommended in writing by adhesive and carpet tile manufacturers. Proceed with installation only after substrates pass testing.

D. Painted Subfloors: Perform bond test recommended in writing by adhesive manufacturer. Verify the following:

1. Underlayment surface is flat, smooth, evenly planed, tightly jointed, and free of irregularities, gaps greater than 1/8 inch, protrusions more than 1/32 inch, and substances that may interfere with adhesive bond or show through surface.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. General: Comply with CRI 104 and with carpet tile manufacturer's written installation instructions for preparing substrates.

B. Use trowelable leveling and patching compounds, in accordance with manufacturer's written instructions, to fill cracks, holes, depressions, and protrusions in substrates. Fill or level cracks, holes and depressions 1/8 inch wide or wider, and protrusions more than 1/32 inch unless more stringent requirements are required by manufacturer's written instructions.

C. Concrete Substrates: Remove coatings, including curing compounds, and other substances that are incompatible with adhesives and that contain soap, wax, oil, or silicone, without using solvents. Use mechanical methods recommended in writing by adhesive and carpet tile manufacturers.

D. Broom and vacuum clean substrates to be covered immediately before installing carpet tile.

3.3 INSTALLATION

A. General: Comply with CRI 104, Section 10, "Carpet Tile," and with carpet tile manufacturer's written installation instructions.

B. Installation Method: Glue down; install every tile with full-spread, releasable, pressure-sensitive adhesive.

C. Maintain dye-lot integrity. Do not mix dye lots in same area.

D. Maintain pile-direction patterns indicated on Drawings.

E. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings. Bind or seal cut edges as recommended in writing by carpet tile manufacturer.

F. Extend carpet tile into toe spaces, door reveals, closets, open-bottomed obstructions, removable flanges, alcoves, and similar openings.

G. Maintain reference markers, holes, and openings that are in place or marked for future cutting by repeating on carpet tile as marked on subfloor. Use nonpermanent, nonstaining marking device.

H. Install pattern parallel to walls and borders.

3.4 CLEANING AND PROTECTION

A. Perform the following operations immediately after installing carpet tile:

1. Remove excess adhesive and other surface blemishes using cleaner recommended in writing by carpet tile manufacturer.
2. Remove yarns that protrude from carpet tile surface.
3. Vacuum carpet tile using commercial machine with face-beater element.

B. Protect installed carpet tile to comply with CRI 104, Section 13.7.

C. Protect carpet tile against damage from construction operations and placement of equipment and fixtures during the remainder of construction period. Use protection methods indicated or recommended in writing by carpet tile manufacturer.

END OF SECTION 09 68 13

SECTION 09 72 00 - WALL COVERINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Vinyl wall covering (WC-x).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include data on physical characteristics, durability, fade resistance, and fire-test-response characteristics.

B. Shop Drawings: Show location and extent of each wall-covering type. Indicate seams and termination points.

C. Samples: For each type of wall covering and for each color, pattern, texture, and finish specified, full width by 36 inches long in size.

1. Wall-Covering Sample: From same production run to be used for the Work, with specified treatments applied.

a. Show complete pattern repeat.
b. Mark top and face of fabric.

D. Product Schedule: For wall coverings. Use same designations indicated on Drawings.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For wall coverings to include in maintenance manuals.

1.5 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install wall coverings until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work above ceilings is complete, and HVAC system is operating and maintaining ambient temperature and humidity conditions at levels intended for occupants after Project completion during the remainder of the construction period.

B. Lighting: Do not install wall covering until lighting that matches conditions intended for occupants after Project completion is provided on the surfaces to receive wall covering.

C. Ventilation: Provide continuous ventilation during installation and for not less than the time recommended by wall-covering manufacturer for full drying or curing.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: As determined by testing identical wall coverings applied with identical adhesives to substrates in accordance with test method indicated below by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Surface-Burning Characteristics: Comply with ASTM E84; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

    a. Flame-Spread Index: 25 or less.
    b. Smoke-Developed Index: 50 or less.

2. Fire-Growth Contribution: No flashover and heat and smoke release when tested in accordance with NFPA 265.

2.2 VINYL WALL COVERING (WC-x)

A. Type WC-1:

B. Description: Provide vinyl products in rolls from same production run and complying with the following:

1. Product: Koroseal Type II Wallcovering
2. Color: Refer to Finish Plans

2.3 ACCESSORIES

A. Adhesive: Mildew-resistant, nonstaining, strippable adhesive, for use with specific wall covering and substrate application indicated and as recommended in writing by wall-covering manufacturer.

B. Primer/Sealer: Mildew resistant, complying with requirements in Section 09 91 23 "Interior Painting" and recommended in writing by primer/sealer and wall-covering manufacturers for intended substrate.

C. Seam Tape: As recommended in writing by wall-covering manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Installer present, for compliance with requirements for installation surfaces being true in plane and vertical and horizontal alignment, maximum moisture content, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Comply with manufacturer's written instructions for surface preparation.

B. Clean substrates of substances that could impair bond of wall covering, including dirt, oil, grease, mold, and mildew.

C. Prepare substrates to achieve a smooth, dry, clean, structurally sound surface free of flaking, unsound coatings, cracks, and defects.

1. Moisture Content: Maximum of 5 percent on new plaster, concrete, and concrete masonry units when tested with an electronic moisture meter.
2. Gypsum Board: Apply primer/sealer as recommended in writing by primer/sealer manufacturer and wall-covering manufacturer.
3. Painted Surfaces:

a. Check for pigment bleeding. Apply primer/sealer to areas susceptible to pigment bleeding as recommended in writing by primer/sealer manufacturer.
b. Sand gloss, semigloss, and eggshell finishes with fine sandpaper.

D. Remove hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

E. Acclimatize wall-covering materials by removing them from packaging in the installation areas not less than 24 hours before installation.

3.3 INSTALLATION OF WALL COVERING

A. Comply with wall-covering manufacturers' written installation instructions applicable to products and applications indicated.

B. Cut wall-covering strips in roll number sequence. Change the roll numbers at partition breaks and corners.

C. Install strips in same order as cut from roll.

1. For solid-color, even-texture, or random-match wall coverings, reverse every other strip.

D. Install wall covering without lifted or curling edges and without visible shrinkage.

E. Match pattern 72 inches above the finish floor.

F. Install seams vertical and plumb at least 6 inches from outside corners and 6 inches from inside corners unless a change of pattern or color exists at corner. Horizontal seams are not permitted.

G. Trim edges and seams for color uniformity, pattern match, and tight closure. Butt seams without overlaps or gaps between strips.

H. Fully bond wall covering to substrate. Remove air bubbles, wrinkles, blisters, and other defects.

3.4 CLEANING

A. Remove excess adhesive at seams, perimeter edges, and adjacent surfaces.

B. Use cleaning methods recommended in writing by wall-covering manufacturer.

C. Replace strips that cannot be cleaned.

D. Reinstall hardware and hardware accessories, electrical plates and covers, light fixture trims, and similar items.

END OF SECTION 09 72 00

SECTION 09 77 23 - FABRIC-WRAPPED PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes shop-fabricated, fabric-wrapped wall panels.

B. Related Sections:

1. Section 09 72 00 "Wall Coverings" for adhesively applied textile wall coverings and for coordinated requirements for fabric.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include fabric facing, panel edge, core material, and mounting indicated.

B. Shop Drawings: For panel assembly and installation.

1. Include plans, elevations, sections, and mounting devices and details.
2. Include details at panel head, base, joints, and corners; and details at ceiling, floor base, and wall intersections. Indicate panel edge profile and core materials.
3. Include details at cutouts and penetrations for other work.
4. Include direction of fabric weave and pattern matching.

C. Samples for Initial Selection: For each type of fabric facing.

1. Include Samples of hardware and accessories involving color or finish selection.

D. Samples for Verification: For the following products:

1. Fabric: Full-width by approximately 36-inch- long Sample, but not smaller than required to show complete pattern repeat, from dye lot to be used for the Work, and with specified treatments applied. Mark top and face of fabric.
2. Panel Edge: 12-inch- long Sample(s) showing each edge profile, corner, and finish.
3. Core Material: 12-inch- square Sample at corner.
4. Mounting Devices: Full-size Samples.

1.3 INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Elevations and other details, drawn to scale, on which the following items are shown and coordinated with each other, using input from installers of the items involved:

1. Electrical outlets, switches, and thermostats.
2. Items penetrating or covered by panels including the following:

a. Lighting fixtures.
b. Air outlets and inlets.
c. Speakers.
d. Alarms.
e. Sprinklers.
f. Access panels.

3. Show operation of hinged and sliding components covered by or adjacent to panels.

B. Product Certificates: For each type of panel.

C. Sample Warranty: For manufacturer's special warranty.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of panel to include in maintenance manuals. Include fabric manufacturers' written cleaning and stain-removal instructions.

1.5 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials from same production run that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fabric: For each fabric, color, and pattern installed, provide length equal to 10 percent of amount installed, but no fewer than 10 sq. yd., full width of bolt.
2. Mounting Devices: Full-size units equal to 5 percent of amount installed, but no fewer than five devices, including unopened adhesives.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with fabric and panel manufacturers' written instructions for minimum and maximum temperature and humidity requirements for shipment, storage, and handling.

B. Deliver materials and panels in unopened bundles and store in a temperature-controlled dry place with adequate air circulation.

1.7 FIELD CONDITIONS

A. Environmental Limitations: Do not install panels until spaces are enclosed and weathertight, wet-work in spaces is complete and dry, work at and above ceilings is complete, and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Lighting: Do not install panels until a permanent level of lighting a lighting level of not less than 50 fc is provided on surfaces to receive the panels.

C. Air-Quality Limitations: Protect panels from exposure to airborne odors such as tobacco smoke, and install panels under conditions free from odor contamination of ambient air.

D. Field Measurements: Verify panel locations and actual dimensions of openings and penetrations by field measurements before fabrication, and indicate them on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace panels and components that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Fabric sagging, distorting, or releasing from panel edge.

2. Warranty Period: Two years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain fabric-wrapped wall panels from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Test-Response Characteristics: Panels shall comply with "Surface-Burning Characteristics" or "Fire Growth Contribution" Subparagraph below, or both, as determined by testing identical products by UL or another testing and inspecting agency acceptable to authorities having jurisdiction:

1. Surface-Burning Characteristics: Comply with ASTM E84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

a. Flame-Spread Index: 25 or less.
b. Smoke-Developed Index: 450 or less.

2. Fire Growth Contribution: Comply with acceptance criteria of local code and authorities having jurisdiction when tested according to NFPA 265 Method B Protocol or NFPA 286.

2.3 FABRIC-WRAPPED WALL PANELS

A. Fabric-Wrapped Wall Panel : Manufacturer's standard panel construction consisting of facing material stretched over front face of edge-framed core and bonded or attached to edges and back of frame.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following: Basis of Design: G&S Acoustics; Acousit-Panels (AP) Wall Panels.

    a. Conwed. Wall Panels
    b. Kinetics.

2. Panel Shape: As indicated on Drawings.
3. Mounting:

    a. Back mounted with manufacturer's standard metal clips or bar hangers, secured to substrate.

4. Core: Manufacturer's standard . Provide wood or plywood nailing strips in core where indicated.

    a. Core-Face Layer: Manufacturer's standard .

5. Core Overlay: Polyester batting manufacturer's standard thickness.
6. Edge Construction: Manufacturer's standard chemically hardened core with no frame.
7. Edge Profile: Custom profile as indicated on Drawings.
8. Corner Detail in Elevation: Custom as indicated on Drawings with continuous edge profile indicated.
9. Reveals between Panels: Flush reveals as indicated on Drawings.
10. Facing Material: As indicated on Drawings.
11. Nominal Overall Panel Thickness: 2 inches.
12. Panel Width: As indicated on Drawings.
13. Panel Height: As indicated on Drawings.

2.4 MATERIALS

A. Core Materials: Manufacturer's standard.

B. Facing Material : Fabric from same dye lot; color and pattern matching Architect's samples.

C. Lining Material : Fabric as indicated by manufacturer's designations.

D. Mounting Devices: Concealed on back of panel, recommended by manufacturer to support weight of panel, and as follows:

1. Splines: Manufacturer's standard concealed metal or plastic splines that engage the kerfed edges of the panel, with other moldings and trim for interior corners, exterior corners, and exposed edges, with factory-applied finish on exposed items.

2.5 FABRICATION

A. Standard Construction: Use manufacturer's standard construction unless otherwise indicated; with facing material applied to face, edges, and back border of dimensionally stable core; and with rigid edges to reinforce panel perimeter against warpage and damage.

B. Edge Hardening: For glass-fiber board and mineral-fiber board cores, chemically harden core edges and areas of core where mounting devices are attached.

C. Core-Face Layer and Core Overlay: Evenly stretched over core face and edges and securely attached to core; free from puckers, ripples, wrinkles, or sags.

D. Facing Material and Lining Material: Apply fabric fully covering visible surfaces of panel; with material stretched straight, on the grain, tight, square, and free from puckers, ripples, wrinkles, sags, blisters, seams, adhesive, or other visible distortions or foreign matter.

1. Square Corners: Tailor corners.
2. Radius and Other Nonsquare Corners: Attach material so there are no seams or gathering of material.
3. Fabrics with Directional or Repeating Patterns or Directional Weave: Mark fabric top and attach fabric in same direction so pattern or weave matches in adjacent panels.

E. Dimensional Tolerances of Finished Panels: Plus or minus 1/16 inch for the following:

1. Thickness.
2. Edge straightness.
3. Overall length and width.
4. Squareness from corner to corner.
5. Chords, radii, and diameters.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fabric, fabricated panels, substrates, areas, and conditions for compliance with requirements, installation tolerances, and other conditions affecting panel performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panels in locations indicated. Unless otherwise indicated, install panels with vertical surfaces and edges plumb, top edges level and in alignment with other panels, faces flush, and scribed to fit adjoining work accurately at borders and at penetrations.

B. Comply with manufacturer's written instructions for installation of panels using type of mounting devices indicated. Mount panels securely to supporting substrate.

C. Align fabric pattern and grain as indicated on Drawings.

3.3 INSTALLATION TOLERANCES

A. Variation from Plumb and Level: Plus or minus 1/16 inch in 48 inches, noncumulative.

B. Variation of Joint Width: Not more than 1/16 inch wide from reveal line in 48 inches, noncumulative.

3.4 CLEANING

A. Clip loose threads; remove pills and extraneous materials.

B. Clean panels on completion of installation to remove dust and other foreign materials according to manufacturer's written instructions.

END OF SECTION 09 77 23

SECTION 09 91 23 - INTERIOR PAINTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Primers.
2. Water-based finish coatings.
3. Floor sealers and paints.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product. Include preparation requirements and application instructions.

1. Include preparation requirements and application instructions.
2. Indicate VOC content.

B. Samples for Verification: For each type of paint system and each color and gloss of topcoat.

1. Submit Samples on rigid backing, 8 inches square.
2. Apply coats on Samples in steps to show each coat required for system.
3. Label each coat of each Sample.
4. Label each Sample for location and application area.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store materials not in use in tightly covered containers in well-ventilated areas with ambient temperatures continuously maintained at not less than 45 deg F.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 FIELD CONDITIONS

A. Apply paints only when temperature of surfaces to be painted and ambient air temperatures are between 50 and 95 deg F.

B. Do not apply paints when relative humidity exceeds 85 percent; at temperatures of less than 5 deg F above the dew point; or to damp or wet surfaces.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by the following:

1. Sherwin-Williams Company (The).

B. Source Limitations: Obtain each paint product from single source from single manufacturer.

2.2 PAINT PRODUCTS, GENERAL

A. Material Compatibility:

1. Materials for use within each paint system shall be compatible with one another and substrates indicated, under conditions of service and application as demonstrated by manufacturer, based on testing and field experience.
2. For each coat in a paint system, products shall be recommended in writing by topcoat manufacturers for use in paint system and on substrate indicated.

B. Colors: As indicated in a color schedule.

1. Thirty percent of surface area will be painted with deep tones.

2.3 PRIMERS

A. Interior/Exterior Latex Block Filler: Water-based, high-solids, emulsion coating formulated to bridge and fill porous surfaces of exterior concrete masonry units in preparation for specified subsequent coatings.

B. Alkali-Resistant, Water-Based Primer: Water-based primer formulated for use on alkaline surfaces, such as plaster, vertical concrete, and masonry.

C. Interior Latex Primer Sealer: Water-based latex sealer used on new interior plaster, concrete, and gypsum wallboard surfaces.

2.4 WATER-BASED FINISH COATS

A. Interior, Latex, High-Performance Architectural Coating, Eggshell: High-performance architectural latex coating providing a significantly higher level of performance than conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.

B. Interior, Latex, High-Performance Architectural Coating, Semigloss: High-performance architectural latex coating providing a significantly higher level of performance than conventional latex paints in the areas of scrub resistance, burnish resistance, and ease of stain removal.

2.5 FLOOR SEALERS AND PAINTS

A. Water-Based Concrete Floor Sealer: Clear, water-based, acrylic-copolymer-emulsion sealer formulated for oil, gasoline, alkali, and water resistance and for use on concrete traffic surfaces.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with Applicator present, for compliance with requirements for maximum moisture content and other conditions affecting performance of the Work.

B. Maximum Moisture Content of Substrates: When measured with an electronic moisture meter as follows:

1. Concrete: 12 percent.
2. Masonry (Clay and CMUs): 12 percent.
3. Gypsum Board: 12 percent.

C. Gypsum Board Substrates: Verify that finishing compound is sanded smooth.

D. Verify suitability of substrates, including surface conditions and compatibility, with existing finishes and primers.

E. Proceed with coating application only after unsatisfactory conditions have been corrected.

1. Application of coating indicates acceptance of surfaces and conditions.

3.2 PREPARATION

A. Comply with manufacturer's written instructions and recommendations applicable to substrates and paint systems indicated.

B. Remove hardware, covers, plates, and similar items already in place that are removable and are not to be painted. If removal is impractical or impossible because of size or weight of item, provide surface-applied protection before surface preparation and painting.

1. After completing painting operations, use workers skilled in the trades involved to reinstall items that were removed. Remove surface-applied protection if any.

C. Clean substrates of substances that could impair bond of paints, including dust, dirt, oil, grease, and incompatible paints and encapsulants.

1. Remove incompatible primers and reprime substrate with compatible primers or apply tie coat as required to produce paint systems indicated.

D. Concrete Substrates: Remove release agents, curing compounds, efflorescence, and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces to be painted exceeds that permitted in manufacturer's written instructions.

E. Masonry Substrates: Remove efflorescence and chalk. Do not paint surfaces if moisture content or alkalinity of surfaces or mortar joints exceeds that permitted in manufacturer's written instructions.

F. Steel Substrates: Remove rust, loose mill scale, and shop primer, if any. Clean using methods recommended in writing by paint manufacturer but not less than the following:

1. SSPC-SP 3.

G. Shop-Primed Steel Substrates: Clean field welds, bolted connections, and areas where shop paint is abraded. Paint exposed areas with the same material as used for shop priming to comply with SSPC-PA 1 for touching up shop-primed surfaces.

3.3 INSTALLATION

A. Apply paints according to manufacturer's written instructions.

1. Use applicators and techniques suited for paint and substrate indicated.
2. Paint surfaces behind movable equipment and furniture same as similar exposed surfaces. Before final installation, paint surfaces behind permanently fixed equipment or furniture with prime coat only.
3. Paint front and backsides of access panels, removable or hinged covers, and similar hinged items to match exposed surfaces.
4. Do not paint over labels of independent testing agencies or equipment name, identification, performance rating, or nomenclature plates.
5. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to topcoat manufacturers.

B. Tint each undercoat a lighter shade to facilitate identification of each coat if multiple coats of same material are to be applied. Tint undercoats to match color of topcoat, but provide sufficient difference in shade of undercoats to distinguish each separate coat.

C. If undercoats or other conditions show through topcoat, apply additional coats until cured film has a uniform paint finish, color, and appearance.

D. Apply paints to produce surface films without cloudiness, spotting, holidays, laps, brush marks, roller tracking, runs, sags, ropiness, or other surface imperfections. Cut in sharp lines and color breaks.

E. Painting Fire-Suppression, Plumbing, HVAC, Electrical, Communication, and Electronic Safety and Security Work:

1. Paint the following work where exposed in equipment rooms:

    a. Equipment, including panelboards and switch gear.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Tanks that do not have factory-applied final finishes.
    g. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.

2. Paint the following work where exposed in occupied spaces:

    a. Equipment, including panelboards.
    b. Uninsulated metal piping.
    c. Uninsulated plastic piping.
    d. Pipe hangers and supports.
    e. Metal conduit.
    f. Duct, equipment, and pipe insulation having cotton or canvas insulation covering or other paintable jacket material.
    g. Other items as directed by Architect.

3. Paint portions of internal surfaces of metal ducts, without liner, behind air inlets and outlets that are visible from occupied spaces.

3.4 CLEANING AND PROTECTION

A. At end of each workday, remove rubbish, empty cans, rags, and other discarded materials from Project site.

    1. Do not clean equipment with free-draining water and prevent solvents, thinners, cleaners, and other contaminants from entering into waterways, sanitary and storm drain systems, and ground.
    2. Dispose of contaminants in accordance with requirements of authorities having jurisdiction.
    3. Allow empty paint cans to dry before disposal.
    4. Collect waste paint by type and deliver to recycling or collection facility.

B. After completing paint application, clean spattered surfaces. Remove spattered paints by washing, scraping, or other methods. Do not scratch or damage adjacent finished surfaces.

C. Protect work of other trades against damage from paint application. Correct damage to work of other trades by cleaning, repairing, replacing, and refinishing, as approved by Architect, and leave in an undamaged condition.

D. At completion of construction activities of other trades, touch up and restore damaged or defaced painted surfaces.

3.5 INTERIOR PAINTING SCHEDULE

A. Concrete Substrates, Traffic Surfaces:

1. Water-Based Concrete Floor Sealer System :

a. First Coat: Matching topcoat.
b. Topcoat: Water-based concrete floor sealer.

B. CMU Substrates:

1. High-Performance Architectural Latex System :

a. Block Filler: Interior/exterior latex block filler.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, high-performance architectural coating, eggshell semigloss.

C. Steel Substrates:

1. High-Performance Architectural Latex System :

a. Prime Coat: Shop primer specified in Section where substrate is specified.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Topcoat: Interior, latex, high-performance architectural coating, semigloss.

D. Gypsum Board Substrates:

1. High-Performance Architectural Latex System :

a. Prime Coat: Interior latex primer sealer.
b. Intermediate Coat: Matching topcoat.
c. Topcoat: Interior, latex, high-performance architectural coating, satin.

END OF SECTION 09 91 23

SECTION 10 14 19 - DIMENSIONAL LETTER SIGNAGE

need to add backlit component for exterior applications (2 backlit, 1 non-backlit at exterior, 2 non-backlit at interior)

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dimensional characters.

a. Cast dimensional characters.
b. Cutout dimensional characters.

1.2 COORDINATION

A. Furnish templates for placement of electrical service embedded in permanent construction by other installers.

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Shop Drawings: For signs.

1. Include fabrication and installation details and attachments to other work.
2. Show sign mounting heights, locations of supplementary supports to be provided by other installers, and accessories.
3. Show message list, typestyles, graphic elements, and layout for each sign.
4. Show locations of electrical service connections.
5. Include diagrams for power, signal, and control wiring.

C. Samples for Verification: For each type of sign assembly showing all components and with the required finish(es), in manufacturer's standard size unless otherwise indicated and as follows:

1. Dimensional Characters: Full-size Sample of[each type of] dimensional character.

1.4 INFORMATIONAL SUBMITTALS

A. Sample Warranty: For special warranty.

1.5 CLOSEOUT SUBMITTALS

A. Maintenance Data: For signs to include in maintenance manuals.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

1.7 FIELD CONDITIONS

A. Field Measurements: Verify locations of electrical service embedded in permanent construction by other installers by field measurements before fabrication, and indicate measurements on Shop Drawings.

1.8 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of signs that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Deterioration of finishes beyond normal weathering.
b. Separation or delamination of sheet materials and components.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 40 00 "Quality Requirements," to design sign structure and anchorage of sign type(s) according to structural performance requirements.

B. Thermal Movements: For exterior , allow for thermal movements from ambient and surface temperature changes.

1. Temperature Change: 120 deg F, ambient; 180 deg F, material surfaces.

2.2 DIMENSIONAL CHARACTERS

A. Cast Characters : Characters with uniform faces, sharp corners, and precisely formed lines and profiles, and as follows:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
a. ACE Sign Systems, Inc.
b. ASI Sign Systems, Inc.
c. Gemini Incorporated.

2. Character Material: Cast aluminum.
3. Character Height: As indicated on Drawings.
4. Thickness: As indicated on Drawings.
5. Finishes:

    a. Integral Aluminum Finish: Brushed Aluminum.

6. Mounting: As indicated on Drawings.
7. Typeface: As indicated on Drawings.

B. Cutout Characters : Characters with uniform faces; square-cut, smooth, eased edges; precisely formed lines and profiles; and as follows:

1. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

    a. ACE Sign Systems, Inc.
    b. ASI Sign Systems, Inc.
    c. Gemini Incorporated.

2. Character Material: Sheet or plate acrylic.
3. Character Height: As indicated on Drawings.
4. Thickness: As indicated on Drawings.
5. Finishes:

    a. Integral Acrylic Color: Match Architect's sample.

6. Mounting: Adhesive .
7. Typeface: As Indicated on Drawings.

2.3 DIMENSIONAL CHARACTER MATERIALS

A. Aluminum Castings: ASTM B26/B26M, alloy and temper recommended by sign manufacturer for casting process used and for type of use and finish indicated.

B. Aluminum Sheet and Plate: ASTM B209, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

C. Aluminum Extrusions: ASTM B221, alloy and temper recommended by aluminum producer and finisher for type of use and finish indicated.

D. Acrylic Sheet: ASTM D4802, category as standard with manufacturer for each sign, Type UVF (UV filtering).

2.4 ACCESSORIES

A. Fasteners and Anchors: Manufacturer's standard as required for secure anchorage of signs, noncorrosive and compatible with each material joined, and complying with the following:

1. Use concealed fasteners and anchors unless indicated to be exposed.

B. Adhesive: As recommended by sign manufacturer.

C. Two-Face Tape: Manufacturer's standard high-bond, foam-core tape, 0.045 inch thick, with adhesive on both sides.

2.5 FABRICATION

A. General: Provide manufacturer's standard sign assemblies according to requirements indicated.

1. Preassemble signs and assemblies in the shop to greatest extent possible. Disassemble signs and assemblies only as necessary for shipping and handling limitations. Clearly mark units for reassembly and installation; apply markings in locations concealed from view after final assembly.
2. Mill joints to a tight, hairline fit. Form assemblies and joints exposed to weather to resist water penetration and retention.
3. Comply with AWS for recommended practices in welding and brazing. Provide welds and brazes behind finished surfaces without distorting or discoloring exposed side. Clean exposed welded and brazed connections of flux, and dress exposed and contact surfaces.
4. Conceal connections if possible; otherwise, locate connections where they are inconspicuous.
5. Internally brace dimensional characters for stability, to meet structural performance loading without oil-canning or other surface deformation, and for securing fasteners.
6. Provide rabbets, lugs, and tabs necessary to assemble components and to attach to existing work. Drill and tap for required fasteners. Use concealed fasteners where possible; use exposed fasteners that match sign finish.
7. Castings: Fabricate castings free of warp, cracks, blowholes, pits, scale, sand holes, and other defects that impair appearance or strength. Grind, wire brush, sandblast, and buff castings to remove seams, gate marks, casting flash, and other casting marks before finishing.

2.6 GENERAL FINISH REQUIREMENTS

A. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Directional Finishes: Run grain with long dimension of each piece and perpendicular to long dimension of finished trim or border surface unless otherwise indicated.

D. Organic, Anodic, and Chemically Produced Finishes: Apply to formed metal after fabrication but before applying contrasting polished finishes on raised features unless otherwise indicated.

2.7 ALUMINUM FINISHES

A. Clear Anodic Finish: AAMA 611, Class I, 0.018 mm or thicker.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Verify that sign-support surfaces are within tolerances to accommodate signs without gaps or irregularities between backs of signs and support surfaces unless otherwise indicated.

C. Verify that electrical service is correctly sized and located to accommodate signs.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION OF DIMENSIONAL CHARACTERS

A. General: Install signs using mounting methods indicated and according to manufacturer's written instructions.

1. Install signs level, plumb, true to line, and at locations and heights indicated, with sign surfaces free of distortion and other defects in appearance.
2. Before installation, verify that sign surfaces are clean and free of materials or debris that would impair installation.
3. Corrosion Protection: Coat concealed surfaces of exterior aluminum in contact with grout, concrete, masonry, wood, or dissimilar metals, with a heavy coat of bituminous paint.

B. Mounting Methods:

1. Adhesive: Clean bond-breaking materials from substrate surface and remove loose debris. Apply linear beads or spots of adhesive symmetrically to back of sign and of suitable quantity to support weight of sign after cure without slippage. Keep adhesive away from edges to prevent adhesive extrusion as sign is applied and to prevent visibility of cured adhesive at sign edges. Place sign in position, and push to engage adhesive. Temporarily support sign in position until adhesive fully sets.

3.3 ADJUSTING AND CLEANING

A. Remove and replace damaged or deformed characters and signs that do not comply with specified requirements. Replace characters with damaged or deteriorated finishes or components that cannot be successfully repaired by finish touchup or similar minor repair procedures.

B. Remove temporary protective coverings and strippable films as signs are installed.

C. On completion of installation, clean exposed surfaces of signs according to manufacturer's written instructions, and touch up minor nicks and abrasions in finish. Maintain signs in a clean condition during construction and protect from damage until acceptance by Owner.

END OF SECTION 10 14 19

SECTION 10 26 00 - WALL AND DOOR PROTECTION

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Corner guards (CG-x).

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, impact strength, dimensions of individual components and profiles, and finishes.

B. Samples for Verification: For each type of exposed finish on the following products, prepared on Samples of size indicated below:

1. Corner Guards: 12 inches long.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of wall and door protection product to include in maintenance manuals.

1. Include recommended methods and frequency of maintenance for maintaining best condition of plastic covers under anticipated traffic and use conditions. Include precautions against using cleaning materials and methods that may be detrimental to finishes and performance.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store wall and door protection in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.

1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
2. Keep plastic materials out of direct sunlight.

3. Store plastic wall- and door-protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.

a. Store corner-guard covers in a vertical position.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of wall- and door-protection units that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including detachment of components from each other or from the substrates, delamination, and permanent deformation beyond normal use.
b. Deterioration of metals, metal finishes, plastics, and other materials beyond normal use.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Source Limitations: Obtain wall- and door-protection products of each type from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Surface Burning Characteristics: Comply with ASTM E 84 or UL 723; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Flame-Spread Index: 25 or less.
2. Smoke-Developed Index: 450 or less.

2.3 CORNER GUARDS (CG-x)

A. Surface-Mounted, Opaque-Plastic Corner Guards : Fabricated as one piece from PVC plastic or acrylic-modified vinyl sheet; with formed edges; fabricated with 90- or 135-degree turn to match wall condition.

1. Products: Subject to compliance with requirements, provide the following products where indicated on Drawings:
2. Manufacturers: Subject to compliance with requirements, provide products by the following:

a. Construction Specialties, Inc.; VA series and LG Series as indicated on drawings.

3. Wing Size: Nominal 3/4 by 3/4 inch .
4. Mounting: Adhesive.
5. Color and Texture: As indicated by manufacturer's designations .

2.4 MATERIALS

A. Plastic Materials: Chemical- and stain-resistant, high-impact-resistant plastic with integral color throughout; extruded and sheet material as required, thickness as indicated.

B. Polycarbonate Plastic Sheet: ASTM D 6098, S-PC01, Class 1 or Class 2, abrasion resistant; with a minimum impact-resistance rating of 15 ft.-lbf/in. of notch when tested according to ASTM D 256, Test Method A.

C. Fasteners: Aluminum, nonmagnetic stainless-steel, or other noncorrosive metal screws, bolts, and other fasteners compatible with items being fastened. Use security-type fasteners where exposed to view.

D. Adhesive: As recommended by protection product manufacturer.

2.5 FABRICATION

A. Fabricate wall and door protection according to requirements indicated for design, performance, dimensions, and member sizes, including thicknesses of components.

B. Factory Assembly: Assemble components in factory to greatest extent possible to minimize field assembly. Disassemble only as necessary for shipping and handling.

C. Quality: Fabricate components with uniformly tight seams and joints and with exposed edges rolled. Provide surfaces free of wrinkles, chips, dents, uneven coloration, and other imperfections. Fabricate members and fittings to produce flush, smooth, and rigid hairline joints.

2.6 FINISHES

A. Protect finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Noticeable variations in same piece are not acceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of the Work.

B. Examine walls to which wall and door protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.

1. For wall and door protection attached with adhesive, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Complete finishing operations, including painting, before installing wall and door protection.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.3 INSTALLATION

A. Installation Quality: Install wall and door protection according to manufacturer's written instructions, level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.

B. Mounting Heights: Install wall and door protection in locations and at mounting heights indicated on Drawings.

3.4 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard ammonia-based household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION 10 26 00

SECTION 10 44 13 - FIRE PROTECTION CABINETS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Fire-protection cabinets for the following:

a. Portable fire extinguisher.

B. Related Requirements:

1. Section 10 44 16 "Fire Extinguishers" for portable, hand-carried fire extinguishers accommodated by fire-protection cabinets.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Show door hardware, cabinet type, trim style, and panel style. Include roughing-in dimensions and details showing recessed-, semirecessed-, or surface-mounting method and relationships of box and trim to surrounding construction.
2. Show location of knockouts for hose valves.

B. Shop Drawings: For fire-protection cabinets.

1. Include plans, elevations, sections, details, and attachments to other work.

1.3 CLOSEOUT SUBMITTALS

A. Maintenance Data: For fire-protection cabinets to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate size of fire-protection cabinets to ensure that type and capacity of fire extinguishers indicated are accommodated.

B. Coordinate sizes and locations of fire-protection cabinets with wall depths.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain fire-protection cabinets, accessories, and fire extinguishers from single source from single manufacturer.

2.2 PERFORMANCE REQUIREMENTS

A. Fire-Rated Fire-Protection Cabinets: Listed and labeled to comply with requirements in ASTM E814 for fire-resistance rating of walls where they are installed.

2.3 FIRE-PROTECTION CABINET (SFEC, RFEC)

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Guardian Fire Equipment, Inc.
2. J. L. Industries, Inc.; Activar Construction Products Group, Inc.
3. Larsen's Manufacturing Company.
4. Potter Roemer LLC; a Division of Morris Group International.

B. Fire-Protection Cabinet Type: Suitable for fire extinguisher .

C. Cabinet Construction: Nonrated unless located in fire rated construction, then match rating of construction.

1. Fire-Rated Cabinets: Construct fire-rated cabinets with double walls fabricated from 0.043-inch- thick cold-rolled steel sheet lined with minimum 5/8-inch- thick fire-barrier material. Provide factory-drilled mounting holes.

D. Cabinet Material: Cold-rolled steel sheet .

E. Recessed Cabinet:

1. Trimless with Concealed Flange: Surface of surrounding wall finishes flush with exterior finished surface of cabinet frame and door, without overlapping trim attached to cabinet. Provide recessed flange, of same material as box, attached to box, to act as drywall bead.

F. Cabinet Trim Material: Same material and finish as door.

G. Door Material: Steel sheet.

H. Door Style: Fully glazed panel with frame .

I. Door Glazing: Acrylic sheet.

1. Acrylic Sheet Color:

a. Clear transparent acrylic sheet.

J. Door Hardware: Manufacturer's standard door-operating hardware of proper type for cabinet type, trim style, and door material and style indicated.

1. Provide manufacturer's standard hinge, permitting door to open 180 degrees.

K. Accessories:

1. Mounting Bracket: Manufacturer's standard steel, designed to secure fire extinguisher to fire-protection cabinet, of sizes required for types and capacities of fire extinguishers indicated, with plated or baked-enamel finish.
2. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate .

a. Identify fire extinguisher in fire-protection cabinet with the words "FIRE EXTINGUISHER."

1) Location: Applied to cabinet door .
2) Application Process: Decals .
3) Lettering Color: Red .
4) Orientation: Vertical .

L. Materials:

1. Cold-Rolled Steel: ASTM A1008/A1008M, Commercial Steel (CS), Type B.

a. Finish: Baked enamel, TGIC polyester powder coat, HAA polyester powder coat, epoxy powder coat, or polyester/epoxy hybrid powder coat, complying with AAMA 2603.
b. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.
c. Color: As selected by Architect from manufacturer's full range .

2. Transparent Acrylic Sheet: ASTM D4802, Category A-1 (cell-cast sheet), 3 mm thick, with Finish 1 (smooth or polished).

2.4 FABRICATION

A. Fire-Protection Cabinets: Provide manufacturer's standard box (tub) with trim, frame, door, and hardware to suit cabinet type, trim style, and door style indicated.

1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Prepare doors and frames to receive locks.
4. Install door locks at factory.

B. Cabinet Doors: Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles.

1. Fabricate door frames of one-piece construction with edges flanged.
2. Miter and weld perimeter door frames and grind smooth.

C. Cabinet Trim: Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.5 GENERAL FINISH REQUIREMENTS

A. Comply with NAAMM's AMP 500, "Metal Finishes Manual for Architectural and Metal Products," for recommendations for applying and designating finishes.

B. Protect mechanical finishes on exposed surfaces of fire-protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire-protection cabinets after assembly.

D. Appearance of Finished Work: Noticeable variations in same piece are unacceptable. Variations in appearance of adjoining components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine walls and partitions for suitable framing depth and blocking where recessed cabinets will be installed.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Prepare recesses for recessed fire-protection cabinets as required by type and size of cabinet and trim style.

3.3 INSTALLATION OF FIRE-PROTECTION CABINETS

A. General: Install fire-protection cabinets in locations and at mounting heights indicated or, if not indicated, at height indicated below:

1. Fire-Protection Cabinet Mounting Height: 42 inches above finished floor to top of fire extinguisher.

B. Fire-Protection Cabinets: Fasten cabinets to structure, square and plumb.

1. Unless otherwise indicated, provide recessed fire-protection cabinets. If wall thickness is inadequate for recessed cabinets, provide semirecessed fire-protection cabinets.
2. Fasten mounting brackets to inside surface of fire-protection cabinets, square and plumb.
3. Fire-Rated Cabinets:

a. Install cabinet with not more than 1/16-inch tolerance between pipe OD and knockout OD. Center pipe within knockout.
b. Seal through penetrations with firestopping sealant as specified in Section 07 84 13 "Penetration Firestopping."

C. Identification:

1. Apply decals at locations indicated.

3.4 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films, if any, as fire-protection cabinets are installed unless otherwise indicated in manufacturer's written installation instructions.

B. Adjust fire-protection cabinet doors to operate easily without binding. Verify that integral locking devices operate properly.

C. On completion of fire-protection cabinet installation, clean interior and exterior surfaces as recommended by manufacturer.

D. Touch up marred finishes, or replace fire-protection cabinets that cannot be restored to factory-finished appearance. Use only materials and procedures recommended or furnished by fire-protection cabinet and mounting bracket manufacturers.

E. Replace fire-protection cabinets that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION 10 44 13

SECTION 10 44 16 - FIRE EXTINGUISHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes portable, hand-carried fire extinguishers and mounting brackets for fire extinguishers.

B. Related Requirements:

1. Section 10 44 13 "Fire Protection Cabinets."

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product. Include rating and classification, material descriptions, dimensions of individual components and profiles, and finishes for fire extinguisher and mounting brackets.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For fire extinguishers to include in maintenance manuals.

1.4 COORDINATION

A. Coordinate type and capacity of fire extinguishers with fire-protection cabinets to ensure fit and function.

1.5 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace fire extinguishers that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Failure of hydrostatic test according to NFPA 10 when testing interval required by NFPA 10 is within the warranty period.
b. Faulty operation of valves or release levers.

2. Warranty Period: Six years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. NFPA Compliance: Fabricate and label fire extinguishers to comply with NFPA 10, "Portable Fire Extinguishers."

B. Fire Extinguishers: Listed and labeled for type, rating, and classification by an independent testing agency acceptable to authorities having jurisdiction.

2.2 PORTABLE, HAND-CARRIED FIRE EXTINGUISHERS (FE)

A. Fire Extinguishers: Type, size, and capacity for each fire-protection cabinet mounting bracket indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Activar Construction Products Group, Inc. - JL Industries.
b. Guardian Fire Equipment, Inc.
c. Larsens Manufacturing Company.
d. Potter Roemer LLC; a Division of Morris Group International.

2. Source Limitations: Obtain fire extinguishers, fire-protection cabinets, and accessories, from single source from single manufacturer.
3. Valves: Manufacturer's standard .
4. Handles and Levers: Manufacturer's standard .
5. Instruction Labels: Include pictorial marking system complying with NFPA 10, Appendix B, and bar coding for documenting fire-extinguisher location, inspections, maintenance, and recharging.

B. Multipurpose Dry-Chemical Type in Steel Container : UL-rated 4-A:60-B:C, 10-lb nominal capacity, with monoammonium phosphate-based dry chemical in enameled-steel container.

2.3 MOUNTING BRACKETS

A. Mounting Brackets: Manufacturer's standard galvanized steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated, with plated or red baked-enamel finish.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Activar Construction Products Group, Inc. - JL Industries.
b. Guardian Fire Equipment, Inc.
c. Larsens Manufacturing Company.
d. Potter Roemer LLC; a Division of Morris Group International.

2. Source Limitations: Obtain mounting brackets and fire extinguishers from single source from single manufacturer.

B. Identification: Lettering complying with authorities having jurisdiction for letter style, size, spacing, and location. Locate as indicated by Architect.

1. Identify bracket-mounted fire extinguishers with the words "FIRE EXTINGUISHER" in red letter decals applied to mounting surface.

a. Orientation: Vertical .

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine fire extinguishers for proper charging and tagging.

1. Remove and replace damaged, defective, or undercharged fire extinguishers.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install fire extinguishers and mounting brackets in locations indicated and in compliance with requirements of authorities having jurisdiction.

B. Mounting Brackets: Fasten mounting brackets to surfaces, square and plumb, at locations indicated.

1. Mounting Height: Top of fire extinguisher to be at 42 inches above finished floor.

END OF SECTION 10 44 16

SECTION 12 24 13 - ROLLER WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Motor-operated, single-roller shades.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood blocking and grounds for mounting roller shades and accessories.
2. Section 07 92 00 "Joint Sealants" for sealing the perimeters of installation accessories for light-blocking shades with a sealant.

1.2 ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, features, finishes, and operating instructions for roller shades.

B. Shop Drawings: Show fabrication and installation details for roller shades, including shadeband materials, their orientation to rollers, and their seam and batten locations.

1. Motor-Operated Shades: Include details of installation and diagrams for power, signal, and control wiring.

C. Samples for Initial Selection: For each type and color of shadeband material.

1.3 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For roller shades to include in maintenance manuals.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Fabricator of products.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver roller shades in factory packages, marked with manufacturer, product name, and location of installation using same designations indicated on Drawings.

1.6 FIELD CONDITIONS

A. Environmental Limitations: Do not install roller shades until construction and finish work in spaces, including painting, is complete and dry and ambient temperature and humidity conditions are maintained at the levels indicated for Project when occupied for its intended use.

B. Field Measurements: Where roller shades are indicated to fit to other construction, verify dimensions of other construction by field measurements before fabrication and indicate measurements on Shop Drawings. Allow clearances for operating hardware of operable glazed units through entire operating range. Notify Architect of installation conditions that vary from Drawings. Coordinate fabrication schedule with construction progress to avoid delaying the Work.

PART 2 - PRODUCTS

2.1 SOURCE LIMITATIONS

A. Obtain roller shades from single source from single manufacturer.

2.2 MOTOR-OPERATED, SINGLE-ROLLER SHADES

A. Basis-of-Design Product: Subject to compliance with requirements, provide Draper Inc.; Shearweave, or comparable product by one of the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hunter Douglas Contract.
2. Lutron Electronics Co., Inc.
3. MechoShade Systems, Inc.

C. Motorized Operating System: Provide factory-assembled, shade-operator system of size and capacity and with features, characteristics, and accessories suitable for conditions indicated, complete with electric motor and factory-prewired motor controls, power disconnect switch, enclosures protecting controls and operating parts, and accessories required for reliable operation without malfunction. Include wiring from motor controls to motors. Coordinate operator wiring requirements and electrical characteristics with building electrical system.

1. Electrical Components: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Electric Motor: Manufacturer's standard tubular, enclosed in roller.

a. Electrical Characteristics: 110-V ac .
b. Maximum Total Shade Width: As required to operate roller shades indicated.
c. Maximum Shade Drop: As required to operate roller shades indicated.

3. Remote Control: Electric controls with NEMA ICS 6, Type 1 enclosure for recessed or flush mounting. Provide the following for remote-control activation of shades:

    a. Individual Switch Control Station: Momentary-contact, wall-switch-operated control station with open, close, and center off functions.

        1) Switch Positions: Five.

    b. Three Zones of control for the system. Refer to the Electrical Drawings for additional information.
    c. Color: As selected by Architect from manufacturer's full range.

4. Crank-Operator Override: Crank and gearbox operate shades in event of power outage or motor failure.
5. Limit Switches: Adjustable switches interlocked with motor controls and set to stop shades automatically at fully raised and fully lowered positions.
6. Operating Features:

    a. Group switching with integrated switch control; single faceplate for multiple switch cutouts.
    b. Capable of interface with audiovisual control system.
    c. Capable of accepting input from building automation control system.

D. Rollers: Corrosion-resistant steel or extruded-aluminum tubes of diameters and wall thicknesses required to accommodate operating mechanisms and weights and widths of shadebands indicated without deflection. Provide with permanently lubricated drive-end assemblies and idle-end assemblies designed to facilitate removal of shadebands for service.

1. Roller Drive-End Location: Right side of interior face of shade.
2. Direction of Shadeband Roll: Regular, from back (exterior face) of roller.
3. Shadeband-to-Roller Attachment: Manufacturer's standard method.

E. Mounting Hardware: Brackets or endcaps, corrosion resistant and compatible with roller assembly, operating mechanism, installation accessories, and mounting location and conditions indicated.

F. Roller-Coupling Assemblies: Coordinated with operating mechanism and designed to join up to three inline rollers that are operated by one roller drive-end assembly.

G. Shadebands:

1. Shadeband Material: Light-filtering fabric.
2. Shadeband Bottom (Hem) Bar: Steel or extruded aluminum.

    a. Type: Enclosed in sealed pocket of shadeband material.
    b. Color and Finish: As selected by Architect from manufacturer's full range.

H. Installation Accessories:

1. Surface Mounted roller shade installation where indicated on drawings.

2. Recessed Shade Pocket: Rectangular, extruded-aluminum enclosure designed for recessed ceiling installation; with front, top, and back formed as one piece, end plates, and removable bottom closure panel, where indicated on drawings.

   a. Height: Manufacturer's standard height required to enclose roller and shadeband assembly when shade is fully open, but not less than 6 inches.
   b. Provide pocket with lip at lower edge to support acoustical ceiling panel.

3. Installation Accessories Color and Finish: As selected from manufacturer's full range.

2.3 SHADEBAND MATERIALS

A. Shadeband Material Flame-Resistance Rating: Comply with NFPA 701. Testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

B. Light-Filtering Fabric: Woven fabric, stain and fade resistant.

1. Source: Roller shade manufacturer.
2. Basis-of-Design: Draper, Inc.; Shearweave.
3. Orientation on Shadeband: Up the bolt.
4. Openness Factor: 3 percent.
5. Color: As selected by Architect from manufacturer's full range.

2.4 ROLLER SHADE FABRICATION

A. Product Safety Standard: Fabricate roller shades to comply with WCMA A 100.1, including requirements for flexible, chain-loop devices; lead content of components; and warning labels.

B. Unit Sizes: Fabricate units in sizes to fill window and other openings as follows, measured at 74 deg F:

1. Between (Inside) Jamb Installation: Width equal to jamb-to-jamb dimension of opening in which shade is installed less 1/4 inch per side or 1/2-inch total, plus or minus 1/8 inch. Length equal to head-to-sill or -floor dimension of opening in which shade is installed less 1/4 inch, plus or minus 1/8 inch.
2. Outside of Jamb Installation: Width and length as indicated, with terminations between shades of end-to-end installations at centerlines of mullion or other defined vertical separations between openings.

C. Shadeband Fabrication: Fabricate shadebands without battens or seams to extent possible, except as follows:

1. Vertical Shades: Where width-to-length ratio of shadeband is equal to or greater than 1:4, provide battens and seams at uniform spacings along shadeband length to ensure shadeband tracking and alignment through its full range of movement without distortion of the material.

2. Skylight Shades: Provide battens and seams at uniform spacings along shadeband as required to ensure shadeband tracking and alignment through its full range of movement without distortion or sag of material.
3. Railroaded Materials: Railroad material where material roll width is less than the required width of shadeband and where indicated. Provide battens and seams as required by railroaded material to produce shadebands with full roll-width panel(s) plus, if required, one partial roll-width panel located at top of shadeband.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, operational clearances, and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 ROLLER SHADE INSTALLATION

A. Install roller shades level, plumb, and aligned with adjacent units according to manufacturer's written instructions.

1. Opaque Shadebands: Located so shadeband is not closer than 2 inches to interior face of glass. Allow clearances for window operation hardware.

B. Electrical Connections: Connect motor-operated roller shades to building electrical system.

C. Roller Shade Locations: As indicated on Drawings.

3.3 ADJUSTING

A. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

3.4 CLEANING AND PROTECTION

A. Clean roller shade surfaces, after installation, according to manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that roller shades are without damage or deterioration at time of Substantial Completion.

C. Replace damaged roller shades that cannot be repaired, in a manner approved by Architect, before time of Substantial Completion.

3.5 DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain motor-operated roller shades.

END OF SECTION 12 24 13

SECTION 21 05 00 - BASIC FIRE SUPPRESSION REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 21 Sections. Also refer to Division 01 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.

B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.

1.3 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    d. Maintenance clearances and code-required dedicated space shall be included.
    e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

    a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

    a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1 '-0" (minimum).
        2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.

4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
    b. Potential layout changes shall be made to avoid additional access panels.
    c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
    d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
    e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.4 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of McHenry Codes, Laws, Ordinances, and other regulations having jurisdiction.
2. Conform to all State Codes.
3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal, and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.

6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Examination of Drawings:

1. The drawings for the fire protection work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in fire protection documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.

    a. Any item listed as furnished shall also be installed, unless otherwise noted.
    b. Any item listed as installed shall also be furnished, unless otherwise noted.

F. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.

8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.5 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
21 13 00	Fire Protection Equipment

B. General Submittal Procedures: In addition to the provisions of Division 01, the following are required:

1. Transmittal: Each transmittal shall include the following:

a. Date
b. Project title and number
c. Contractor's name and address
d. Division of work (e.g., plumbing, heating, ventilating, etc.)
e. Description of items submitted and relevant specification number
f. Notations of deviations from the contract documents
g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

a. Date
b. Project title and number
c. Architect/Engineer
d. Contractor and subcontractors' names and addresses
e. Supplier and manufacturer's names and addresses
f. Division of work (e.g., plumbing, heating, ventilating, etc.)
g. Description of item submitted (using project nomenclature) and relevant specification number
h. Notations of deviations from the contract documents
i. Other pertinent data
j. Provide space for Contractor's review stamps

3. Composition:

a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.
    c. The Contractor's review shall include, but not be limited to, verification of the following:

        1) Only approved manufacturers are used.
        2) Addenda items have been incorporated.
        3) Catalog numbers and options match those specified.
        4) Performance data matches that specified.
        5) Electrical characteristics and loads match those specified.
        6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
        7) Dimensions and service clearances are suitable for the intended location.
        8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
        9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

    d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
    e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

    a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
    b. The Contractor shall clearly indicate the size, finish, material, etc.
    c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
    d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.

11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions. or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 21 XX XX.description.YYYYMMDD
    b. Transmittal file name: 21 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.6 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.7 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.

B. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.

C. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

D. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.8 WARRANTY

A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.9 INSURANCE

A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.10 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the scheduled manufacturer is the basis for job design and establishes the quality required.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.

D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.

F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Covering exterior walls, interior partitions and chases.
2. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

   a. Pipe wall penetrations are sealed.
   b. Pipe identification is installed.
   c. Branch piping in the location of sprinklers shall be dropped to the ceiling.

2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.3 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 01.

B. Final Jobsite Observation:

1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

C. Before final payment is authorized, this Contractor must submit the following:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including reproducible drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
4. Inspection report by the State Fire Marshal of the fire protection system.
5. Start-up reports on all equipment requiring a factory installation inspection or start-up.
6. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.4 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number, followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div21.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div21.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment, and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses, and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.

7. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.5 INSTRUCTING THE OWNER'S REPRESENTATIVES

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

D. The instructions shall include:

1. Maintenance of equipment.

E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.

F. Minimum hours of instruction for each item shall be:

1. Sprinkler System(s) - 2 hours.

G. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the fire protection and control systems.
2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.6 SYSTEM STARTING AND ADJUSTING

A. The fire protection systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final comfort adjustments as required.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.

C. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.

D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.7 RECORD DOCUMENTS

A. The following paragraphs supplement Division 01 requirements.

B. Maintain at the job site a separate and complete set of fire protection drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations of other control devices, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.

D. Before completion of the project, a set of reproducible fire protection drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.

E. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.

F. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

G. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.8 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.

B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.

D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.9 SPECIAL REQUIREMENTS

A. Contractor shall coordinate the installation of all equipment, valves, etc., with other trades to maintain clear access area for servicing.

B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copying this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations are fire-sealed and labeled in accordance with specifications.
2. Fire protection system operational.
3. Pipes labeled.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION

SECTION 21 05 03 - THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 - Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. The Building Officials and Code Administrators National Building Code

J. 2021 International Building Code

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

1.5 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.6 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

B. Manufacturers:

1. 3M; Fire Protection Products Division.
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk.
4. Tremco; Sealant/Weatherproofing Division.
5. Johns-Manville.
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Dow Corning Corp.

10. Fire Trak Corp.
11. International Protective Coating Corp.
12. HoldRite

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Firestopping systems for wet pipe sprinkler piping shall be moisture resistant.

E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

F. Provide firestopping systems allowing continuous insulation for all insulated pipes.

G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

a. F Rating = Wall Rating

H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 21 05 05 - FIRE SUPPRESSION DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mechanical Demolition.

B. Cutting and Patching.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The drawings are intended to indicate the general scope of work and do not show every pipe, duct, or piece of equipment that must be removed. The contractor shall visit the site and verify conditions prior to submitting a bid.

B. Where walls, ceilings, etc., are shown as being removed on general drawings, the Contractor shall remove all mechanical equipment, devices, fixtures, piping, ducts, systems, etc., from the removed area.

C. Where ceilings, walls, partitions, etc., are temporarily removed and replaced by others, This Contractor shall remove, store, and replace equipment, devices, fixtures, pipes, ducts, systems, etc.

D. Verify that abandoned utilities serve only abandoned equipment or facilities. Extend services to facilities or equipment that shall remain in operation following demolition.

E. Coordinate work with all other Contractors and the Owner. Schedule removal of equipment to avoid conflicts.

F. This Contractor shall verify all existing equipment sizes and capacities where equipment is scheduled to be replaced or modified, prior to ordering new equipment.

G. Bid submittal shall mean the Contractor has visited the project site and verified existing conditions and scope of work.

3.2 PREPARATION

A. Disconnect fire protection systems in walls, floors, and ceilings scheduled for removal.

B. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on operating equipment, use personnel experienced in such operations.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned piping to source of supply and/or main lines.

C. Remove exposed abandoned pipes, including abandoned pipes above accessible ceilings. Cut pipes above ceilings, below floors and behind walls. Cap remaining lines. Repair building construction to match original. Remove all clamps, hangers, supports, etc. associated with pipe and duct removal.

D. Disconnect and remove mechanical devices and equipment serving equipment that has been removed.

E. Repair adjacent construction and finishes damaged during demolition and extension work.

F. Maintain access to existing mechanical installations which remain. Modify installation or provide access panels as appropriate.

G. Extend existing installations using materials and methods compatible with existing installations, or as specified.

3.4 CUTTING AND PATCHING

A. This Contractor is responsible for all penetrations of existing construction required to complete the work of this project. Refer to Section 21 05 29 for additional requirements.

B. Penetrations in existing construction should be reviewed carefully prior to proceeding with any work.

C. Penetrations shall be neat and clean with smooth and/or finished edges. Core drill where possible for clean opening.

D. Repair existing construction as required after penetration is complete to restore to original condition. Use similar materials and match adjacent construction unless otherwise noted or agreed to by the Architect/Engineer prior to start of work.

E. This Contractor is responsible for <u>all</u> costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.5 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Clean all systems adjacent to project that are affected by the dust and debris caused by this construction.

C. Fire protection items removed and not relocated remain the property of the owner. Contractor shall place items retained by the owner in a location coordinated with the owner. The contractor shall dispose of material that the owner does not want to reuse or retain for maintenance purposes.

END OF SECTION

SECTION 21 05 29 - FIRE SUPPRESSION SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hangers, Supports, and Associated Anchors.

B. Sleeves and Seals.

C. Cutting of Openings.

D. Escutcheon Plates and Trim.

1.2 QUALITY ASSURANCE

A. Support Sprinkler Piping in conformance with NFPA 13.

1.3 REFERENCES

A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

D. NFPA 13 - Standard for the Installation of Sprinkler Systems.

1.4 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 HANGER RODS

A. Hanger rods for single rod hangers supporting steel shall conform to the following:

1. Hanger Rod Diameter:

a. 4" and smaller: 3/8"
b. 5", 6", and 8": 1/2"

B. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2.2 PIPE HANGERS AND SUPPORTS

A. General:

1. All pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS-SP-58, 69, 89, and 127 (where applicable).

B. Hangers and Clamps:

1. Unless otherwise indicated, hangers shall be as follows:

a. Clevis Type: Service: Bare Metal Pipe

1) Products: Bare Stee Pipe

a) Anvil Fig. 260
b) Eaton Fig. 3100
c) nVent Model 400

b. Adjustable Swivel Ring Type: Service: Bare Metal Pipe - 4 inches and Smaller

1) Products: Bare Steel Pipe

a) Anvil Fig. 69
b) Eaton Fig. B3170NF
c) nVent Model 115

2. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.
3. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
4. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

a. Clamp Type: Service: Bare Metal Pipe

1) Pipes subject to expansion and contraction shall have clamps slightly oversized to allow limited pipe movement.
2) Products: Bare Steel, Plastic or Insulated Pipe

a) Unistrut Fig. P1100 or P2500
b) Eaton Fig. B2000 or B2400
c) Anvil AS1200
d) nVent USC

C. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

a. Steel Structure Clamps: C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar joists.)

1) Products:

a) Anvil Fig. 86
b) Eaton Fig. B3033/B3034
c) nVent Model 300 & 310

b. Scissor Type Beam Clamps (for use with bar joists and wide flange):

1) Products:

a) Anvil Fig. 228, 292
b) Eaton Fig. B3054
c) nVent Model 360

2.3 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.

B. Supports:

1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment, and conduit without sag.
2. Hang heavy equipment from concrete floors or ceilings with Architect-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.

2.4 OPENINGS IN WALLS

A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.

B. Coordinate all openings with other Contractors.

C. Hire the proper tradesman and furnish all labor, material, and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.

D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.

E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.5 PIPE SLEEVES AND LINTELS

A. Each Contractor shall provide pipe sleeves and lintels for all openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.

B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.

C. Sleeves shall not penetrate structural members or masonry walls without approval from the Structural Engineer. Sleeves shall then comply with the Engineer's design.

D. Install all sleeves concentric with pipes. Secure sleeves in concrete to wood forms. This Contractor is responsible for sleeves dislodged or moved when pouring concrete.

E. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

2.6 ESCUTCHEON PLATES AND TRIM

A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.

B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.

C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes duct and pipe openings.

2.7 PIPE PENETRATIONS

A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.

B. Seal fire rated wall penetrations with fire seal system as specified.

2.8 PIPE ANCHORS

A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.

B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.9 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 FIRE SUPPRESSION SUPPORTS AND ANCHORS

A. General Installation Requirements:

1. Install all items per manufacturer's instructions.
2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
4. Supports shall extend directly to building structure. Do not support piping from duct hangers. Do not allow lighting or ceiling supports to be hung from piping supports.

B. Supports Requirements:

1. Where building structural steel is fireproofed, all hangers, clamps, auxiliary steel, etc., which attach to it shall be installed prior to application of fireproofing. Repair all fireproofing damaged during pipe installation.
2. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
3. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
4. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:

a. The hanger is attached within 6" from a web/chord joint.

b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.

H. Spacing of hangers shall in no case exceed the following:

1. Steel (All steel pipe unless otherwise noted):

a. Maximum Spacing:

1) 1-1/4" & under: 12'-0"
2) 1-1/2" & larger: 15'-0"

I. Installation of hangers shall conform to MSS SP-58, 69, 89, and applicable NFPA standards.

END OF SECTION

SECTION 21 05 53 - FIRE SUPPRESSION IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Identification of products installed under Division 21.

1.2 REFERENCES

A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

B. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. 3M

B. Bunting

C. Calpico

D. Craftmark

E. Emedco

F. Kolbi Industries

G. Seton

H. W.H. Brady

I. Marking Services.

2.2 MATERIALS

A. All pipe markers shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

OD of Pipe or Insulation	Marker Length	Size of Letters
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"
" (200 mm)" (250 mm)		
Plastic tags may be used for outside diameters under 3/4"		

B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.

C. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.

D. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.

E. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.

F. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.

G. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all products per manufacturer's recommendations.

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Valves:

1. All valves (except shutoff valves at equipment) shall have numbered tags.
2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
4. Secure tags with heavy duty key chain and brass "S" link or with mechanically fastened plastic straps.
5. Attach to handwheel or around valve stem.
6. Number all tags and show the service of the pipe.
7. Add to existing valve directory listing all valves, with respective tag numbers, uses and locations. Mount directory in location chosen by the Architect/Engineer.

D. Pipe Markers:

1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
3. Apply markers and arrows in the following locations where clearly visible:

    a. At each valve.
    b. On both sides of walls that pipes penetrate.
    c. At least every 20 feet along all pipes.

d. On each riser and each leg of each "T" joint.
e. At least once in every room.

E. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
2. Fasten nameplates or plastic tags with stainless steel self-tapping screws or permanently bonding cement.
3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

3.2 SCHEDULE

A. Pipes to be marked shall be labeled with text shown as follows, regardless of which method or material is used:

1. FIRE PROTECTION WATER: White lettering; red background

END OF SECTION

SECTION 21 13 00 - FIRE PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe, Fittings, Valves, and Connections for Fire Protection System.

B. Wet-Pipe Sprinkler System.

1.2 QUALITY ASSURANCE

A. Welding Materials and Procedures: Conform to ASME Code.

B. Equipment and Components: Bear UL label or marking.

C. Valves: Bear UL label or marking. Provide manufacturer's name and pressure rating marked on valve body. Pressure rating shall match specified pipe system pressure rating. Remanufactured valves are not acceptable.

D. Specialist Firm: Company specializing in sprinkler systems with minimum three years' experience.

E. Sprinkler design drawings submitted by the Contractor shall be prepared by a NICET Water-Based Fire Protection Systems Layout Level III or Level IV designer or PE.

1.3 REFERENCES

A. ANSI/ASME B16.3 - Malleable Iron Threaded Fittings, Class 150 and 300.

B. ANSI/ASME B16.4 - Cast Iron Threaded Fittings, Class 125 and 250.

C. ANSI/ASME B16.11 - Forged Steel Fittings, Socket-Welding and Threaded.

D. ANSI/ASTM A47 - Malleable Iron Castings.

E. ANSI/ASTM A135 - Electric-Resistance-Welded Steel Pipe.

F. ANSI/AWWA C110 - Ductile Iron and Gray Iron Fittings.

G. ANSI/AWWA C151 - Ductile Iron Pipe, Centrifugally Cast.

H. ASME - Boiler and Pressure Vessel Code - Section IX, Welding and Brazing Requirements.

I. ASTM A153 - Pipe, Steel, Black and Hot-Dipped, Zinc-coated Welded and Seamless.

J. AWS D10.9 - Specifications for Qualification of Welding Procedures and Welders for Piping and Tubing.

K. IBC - International Building Code.

L. NFPA 101 - Life Safety Code,

M. NFPA 13 - Standard for the Installation of Sprinkler Systems.

N. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances.

O. UL - Underwriter's Laboratory Fire Protection Equipment Directory.

1.4 SUBMITTALS

A. Submit shop drawings per Section 21 05 00. Indicate pipe materials, joining methods, supports, floor and wall penetration seals, sprinklers, equipment data and ratings, and hydraulic calculations.

B. Submit detailed pipe and sprinkler layout and other calculations and forms as described in NFPA 13.

C. Submit detailed working drawings and obtain review of them in the following order:

1. Engineer/Architect/State Fire Marshal/Authority Having Jurisdiction
2. Owner's Insurance Company
3. Local Fire Department
4. Owner's Insurance Company
5. Architect/Engineer

D. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

1.5 EXTRA STOCK

A. Provide metal storage cabinet, wrenches for each sprinkler type, and extra sprinklers per NFPA 13 and applicable building code.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store valves and sprinklers in shipping containers, with labels in place.

B. Provide temporary protective coating on iron and steel valves.

C. Maintain temporary end caps and closures in place until installation.

1.7 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish sleeves to General Contractor for placement in walls and floors. Sleeve location to be determined by the Fire Protection Contractor prior to construction. If additional sleeves are required, they shall be core drilled by the Fire Protection Contractor.

1.8 SYSTEM DESCRIPTION

A. Contractor shall design and install the following water-based fire protection systems for the areas noted on the contract documents:

1. Wet pipe sprinkler system(s)

B. Sprinkler systems shall be designed and installed according to the following standard(s):

1. NFPA 13 - Standard for the Installation of Sprinkler Systems
2. FM Global Datasheet 2-0 - Installation Guideline for Automatic Sprinklers
3. FM Global Datasheet 3-26 - Fire Protection Water Demand for Non-storage Sprinklered Properties

C. System design and installation shall include all requirements by the Authority Having Jurisdiction, local and state building codes, and Owner's insurance company in addition to the previously listed design standard(s). Those requirements shall take precedence over the contract documents in the case of discrepancies.

D. Systems shall be hydraulically calculated in accordance with the applicable design standard(s). Contractor is responsible for final pipe sizing based on results from hydraulic calculations. Pipe sizing shown on drawings for service entrance and main risers is preliminary and for coordination purposes only.

E. The water supply source for this project is the following:

1. Public waterworks system.

F. Coordinate with Plumbing Contractor for installation of a floor drain or floor sink below the backflow preventer.

1.9 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 21 05 00 for required fire protection systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit manufacturers' operation and maintenance data. Include written maintenance data on components of system, servicing requirements, and record drawings.

1.11 JOB CONDITIONS

A. Fire Protection Contractor shall determine the flow and pressure available at the service connection. The Fire Protection Contractor is responsible to verify this information and make all tests required. Base all pipe sizing and hydraulic calculations on flow test data no older than 18 months.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS - WET PIPE SPRINKLER SYSTEMS

A. Piping - 2" and Under (Steel Pipe):

1. Design Pressure: 175 psig
2. Pipe: Schedule 40, black steel, ASTM A53, ASTM A795, UL. Inner wall shall be coated with an anti-MIC (microbiologically influenced corrosion) coating.
3. Schedule 40 Joints: Threaded.

4. Fittings:

    a. Threaded:

        1) Cast iron, Class 125, black, UL, ANSI/ASME B16.4ASTM A153.
        2) Malleable iron, Class 150, black, UL, ANSI/ASME B16.3ASTM A153.
        3) Ductile iron, Class 150, black, UL, ANSI/ASME B16.3ASTM A153.

5. Unions: Class 150 malleable iron, ANSI B16.39, ground joint with copper or copper alloy-to-iron seat.

B. Piping - 2-1/2" and Above (Steel Pipe):

1. Design Pressure: 175 psig
2. Pipe: Schedule 10, black steel, ASTM A135, ASTM A795, UL/FM. Inner wall shall be coated with an anti-MIC (microbiologically influenced corrosion) coating.
3. Joints: Roll Grooved.
4. Fittings:

    a. Grooved:

        1) Ductile iron housing ASTM A-536, Grade 65-45-12, UL/FM, enamel coating, Grade E (Type A) EPDM molded pressure-responsive gaskets suited for 40F to 150F. Carbon steel bolts and nuts.

2.2 FLEXIBLE FIRE SPRINKLER CONNECTIONS

A. Flexible Connection: Stainless steel hose, 175 psig max working pressure, fully welded non-mechanical fittings, stainless steel braid, maximum of 6' hose length, leak-tested with a minimum 7/8" internal corrugated hose diameter made of 304 stainless steel, end fittings made of carbon or stainless steel. Outlet of end fittings shall be 1/2" or 3/4" to match sprinkler connection. UL.

B. Ceiling Bracket: G90 galvanized steel, direct attachment type, integrated snap-on clip ends, tamper resistance screws, removable attachment hub with set screw for attachment and adjustment of stainless-steel hose.

C. Flexible sprinkler connections are not allowed to be used in exposed areas.

1. Manufacturers:

    a. Flexhead Industries
    b. Victaulic VicFlex,
    c. Sprinkflex
    d. or approved equal.

2.3 EQUIPMENT

A. Equipment shall be as scheduled on the drawings.

2.4 PIPE LABELING AND IDENTIFICATION

A. All pipe shall be marked along its length by the manufacturer in such a way as to properly identify the type of pipe. The manufacturer pipe marking shall be visible on every piece of pipe over 2 ft long. Manufacturer pipe identification shall include the manufacturer's name, model designation, and/or schedule.

PART 3 - EXECUTION

3.1 INSTALLATION - PIPING

A. General Installation Requirements:

1. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over sprinkler piping and sprinklers.
2. Ream pipe and tube ends to full inside diameter. Remove burrs. Remove scale and foreign material, inside and outside, before assembly.
3. Die cut screw joints with full cut standard taper pipe threads.
4. Coat threads with pipe joint compound or wrap with Teflon tape.
5. Locate piping to minimize obstruction of other work.
6. Route piping in concealed spaces above finished ceiling.
7. Use full and double lengths of pipe wherever possible.
8. Slope all piping for complete drainage. Install auxiliary drains for all trapped piping per NFPA 13.
9. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.
10. Comply with manufacturer's installation instructions.

B. Installation Requirements in Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment. Fire protection equipment dedicated to the electrical equipment room or space may be installed above equipment if other alternatives are not available.

C. Hangers and Supports:

1. Provide hangers and supports as required by NFPA 13 and UL, with the following exceptions:

    a. Do not use powder driven devices, explosive devices, wooden plugs, or plastic inserts.
    b. Do not install fasteners to carry the load in tension, unless absolutely necessary.

D. Exposed Piping:

1. Install chrome plated steel escutcheons where exposed pipes penetrate walls or floors.
2. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.

3.2 INSTALLATION - EQUIPMENT

A. Coordinate piping and sprinkler locations with all other trades. Ductwork, diffusers and light fixture locations shall have priority over system equipment and sprinklers.

B. Sprinklers:

1. Locate sprinklers to clear lights, ducts and diffusers. Do not run sprinkler pipes through ducts. Ductwork has priority over sprinkler pipes. Offset pipes as needed.
2. Center sprinklers in two directions in ceiling tiles and provide offsets as required.
3. Do not allow concealed sprinkler cover plates to be painted. Sprinkler cover plates are to be factory painted only. Do not field paint.
4. Apply strippable or paper covers so concealed sprinkler cover plates do not receive field paint finish.

3.3 SYSTEMS CLEANING AND TESTING

A. General Requirement:

1. All water used for testing and remaining in the piping system shall be obtained from a potable water source.

B. Interior Piping:

1. Verify adequate water flow at the inspector's test connection.
2. Flush all interior piping to remove scale and other foreign material before placing system into service.
3. Hydrostatically test the entire interior piping system at a minimum of 200 psig or 50 psig more than the normal system working pressure for systems subjected to pressures more than 150 psig. Maintain test pressure for 2 hours without loss of pressure..

C. Fire Alarm System:

1. Test the alarm system by operating the inspector's test connection or the alarm test valves. Verify that the building fire alarm system activates.
2. Adjust all monitor switches for proper operation.

END OF SECTION

SECTION 22 05 00 - BASIC PLUMBING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 22 Sections. Also refer to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.

B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.

1.3 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder racks, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    d. Maintenance clearances and code-required dedicated space shall be included.
    e. The coordination drawings shall include all underground, underfloor, in-floor, in-chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance that can be maintained. Failure to comply will result in modifications with no cost to Owner.

    a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

    a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1 '-0" (minimum).
        2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.

4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
    b. Potential layout changes shall be made to avoid additional access panels.
    c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
    d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
    e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.4 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receipt of instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of McHenry Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all State Codes.
3. Conform to Federal Act S.3874 requiring the reduction of lead in drinking water.
4. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
6. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
7. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
8. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.

6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Examination of Drawings:

1. The drawings for the plumbing work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.

    a. Any item listed as furnished shall also be installed, unless otherwise noted.
    b. Any item listed as installed shall also be furnished, unless otherwise noted.

F. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.

8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.5 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

Referenced Specification Section	Submittal Item
22 40 00	Plumbing Fixtures

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

a. Date
b. Project title and number
c. Contractor's name and address
d. Division of work (e.g., plumbing, heating, ventilating, etc.)
e. Description of items submitted and relevant specification number
f. Notations of deviations from the contract documents
g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

a. Date
b. Project title and number
c. Architect/Engineer
d. Contractor and subcontractors' names and addresses
e. Supplier and manufacturer's names and addresses
f. Division of work (e.g., plumbing, heating, ventilating, etc.)
g. Description of item submitted (using project nomenclature) and relevant specification number
h. Notations of deviations from the contract documents
i. Other pertinent data
j. Provide space for Contractor's review stamps

3. Composition:

a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.
    c. The Contractor's review shall include, but not be limited to, verification of the following:

        1) Only approved manufacturers are used.
        2) Addenda items have been incorporated.
        3) Catalog numbers and options match those specified.
        4) Performance data matches that specified.
        5) Electrical characteristics and loads match those specified.
        6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
        7) Dimensions and service clearances are suitable for the intended location.
        8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
        9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

    d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
    e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

    a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
    b. The Contractor shall clearly indicate the size, finish, material, etc.
    c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
    d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.

11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 22 XX XX.description.YYYYMMDD
    b. Transmittal file name: 22 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.6 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.7 WARRANTY

A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.8 INSURANCE

A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.9 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the first manufacturer is the basis for job design and establishes the quality.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.

D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractor's part or on the part of other Contractors whose work is affected.

E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.

F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (https://call811.com/) or by calling 811.
2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workers.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. Utilities Bedding: Lay underground utilities on minimum of 6" sand bedding or CA6 crushed stone. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
2. Envelope Around Utilities to 6" Above Utilities: Place sand or CA6 crushed stone or flowable fill to a height of 6" over utilities in 6" layers. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
3. Backfill From 6" Above Utilities to Earthen Grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep.
4. Backfill From 6" Above Utilities to Below Slabs or Paved Area: Where the sand or CA6 crushed stone fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
5. Backfill Materials:

    a. Sand, CA6: Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    b. Native Soil: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Native soils shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    c. Flowable Fill: Cementitious, self-leveling, self-compacting slurry as defined by the ACI with compressive strength of 50-100psi at 28 days; consisting of a mixture of fine aggregate or filler, water and cementitious materials. Filler material consist of sand, fly ash, spent foundry sand, quarry fines, baghouse dust. Cementitious materials consist of Portland cement, pozzolanic materials, and self-cementing materials. Flowable fill may be placed in a pour instead of 6" layers noted above.

6. Water shall not be permitted to rise in unbackfilled trenches.
7. Dispose of excess excavated earth as directed.
8. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.
9. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions, and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

a. Pipe insulation is installed and fully sealed.
b. Pipe wall penetrations are sealed.
c. Pipe identification and valve tags are installed.

2. To prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.4 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. To prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.

4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

C. Before final payment is authorized, this Contractor must submit the following:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including reproducible drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div22.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div22.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.

8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Dimensional drawings of equipment.
8. Capacities and utility consumption of equipment.
9. Detailed parts lists with lists of suppliers.
10. Operating procedures for each system.
11. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
12. Repair procedures for major components.
13. Instruction books, cards, and manuals furnished with the equipment.
14. Owner and Contractor attendance list for domestic water systems operation, maintenance, and flushing training.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVES

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

D. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.

E. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
2. If the Contractor does not have staff that can adequately provide the required instructions the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM STARTING AND ADJUSTING

A. The plumbing systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments and final adjustments as required.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.

C. Contractor shall adjust the plumbing systems and controls at season changes during the one year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.

D. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.

E. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

A. The following paragraphs supplement Division 1 requirements.

B. Maintain at the job site a separate and complete set of plumbing drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings to indicate revisions to piping size and location, both exterior and interior; including locations devices, requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located; Change Orders; concealed control system devices.

D. Before completion of the project, a set of reproducible plumbing drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.

E. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.

F. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

G. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.9 PAINTING

A. This Contractor shall paint the following items:

1. Exposed Piping

B. After surfaces have been thoroughly cleaned and are free of oil, dirt, and other foreign matter; paint all pipes and equipment with the following:

1. Insulated Surfaces - Paint insulation jackets with two coats of semi-gloss acrylic latex paint.

3.10 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.

B. Clean all areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed piping, hangers, and accessories.

D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.11 UTILITY REBATE

A. Submit utility rebate forms, where offered at project location, with rebate items completed. Rebate may include lighting, lighting controls, variable speed drives, heat pumps, package terminal A/C, air conditioners, chillers, water heaters, programmable thermostats, and motors.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed in accordance with specifications.
2. Pipe insulation complete, pipes labeled and valves tagged.

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.
It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION

SECTION 22 05 03 - THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 - Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. The Building Officials and Code Administrators National Building Code

J. 2021 International Building Code

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

1.5 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.6 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division.
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk.
4. Tremco; Sealant/Weatherproofing Division.
5. Johns-Manville.

6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Dow Corning Corp.
10. Fire Trak Corp.
11. International Protective Coating Corp.
12. HoldRite

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.

E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

F. Provide firestopping systems allowing continuous insulation for all insulated pipes.

G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

    a. F Rating = Floor/Wall Rating

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

    a. F Rating = Floor/Wall Rating

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

    a. F Rating = Wall/Floor Rating

H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 22 05 05 - PLUMBING DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mechanical Demolition.

B. Cutting and Patching.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The drawings are intended to indicate the general scope of work and do not show every pipe, duct, or piece of equipment that must be removed. The contractor shall visit the site and verify conditions prior to submitting a bid.

B. Where walls, ceilings, etc., are shown as being removed on general drawings, the Contractor shall remove all mechanical equipment, devices, fixtures, piping, ducts, systems, etc., from the removed area.

C. Where ceilings, walls, partitions, etc., are temporarily removed and replaced by others, This Contractor shall remove, store, and replace equipment, devices, fixtures, pipes, ducts, systems, etc.

D. Verify that abandoned utilities serve only abandoned equipment or facilities. Extend services to facilities or equipment that shall remain in operation following demolition.

E. Coordinate work with all other Contractors and the Owner. Schedule removal of equipment to avoid conflicts.

F. This Contractor shall verify all existing equipment sizes and capacities where equipment is scheduled to be replaced or modified, prior to ordering new equipment.

G. Bid submittal shall mean the Contractor has visited the project site and verified existing conditions and scope of work.

3.2 PREPARATION

A. Disconnect plumbing systems in walls, floors, and ceilings scheduled for removal.

B. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on operating equipment, use personnel experienced in such operations.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Demolish and extend existing plumbing work under provisions of Division 2 and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned piping to source of supply and/or main lines.

D. Remove exposed abandoned pipes, including abandoned pipes above accessible ceilings. Cut pipes above ceilings, below floors and behind walls. Cap remaining lines. Repair building construction to match original. Remove all clamps, hangers, supports, etc. associated with pipe and duct removal.

E. Disconnect and remove mechanical devices and equipment serving equipment that has been removed.

F. Repair adjacent construction and finishes damaged during demolition and extension work.

G. Extend existing installations using materials and methods compatible with existing installations, or as specified.

3.4 CUTTING AND PATCHING

A. This Contractor is responsible for all penetrations of existing construction required to complete the work of this project. Refer to Section 22 05 29 for additional requirements.

B. Penetrations in existing construction should be reviewed carefully prior to proceeding with any work.

C. Penetrations shall be neat and clean with smooth and/or finished edges. Core drill where possible for clean opening.

D. Repair existing construction as required after penetration is complete to restore to original condition. Use similar materials and match adjacent construction unless otherwise noted or agreed to by the Architect/Engineer prior to start of work.

E. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.5 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment which remain or are to be reused.

B. Clean all systems adjacent to project that are affected by the dust and debris caused by this construction.

C. Plumbing items removed and not relocated remain the property of the owner. Contractor shall place items retained by the owner in a location coordinated with the owner. The contractor shall dispose of material that the owner does not want to reuse or retain for maintenance purposes.

END OF SECTION

SECTION 22 05 29 - PLUMBING SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hangers, Supports, and Associated Anchors.

B. Sleeves and Seals.

1.2 REFERENCES

A. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

B. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

C. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices

1.3 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 HANGER RODS

A. Hanger rods for single rod hangers shall conform to the following:
   1. Cast Iron Pipe:
      a. Hanger Rod Diameter:
         1) 2-1/2" and smaller: 3/8"
         2) 3" through 3-5/8": 3/8"
         3) 4" through 6": 1/2"
         4) 8": 5/8"
         5) 10": 3/4"
   2. Plastic Pipe:
      a. Hanger Rod Diameter:
         1) 2-1/2" and smaller: 3/8"
         2) 3") through 3-5/8": 3/8"
         3) 4") through 6": 1/2"
         4) 8": 5/8"
         5) 10": 3/4"

B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.

C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2.2 PIPE AND STRUCTURAL SUPPORTS

A. General:

1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).
2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.

B. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
2. Unless otherwise indicated, hangers shall be as follows:

a. Clevis Type: Insulated Cold Pipe, 3 inches & Smaller

1) Products: Insulated Pipe:

a) Anvil Fig. 260
b) Eaton Fig. 3100
c) nVent Model 400

3. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

a. Clamp Type: Insulated Cold Pipe - 3 inches and smaller

1) Pipes subject to expansion and contraction shall have oversized clamps to allow limited pipe movement.
2) Products: Insulated Pipe:

a) Unistrut Fig. P1100 or P2500
b) Eaton Fig. B2000 or B2400
c) Anvil Fig. AS1200
d) nVent USC

C. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

a. Steel Structure Clamps: C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar joists.):

1) Products:

a) Anvil Fig. 86
b) Eaton Fig. B3033/B3034
c) nVent Model 300 & 310

b. Steel Structure Clamps: Scissor Type Beam Clamps (for use with bar-joists and wide flange):

1) Products:

a) Anvil Fig. 228, 292
b) Eaton Fig. B3054
c) nVent Model 360

c. Steel Structure Welding:

1) Unless otherwise noted, hangers, clips, and auxiliary support steel may be welded in lieu of bolting, clamping, or riveting to the building structural frame. Take adequate precautions during all welding operations for fire prevention and protecting walls and ceilings from smoke damage.

2.3 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either the General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.

B. Supports:

1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.

2.4 OPENINGS IN WALLS

A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.

B. Coordinate all openings with other Contractors.

C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.

D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.

E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.5 SLEEVES

A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.

B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.

C. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

2.6 ESCUTCHEON PLATES AND TRIM

A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.

B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.

C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

2.7 PIPE PENETRATIONS

A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.

B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.8 PIPE ANCHORS

A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.

B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.9 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 PLUMBING SUPPORTS AND ANCHORS

A. General Installation Requirements:

1. Install all items per manufacturer's instructions.
2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with Sheet Metal Contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.

B. Supports Requirements:

1. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
2. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
3. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.
2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:

    a. The hanger is attached within 6" from a web/chord joint.
    b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.

H. Steel/Concrete Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

1. Steel (Std. Weight or Heavier - Liquid Service):

a. Maximum Spacing:

1) 1-1/4" & under: 7'-0"
2) 1-1/2": 9'-0"
3) 2": 10'-0"
4) 2-1/2": 11'-0"
5) 3": 12'-0"
6) 4" & larger: 12'-0"

2. Plastic Pipe:

a. Hangers shall be spaced based on the piping system manufacturer's instructions or, if no system instructions are available, space hangers at 4'-0" maximum centers.

I. Installation of hangers shall conform to MSS SP-58, 69, 89 and the applicable Plumbing Code.

END OF SECTION

SECTION 22 05 53 - PLUMBING IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Identification of products installed under Division 22.

1.2 REFERENCES

A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

B. UL 1581 Standard for Electrical Wires, Cables, and Flexible Cords.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

1. 3M
2. Bunting
3. Calpico
4. Craftmark
5. Emedco
6. Kolbi Industries
7. Seton
8. W.H. Brady
9. Marking Services

2.2 MATERIALS

A. All pipe markers shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

OD of Pipe or Insulation	Marker Length	Size of Letters
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
2-1/2" to 6"	12"	1-1/4"
Plastic tags may be used for outside diameters under 3/4"		

B. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.

C. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.

D. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.

E. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.

F. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.

G. Vinyl Pipe Markers: Colored vinyl with permanent pressure sensitive adhesive backing.

H. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape 6" wide by 3.5 mils thick, manufactured for direct burial, with aluminum foil core for location by non-ferric metal detectors and bold lettering identifying buried item.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all products per manufacturer's recommendations.

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Pipe Markers:

1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure sensitive tape completely around the pipe.
2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
3. Apply markers and arrows in the following locations where clearly visible:

    a. At each valve.
    b. On both sides of walls that pipes penetrate.
    c. At least every 20 feet along all pipes.
    d. On each riser and each leg of each "T" joint.
    e. At least once in every room.

4. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.

3.2 SCHEDULE

A. Pipes to be marked shall be labeled with text as follows, regardless of which method or material is used:

1. STORM SEWER (PRIMARY AND SECONDARY): White lettering; green background

END OF SECTION

SECTION 22 07 19 - PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping Insulation.

B. Insulation Jackets.

1.2 QUALITY ASSURANCE

A. Applicator: Company specializing in piping insulation application with five years minimum experience.

B. Materials: Listed and labeled for flame spread/smoke developed rating of no more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

1.3 REFERENCES

A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ASTM E84 - Surface Burning Characteristics of Building Materials.

C. NFPA 255 - Surface Burning Characteristics of Building Materials.

D. UL 723 - Surface Burning Characteristics of Building Materials.

E. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

PART 2 - PRODUCTS

2.1 INSULATION

A. Type A: Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75F; non-combustible. All-purpose polymer or polypropylene service jacket, listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.

B. Type C: Molded rigid cellular glass; ANSI/ASTM C-552; 0.29 maximum 'K' value at 75F; density 7.3lb/ft; minimum compressive strength 90 psi parallel to rise; moisture resistant, non-combustible; suitable for -100F to +900F. For below grade installations, use asphaltic mastic paper vapor barrier jacket. Use self-seal all-purpose polymer or polypropylene service jacket for above grade installations.

2.2 VAPOR BARRIER JACKETS

A. All-purpose polymer or polypropylene service jacket vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

B. Polyvinylidene Chloride (PVDC or Saran) film and tape: Durable and highly moisture and moisture vapor resistant. Please refer to manufacturer's recommended installation guidelines.

2.3 JACKET COVERINGS

A. Plastic Jackets and Fitting Covers: High impact, glossy white, 0.020" thick, self-extinguishing plastic. Suitable for use indoors or outdoors with ultraviolet inhibitors. Suitable for -40F to 150F. Listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.

3.2 INSTALLATION

A. General Installation Requirements:

1. Install materials per manufacturer's instructions, building codes and industry standards.
2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.

B. Insulated Piping Operating Below 60F:

1. Insulate fittings, valves, unions, flanges, strainers, flexible connections, flexible hoses, and expansion joints. Seal all penetrations of vapor barrier.

C. Exposed Piping:

1. Locate and cover seams in least visible locations.
2. Where exposed insulated piping extends above the floor, provide a sheet metal guard around the insulation extending 12" above the floor. Guard shall be 0.016" cylindrical smooth or stucco aluminum and shall fit tightly to the insulation.
3. On exposed piping serving kitchen equipment or plumbing fixtures, the piping shall be insulated unless local code allows it to be uninsulated. In no instance should the uninsulated portion of the piping be more than 4ft in developed length.

3.3 SUPPORT PROTECTION

A. Insulation with pipe size greater than 1-1/2" shall be protected from saggin and crushing by one of the following means.
   1. High Compressive Strength Insert: On all insulated piping greater than 1-1/2", provide shield with insulation insert of same thickness and contour as adjoining insulation at each support, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Inserts shall be as follows:

      a. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a minimum 180-degree cylindrical segment the same length as metal shields. Inserts shall be:
      b. Cellular glass (Type C) (for all temperature ranges) with a minimum compressive strength of 90 psi is acceptable for pipe sizes 14" and below. For pipe sizes larger than 14", provide rolled steel plate in addition to the shield.
      c. Where rolled steel plate is noted above, provide minimum 1/4" (6mm) rolled galvanized steel plates in addition to the shield as reinforcement on large pipes as noted above to reduce point loading on roller, trapeze hanger and strut support locations depending on insulation compressive stength.
   2. Premanufactured Insulation Insert/Shield: As an alternative to separate pipe insulation insert and saddle, properly sized manufactured integral rigid insulation insert and shield assemblies may be used.

      a. Products:

         1) Buckaroo CoolDry

         2) Cooper/B-Line Fig. B3380 through B3384

         3) Pipe Shields A1000, A2000

B. Rectangular blocks, plugs, or wood material are not acceptable.

C. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.

D. Neatly finish insulation at supports, protrusions, and interruptions.

3.4 INSULATION

A. Type A Insulation:

   1. All Service Jackets: Seal all longitudinal joints with self-seal laps using a single pressure sensitive adhesive system. Do not staple.
   2. Insulation without self-seal lap may be used if installed with Benjamin Foster 85-20 or equivalent Chicago Mastic, 3M or Childers lap adhesive.
   3. Apply insulation with laps on top of pipe.
   4. Fittings, Valve Bodies and Flanges: For 4" and smaller pipes, insulate with 1 lb. density insulation wrapped under compression to a thickness equal to the adjacent pipe insulation. For pipes over 4", use mitered segments of pipe insulation. Finish with preformed plastic fitting covers. Secure fitting covers with pressure sensitive tape at each end. Overlap tape at least 2" on itself. For pipes operating below 60F, seal fitting covers with vapor retarder mastic in addition to tape.

B. Type C Insulation:

1. Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner.
2. Insulate fittings with prefabricated fittings.

3.5 JACKET COVER INSTALLATION

A. Plastic Covering:

1. Provide vapor barrier as specified for insulation type. Cover with plastic jacket covering. Position seams to shed water.
2. Solvent weld all joints with manufacturer recommended cement.
3. Overlap all laps and butt joints 1-1/2" minimum. Repair any loose ends that do not seal securely. Solvent weld all fitting covers in the same manner. Final installation shall be watertight.
4. Use plastic insulation covering on all exposed pipes including, but not limited to:

a. All exposed piping in finished spaces unless noted otherwise on the drawings.

3.6 SCHEDULE

A. Refer to drawings for insulation schedule.

END OF SECTION

SECTION 22 10 00 - PLUMBING PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and Pipe Fittings.

B. Valves.

C. Check Valves.

1.2 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.

B. Welding Materials and Procedures: Conform to ASME Code and applicable state labor regulations.

C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.

D. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

1.3 REFERENCES

A. ANSI/ASTM D2466 - PVC Plastic Pipe Fittings, Schedule 40.

B. ANSI/AWWA C111 - Rubber-Gasket Joints for Ductile Iron and Gray Iron Pressure Pipe and Fittings.

C. ANSI/AWWA C153 - Compact Ductile Iron Fittings 3" through 48", for Water and Other Liquids.

D. ASTM A888 - Hubless Cast Iron Soil Pipe and Fittings.

E. ASTM C564 - Rubber Gaskets for Cast Iron Soil Pipe and Fittings.

F. ASTM C1540 - Shielded Couplings Joining Hubless Cast Iron Soil Pipe and Fittings.

G. ASTM D1784 - Standard Specification for Rigid Poly (Vinyl Chloride) (PVC) Compounds and Chlorinated Poly (Vinyl Chloride) (CPVC) Compounds.

H. ASTM D1785 - Polyvinylchloride (PVC) Plastic Pipe, Schedules 40, 80 and 120.

I. ASTM D2321 - Standard Practice for Underground Installation of Thermoplastic Pipe for Sewers and Other Gravity-Flow Applications.

J. ASTM D2661 - ABS DWV Pipe & Fittings.

K. ASTM D2665 - PVC DWV Pipe & Fittings.

L. ASTM D3033 - Type PSP (Polyvinylchloride) (PVC) Sewer Pipe and Fittings.

M. ASTM D3034 - Type PSM (Polyvinylchloride) (PVC) Sewer Pipe and Fittings.

N. ASTM F402 - Standard Practice for Safe Handling of Solvent Cements, Primers, and Cleaners Used for Joining Thermoplastic Pipe and Fittings.

O. ASTM F477 - Elastomeric Seals (Gaskets) for Joining Plastic Pipes.

P. ASTM F656 - Standard Specification for Primers for Use in Solvent Cement Joints of Poly (Vinyl Chloride) (PVC) Plastic Pipe and Fittings

Q. CISPI 301 - Cast Iron Soil Pipe and Fittings for Hubless Cast Iron Sanitary Systems.

R. CISPI 310 - Joints for Hubless Cast Iron Sanitary Systems.

S. FM 1680 - Couplings Used in Hubless Cast Iron Systems.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers with labeling in place.

1.5 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 22 05 00 for required plumbing systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

PART 2 - PRODUCTS

2.1 CAST IRON PIPE

A. Cast Iron; Standard Weight; Hub and Spigot Joints:
1. Pipe: Standard weight hub and spigot cast iron soil pipe, bituminous corrosion protective coating inside and outside, CISPI 301 and CISPI Trademark.
2. Design Pressure: Gravity Maximum Design Temperature: 180°F
3. Joints: Compression gasket, ASTM C564.
4. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 301. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
5. Adapters: Heavy duty no-hub transition for joining cast iron and PVC pipe. Adapters shall be tested and certified to ASTM C 1460 and be constructed with Type 304 stainless steel shield, thickness 0.015" shield, gasket material to meet ASTM C564, 1-1/2" to 4" will be 3" wide with four 304 stainless steel bands, and 6" to 10" will be 4" wide with six 304 stainless steel bands and 3/8" 305 stainless steel hex head screws torqued to 80 inch pounds.

B. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets:

1. Pipe: Standard weight no-hub cast iron soil pipe, bituminous corrosion protective coating inside and outside, CISPI 301 and CISPI Trademark.
2. Design Pressure: Gravity Maximum Design Temperature: 180°F

3. Joints: ASTM C1540, FM 1680, and ASTM C-564.

    a. Super Duty, Shielded Stainless Steel Couplings: Neoprene sleeve gasket, 0.015" thick 304 stainless steel shield , stainless steel 3/8" screw type clamps, minimum of four clamps for 1-1/2" to 4" and six clamps for 5" and larger pipe sizes. Clamps shall be tightened to minimum 80 inch pounds or as manufacturer requires. Husky SD-4000 or equal.

4. Restraints: Install pipe and fittings per the Cast Iron Soil Pipe Institute's Designation 310. Restrain pipe and fittings using an engineered and tested product manufactured for restraining no-hub cast iron soil pipe. Install per manufacturer's recommendations.
5. Adapters: Transition from cast iron soil pipe to other pipe materials with manufactured adapters specifically for the application. Adapter must meet the same requirements as the joints listed above. ASTM C1460. Sticker identifying transition fitting application must be visible to view. For example, the most commonly used transition fitting from cast iron no-hub to PVC would be the Husky SD-4200 series.

2.2 PLASTIC PIPE

A. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints:

1. Pipe: Schedule 40 rigid, PVC-DWV, or ABS-DWV, cell classification 12454 for PVC per ASTM D1784 or 42222 for ABS per ASTM D3965, with plain ends, conforming to ASTM Standards D2665 or D2661. Cellular core piping is not acceptable.
2. Design Pressure/Temperature: Gravity at 140°F.
3. Joints: Solvent-weld socket type with solvent recommended by pipe manufacturer.
4. Fittings: PVC-DWV, or ABS-DWV, cell classification 12454 for PVC per ASTM D1784 or 42222 for ABS per ASTM D3965, with solvent-weld socket type ends for Schedule 40 pipe.
5. Limits: Schedule 40 PVC-DWV, or ABS-DWV pipe must not be threaded. Do not use where exposed or in return air plenums.
6. Use: Use PVC or ABS only where allowed by local jurisdiction. Comply with all special requirements or limitations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Install all products per manufacturer's recommendations.

B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

C. Remove scale and dirt, on inside and outside, before assembly.

D. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.

E. Connect to equipment with flanges or unions. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

F. Use only piping materials rated for the maximum temperature of the application, e.g., do not use PVC for dishwasher drainage or piping that receives boiler blowdown.

G. Existing building sewers or building drains which are shown on the documents to be reused shall be inspected and recorded by closed circuit television for their condition. Report findings back to the Architect, Engineer, and Owner before proceeding with work so any necessary rework can take place if needed.

3.2 SYSTEM, PIPING AND VALVE SCHEDULE

A. Storm Drainage:

1. Cast Iron; Standard Weight; Hub and Spigot Joints: All Sizes
2. Cast Iron; Standard Weight; No-Hub Sleeve Gaskets: 1-1/2" to 15"
3. PVC-DWV or ABS-DWV; Schedule 40; Solvent Weld Joints: All Sizes

3.3 TESTING PIPING

A. Storm Drainage:

1. Test all piping with water to prove tight.
2. Test piping before insulation is applied.
3. Hydrostatically test all soil, waste, and vent piping inside of building with 10 feet head of water for 15 minutes. Inspect before fixtures are connected. If leaks appear, repair them and repeat the test.
4. Hydrostatically test interior downspouts with 10 feet head of water for 15 minutes with no leaks.
5. Test force mains with water at 105% of the operating pump discharge pressure for 15 minutes.
6. Test pressures stated above shall be as listed or as required by the Authority Having Jurisdiction, whichever is most stringent.

3.4 CLEANING PIPING

A. Assembly:

1. Before assembling pipe systems, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer's representative. Blow chips and burrs from machinery or thread cutting operation out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing.
3. Notify the Architect/Engineer's representative before starting any post erection cleaning in sufficient time to allow witnessing the operation. Consult with and obtain approval from the Architect/Engineer's representative regarding specific procedures and scheduling. Dispose of cleaning and flushing fluids properly.
4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, and be certain all strainer screens are in place.

3.5 INSTALLATION

A. General Installation Requirements:

1. Provide dielectric connections between dissimilar metals.
2. Route piping in orderly manner and maintain gradient. Install to conserve building space.
3. Group piping whenever practical at common elevations.

4. Install piping to allow for expansion and contraction without stressing pipe, joints, or equipment.
5. Slope water piping and arrange to drain at low points.
6. Install bell and spigot piping with bells upstream.
7. Where pipe supports are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

B. Underground Piping:

1. Refer to Section 22 05 00 for Excavation, Fill, Backfill and Compaction requirements
2. Exercise care in handling, storing and laying pipe to avoid damaging factory applied coatings. If any damage occurs, repair the coating to a condition equal to the original.
3. Field application of protective coatings to joints, fittings and to any damaged factory applied coatings shall be similar to factory applied coatings specified above and shall be done in strict accordance with recommendations of the supplier of pipe coatings.
4. After completion of the fabrication, laying and field coating of the joints and fittings, but prior to backfilling, inspect the entire line in the presence of the Architect/Engineer's representative with an electronic holiday detector. Any defects in the protective coatings shall be repaired in accordance with requirements for original coatings.
5. Coat flange bolts and nuts in pits and below ground at the time of installation with a corrosion protective coating.

C. Storm Piping:

1. Install all storm piping inside the building with a slope as shown on the drawings.
2. Install horizontal offset at all connections to roof drains to allow for pipe expansion.
3. Slope storm piping outside the building to meet invert elevations shown on drawings and to maintain a minimum velocity of 2 feet per second.
4. All storm piping shall have at least 42" of cover when leaving the building.
5. Starter fittings with internal baffles are not permitted.

3.6 PIPE ERECTION AND LAYING

A. Carefully inspect all pipe, fittings, valves, equipment and accessories before installation. Any items that are unsuitable, cracked or otherwise defective shall be removed from the job immediately.

B. All pipe, fittings, valves, equipment and accessories shall have factory applied markings, stampings, or nameplates with sufficient data to determine their conformance with specified requirements.

C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not install any item that is not clean.

D. Until system is fully operational, all openings in piping and equipment shall be kept closed except when actual work is being performed on that item or system. Closures shall be plugs, caps, blind flanges or other items specifically designed and intended for this purpose.

E. Run pipes straight and true, parallel to building lines with minimum use of offsets and couplings. Provide only offsets required to provide needed headroom or clearance and to provide needed flexibility in pipe lines.

F. Make changes in direction of pipes only with fittings or pipe bends. Changes in size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be of the long radius type, unless otherwise shown on the drawings or specified.

G. Provide flanges or unions at all final connections to equipment, traps and valves.

H. Arrange piping and connections so equipment served may be totally removed without disturbing piping beyond final connections and associated shutoff valves.

I. Use full and double lengths of pipe wherever possible.

J. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.

K. Underground pipe shall be laid in dry trenches maintained free of accumulated water. Refer to Section 22 05 00 for Excavation, Fill, Backfill and Compaction requirements.

3.7 JOINING OF PIPE

A. Hub and Spigot Joints - Sanitary Pipe:

1. Compression Gasket Joints: Joint shall be one-piece double seal compression type gasket made specifically for joining cast iron soil pipe. Gasket shall be neoprene, permitting joint to flex as much as 5 degrees without loss of seal. Gasket shall be extra heavy weight class, conforming to ASTM C-564.

B. Solvent Weld Joints (PVC):

1. Make joints with a two-step process. Use primer conforming to ASTM F656 and solvent cement conforming to ASTM D2564.
2. All contractor personnel that will prepare solvent cemented joints shall be qualified for such bonding practices according to the bonding qualifications procedures described in ASME B31.3, Chapter VII for bonding of plastic piping.

C. No-Hub Sleeve Gaskets (No-Hub) (Cast Iron Pipe):

1. Gasket shall be heavy weight class, conforming to ASTM C564.
2. The gasket shall have an internal center stop.
3. The gasket shall be covered by a stainless steel band secured with a minimum of four stainless steel bands per fitting/joint.
4. Sleeve gaskets shall be installed in accordance with the manufacturer's installation instructions.

D. Couplings: Assemblies with combinations of clamps, gaskets, sleeves, and threaded or flanged parts; compatible with piping and system liquid; and made by piping manufacturer for joining system piping.

E. Adapters and Transition Fittings: Assemblies with combinations of clamps, couplings, adapters, gaskets, and threaded or flanged parts; compatible with piping and system liquid; and made for joining different piping materials.

F. Flanges: Assemblies of companion flanges and gaskets complying with ASME B16.21 and compatible with system liquid, and bolts and nuts.

END OF SECTION

SECTION 22 10 30 - PLUMBING SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Cleanouts.

B. Roof Drains.

1.2 QUALITY ASSURANCE

A. Manufacturer: For each product specified, provide components by same manufacturer throughout.

B. Piping, Fittings, Valves, and Flux for Potable Water Systems: All components shall be lead free per Federal Act S.3874, Reduction of Lead in Drinking Water Act.

1.3 REFERENCES

A. ANSI A112.21.2 - Roof Drains.

B. ANSI A112.6.4 - Roof, Deck, and Balcony Drains; The American Society of Mechanical Engineers.

1.4 SUBMITTALS

A. Submit shop drawings under provisions of Section 22 05 00.

B. Include sizes, rough-in requirements, service sizes, and finishes.

PART 2 - PRODUCTS

2.1 CLEANOUTS

A. Provide cleanouts as shown and specified on the drawings as well as required by code.

B. Coordinate floor cleanout cover with surrounding floor finish. Provide either solid, recessed for tile or terrazzo or carpet marker as applicable.

C. Cleanouts on exposed pipes shall be cast iron with heavy duty cast brass plug with raised head.

D. Cleanout shall be same size as the pipe up to 6" and 6" for larger pipes.

2.2 YARD CLEANOUTS

A. Provide yard cleanouts as shown and specified on the drawings as well as required by code.

B. Cleanout shall be same size as pipe up to 6" and 6" for larger pipes.

2.3 ROOF DRAINS

A. Provide roof drains as shown and specified on the drawings as well as required by code.

PART 3 - EXECUTION

3.1 INSTALLATION AND APPLICATION

A. Coordinate construction to receive drains at required invert elevations.

B. Install all items per manufacturer's instructions.

C. Cleanouts:
1. Provide cleanouts where shown on the drawings and as required by code, but in no case farther apart than 50 feet in pipe less than 6" size and 100 feet apart in 6" and larger pipes inside the building. Provide cleanouts at bases of all storm risers as shown on the drawings and as required by code.
2. Provide a cleanout at the upstream end of a horizontal waste pipe in a plumbing chase serving multiple plumbing fixtures; for example a bank of water closets or lavatories.
3. Extend underfloor cleanouts up to the floor with long sweep elbows.
4. Install a full size, two-way cleanout within 5 feet of the foundation inside or outside of building.
5. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with graphite and linseed oil. Ensure clearance at cleanouts for rodding of drainage system.
6. Wall cleanouts shall be installed above the flow line of the pipe they serve, but no less than 12" above the finished floor.

D. Yard Cleanouts:

1. Install cleanouts on maximum 90 foot centers (including riser) for pipes 8" and smaller.
2. Extend cleanout to grade. Encase cleanout in 5" thick concrete pad extending 6" beyond cleanout, set low enough not to interfere with lawn mowers.

E. Roof Drains:

1. Roof drains shall have bearing pans.
2. Provide auxiliary support steel under drains as required to prevent movement of the drain.
3. All roof drains shall have underdeck clamps or a manufacturer provided attachment method for the specific roof style the drain is installed in.
4. Drains in built-up roofing systems shall have a 36" x 36" flashing.

END OF SECTION

SECTION 23 05 00 - BASIC HVAC REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 23 Sections. Also refer to Division 01 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

A. This Specification and the associated drawings govern the furnishing, installing, testing and placing into satisfactory operation the Mechanical Systems.

B. Each Contractor shall provide all new materials indicated on the drawings and/or in these specifications, and all items required to make the portion of the Mechanical Work a finished and working system.

1.3 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    d. Maintenance clearances and code-required dedicated space shall be included.
    e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

    a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

    a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1'-0" (minimum).
        2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1'-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.

4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
    b. Potential layout changes shall be made to avoid additional access panels.
    c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
    d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
    e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.4 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guidelines, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Design Team any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receiving instructions from the Design Team will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers are acceptable.
2. All Contractors and subcontractors shall employ only workers skilled in their trades.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of McHenry Codes, Laws, Ordinances, and other regulations having jurisdiction.
2. Conform to all State Codes.
3. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
4. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
5. All changes to the system made after letting of the contract, to comply with codes or requirements of Inspectors, shall be made by the Contractor without cost to the Owner.
6. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
7. All rotating shafts and/or equipment shall be completely guarded from all contact. Partial guards and/or guards that do not meet all applicable OSHA standards are not acceptable. Contractor is responsible for providing this guarding if it is not provided with the equipment supplied.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by the State, Municipal, and/or other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.

6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be approved or listed by Underwriter's Laboratories, Inc.

E. Examination of Drawings:

1. The drawings for the mechanical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of pipes and ducts to best fit the layout of the job.
3. Scaling of the drawings is not sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as fittings, boxes, valves, unions, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either on the drawings or in the specifications, it shall be included in this contract.
7. Determination of quantities of material and equipment required shall be made by the Contractor from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater number shall govern.
8. Where used in mechanical documents, the word "furnish" shall mean supply for use, the word "install" shall mean connect complete and ready for operation, and the word "provide" shall mean to supply for use and connect complete and ready for operation.

    a. Any item listed as furnished shall also be installed, unless otherwise noted.
    b. Any item listed as installed shall also be furnished, unless otherwise noted.

F. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any materials or fabricating any supports, pipes or ducts.

G. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.

8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

1.5 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals List:

Referenced Specification Section	Submittal Item
23 05 93	Testing, Adjusting, and Balancing
23 09 00	Controls
23 31 00	Ductwork
23 33 00	Ductwork Accessories
23 34 23	Power Ventilators
23 37 00	Grilles, Registers, and Diffusers
23 74 16.12	Packaged Rooftop Air Conditioning Units - 25T and Below
23 82 00	Terminal Heat Transfer Equipment

B. General Submittal Procedures: In addition to the provisions of Division 01, the following are required:

1. Transmittal: Each transmittal shall include the following:

a. Date
b. Project title and number
c. Contractor's name and address
d. Division of work (e.g., plumbing, heating, ventilating, etc.)
e. Description of items submitted and relevant specification number
f. Notations of deviations from the contract documents
g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

a. Date
b. Project title and number
c. Architect/Engineer
d. Contractor and subcontractors' names and addresses
e. Supplier and manufacturer's names and addresses
f. Division of work (e.g., plumbing, heating, ventilating, etc.)
g. Description of item submitted (using project nomenclature) and relevant specification number
h. Notations of deviations from the contract documents
i. Other pertinent data
j. Provide space for Contractor's review stamps

3. Composition:

a. Submittals shall be submitted using specification sections and the project nomenclature for each item.

b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; electrical power criteria (e.g., voltage, phase, amps, horsepower, kW, etc.) wiring and control diagrams; Short Circuit Current Rating (SCCR); dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.
    c. The Contractor's review shall include, but not be limited to, verification of the following:

        1) Only approved manufacturers are used.
        2) Addenda items have been incorporated.
        3) Catalog numbers and options match those specified.
        4) Performance data matches that specified.
        5) Electrical characteristics and loads match those specified.
        6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
        7) Dimensions and service clearances are suitable for the intended location.
        8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
        9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

    d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
    e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

    a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
    b. The Contractor shall clearly indicate the size, finish, material, etc.
    c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
    d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions. or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 23 XX XX.description.YYYYMMDD
    b. Transmittal file name: 23 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.6 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.7 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage. Keep materials clean, dry and free from harmful conditions. Immediately remove any materials that become wet or that are suspected of becoming contaminated with mold or other organisms.

B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:

1. Motor windings and ventilation openings.
2. Bearings.
3. Equipment Duct and Accessories connections openings. (e.g. AHU/RTU duct connections; Terminal Air Boxes, etc.)
4. Starter and control cabinets.

C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.

D. Keep all bearings properly lubricated and all belts properly tensioned and aligned.

E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Mechanical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.8 WARRANTY

A. Provide one-year warranty, unless otherwise noted, to the Owner for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this Division of the specifications shall commence on the date of final acceptance, unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements shall extend to correction, without cost to the Owner, of all Work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from defects or nonconformance with contract documents.

1.9 INSURANCE

A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.10 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the scheduled manufacturer is the basis for job design and establishes the quality required.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections, piping and ductwork connections and arrangement, plumbing connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer not later than ten days prior to the bid opening.

D. This Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

E. This Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder.

F. All material substitutions requested later than ten (10) days prior to bid opening must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found at the following website (https://call811.com/) or by calling 811.
2. The Contractor shall do all excavating, filling, backfilling and compacting associated with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. Where excavations are made in error below foundations, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer, shall be placed in such excess excavations. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment, or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workers.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. Where satisfactory bearing soil for foundations is not found at the indicated levels, the Architect/Engineer or their representative shall be notified immediately, and no further work shall be done until further instructions are given by the Architect/Engineer or their representative.

C. Dewatering:

1. Contractor shall furnish, install, operate, and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Use great care in making installations near underground obstruction.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. Utilities Bedding: Lay underground utilities on minimum of 6"sand bedding or CA6 crushed stone. Compact bedding under utilities smooth, with no sharp edges protruding, to protect the utilities from puncture. Shape bedding to provide continuous support for bells, joints, and barrels of utilities and for joints and fittings.
2. Envelope Around Utilities to 6" Above Utilities: Place sand or CA6 crushed stone or flowable fill to a height of 6" over utilities in 6" layers. After connection joints are made, any misalignment can be corrected by tamping backfill around the utilities.
3. Backfill From 6" Above Utilities to Earthen Grade: Place all backfill materials above the utilities in uniform layers not exceeding 6" deep.
4. Backfill From 6" Above Utilities to Below Slabs or Paved Area: Where the sand or CA6 crushed stone fill and backfill will ultimately be under a building, floor or paving, each layer of backfill materials shall be compacted to 95% of the maximum density determined by AASHTO Designation T 99 or ASTM Designation D 698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content determined by AASHTO T 99 or ASTM D 698 test.
5. Backfill Materials:

    a. Sand, CA6: Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    b. Native Soil: Native soil materials may be used as backfill if approved by the Geotechnical Engineer. Native soils shall be free of rock or gravel larger than 3" in any dimension and shall be free of debris, waste, frozen materials, vegetation, high void content, and other deleterious materials. Each layer shall be placed, then carefully and uniformly tamped, to eliminate lateral or vertical displacement.
    c. Flowable Fill: Cementitious, self-leveling, self-compacting slurry as defined by the ACI with compressive strength of 50-100psi at 28 days; consisting of a mixture of fine aggregate or filler, water and cementitious materials. Filler material consist of sand, fly ash, spent foundry sand, quarry fines, baghouse dust. Cementitious materials consist of Portland cement, pozzolanic materials, and self-cementing materials. Flowable fill may be placed in a pour instead of 6" layers noted above.

6. Water shall not be permitted to rise in unbackfilled trenches.
7. Dispose of excess excavated earth as directed.
8. Backfill all trenches and excavations immediately after installing utilities or removal of forms, unless other protection is provided.
9. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Fill and backfill materials shall be spread in 6 inch uniform horizontal layers with each layer compacted separately to required density.

F. Surface Restoration:

1. Where trenches are cut through existing graded, planted, or landscaped areas, the areas shall be restored to the original condition. Replace all planting removed or damaged to its original condition. A minimum of 6 inches of topsoil shall be applied where disturbed areas are to be seeded or sodded.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The Contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will have the opportunity to review the installation and provide a written report noting deficiencies requiring correction. The Contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

a. Pipe insulation is installed and fully sealed.
b. Pipe and duct wall penetrations are sealed.
c. Pipe identification and valve tags are installed.
d. Main, branch and flexible ducts are installed.
e. Diffusers, registers and grilles are installed and connected to ductwork.

2. In order to prevent the Above-Ceiling Final Observation from occurring too early, the Contractor shall review the status of the work and certify, in writing, that the work is ready for the Above-Ceiling Final Observation.
3. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to 7 days elapsing, the Architect/Engineer may not recommend further payments to the contractor until such time as full access has been provided.

3.4 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 01.

B. Final Jobsite Observation:

1. In order to prevent the Final Jobsite Observation from occurring too early, the Contractor is required to review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review.
3. Upon Contractor certification that the project is complete and ready for a final observation, the Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.

4. It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineer's additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

C. Before final payment is authorized, this Contractor must submit the following:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including reproducible drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representatives.
4. Start-up reports on all equipment requiring a factory installation inspection or start-up.
5. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site and place in location as directed; receipt by Architect/Engineer required prior to final payment approval.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div23.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div23.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.

8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Refer to Section 23 09 00 for additional requirements for Temperature Control submittals.
5. Copy of final approved test and balance reports.
6. Copies of all factory inspections and/or equipment startup reports.
7. Copies of warranties.
8. Schematic electrical power/controls wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
9. Dimensional drawings of equipment.
10. Capacities and utility consumption of equipment.
11. Detailed parts lists with lists of suppliers.
12. Operating procedures for each system.
13. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
14. Repair procedures for major components.
15. List of lubricants in all equipment and recommended frequency of lubrication.
16. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVES

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of all systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

D. The instructions shall include:

1. Explanation of all air handling systems.
2. Temperature control system operation including calibration, adjustment and proper operating conditions of all sensors.
3. Maintenance of equipment.
4. Start-up procedures for all major equipment.

E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can attend if desired.

F. Minimum hours of instruction for each item shall be:

1. Air Handling System(s) - 2 hours.
2. Temperature Controls - As defined in Section 23 09 00.

G. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the mechanical and control systems.
2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM STARTING AND ADJUSTING

A. The mechanical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes calibration and adjustments of all controls, noise level adjustments, and final comfort adjustments as required.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper motor rotation, electrical power voltage is within equipment limitations, equipment controls maintain pressures and temperatures within acceptable ranges, all filters and protective guards are in-place, acceptable access is provided for maintenance and servicing, and equipment operation does not pose a danger to personnel or property.

C. Operate all HVAC systems continuously for at least one week prior to occupancy to bring construction materials to suitable moisture levels. Areas with mechanical cooling shall be maintained below 60% RH.

D. Contractor shall adjust the mechanical systems and controls at seasonal changes during the one-year warranty period, as required, to provide satisfactory operation and to prove performance of all systems in all seasons.

E. All operating conditions and control sequences shall be tested during the start-up period. Test all interlocks, safety shutdowns, controls, and alarms.

F. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

A. The following paragraphs supplement Division 01 requirements.

B. Maintain at the job site a separate and complete set of mechanical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings to indicate revisions to piping and ductwork, size and location, both exterior and interior; including locations of coils, dampers, other control devices, filters, and other units requiring periodic maintenance or repair; actual equipment locations, dimensioned from column lines; actual inverts and locations of underground piping; concealed equipment, dimensioned from column lines; mains and branches of piping systems, with valves and control devices located and numbered, concealed unions located, and with items requiring maintenance located (e.g., traps, strainers, expansion compensators, tanks, etc.); Change Orders; concealed control system devices.

D. Refer to Section 23 09 00 for additional requirements for Temperature Control documents.

E. Before completion of the project, a set of reproducible mechanical drawings will be given to the Contractor for transfer of all as-built conditions from the paper set maintained at the job site. All marks on reproducibles shall be clear and permanent.

F. Mark specifications to show approved substitutions; Change Orders, and actual equipment and materials used.

G. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

H. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

3.9 PAINTING

A. This Contractor shall paint the following items:
   1. Exposed ductwork

B. Paint all outdoor exposed natural gas piping the color selected by Owner or Architect/Engineer.

3.10 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project. Clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from all equipment.

B. Clean all drain pans and areas where moisture is present. Immediately report any mold, biological growth, or water damage.

C. Remove all rust, scale, dirt, oils, stickers and thoroughly clean exterior of all exposed bare metal ductwork, piping, hangers, and accessories.

D. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.11 SPECIAL REQUIREMENTS

A. Contractor shall coordinate the installation of all equipment, valves, dampers, operators, etc., with other trades to maintain clear access area for servicing.

B. All equipment shall be installed in such a way to maximize access to parts needing service or maintenance. Review the final field location, placement, and orientation of equipment with the Owner's designated representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's designated representative will result in removal and reinstallation of the equipment at the Contractor's expense.

3.12 MAINTAINING CLEAN DUCTWORK THROUGHOUT CONSTRUCTION

A. Throughout the duration of construction, all ductwork shall be capped or sealed with sheet metal caps, polyethylene film, or other airtight protective to keep dust, dirt, and construction debris out of ducts. Similar means shall be used to seal air-side connections of HVAC equipment to include, but not limited to, air handling units, fans, terminal air boxes, fan coil units, cabinet heaters, blower coils, and the like.

B. When air terminal devices are installed, contractors shall seal all supply, return, and exhaust grilles with polyethylene film or other airtight protective to keep dust, dirt, and construction debris out of ducts.

C. Should HVAC equipment be started during construction, Contractor shall remove airtight protectives and shall install one-inch thick MERV 8 filter media over all return and exhaust grilles to prevent dust, dirt, and construction debris from entering ductwork. Filter media shall cover the entire grille face and shall be secured such that air cannot bypass filter media.

D. Should filter media become laden with dust and dirt, Contractor shall replace filter media with new media to prevent damage to air distribution system and equipment.

E. The following steps shall be taken during testing, adjusting, and balancing of each air system:

1. All construction activities in all spaces served by the air system shall stop.
2. All airtight protectives and temporary filter media shall be removed from all portions of the air system.
3. Testing, adjusting, and balancing work shall not commence until all construction activity is stopped and all airtight protectives and temporary filter media is removed.
4. Once testing, adjusting, and balancing work is complete for the air system, airtight protectives or temporary filter media shall be installed over all ductwork openings and air terminals on the air system prior to resuming construction activities in any spaces served by the air system.

The Owner shall agree the building is sufficiently clean prior to the removal of any filtration media and airtight protectives from air terminal devices.

READINESS CERTIFICATION PRIOR TO FINAL JOBSITE OBSERVATION

To prevent the final job observation from occurring too early, we require that the Contractor review the completion status of the project and, by copy of this document, certify that the job is indeed ready for the final job observation. The following is a typical list of items that represent the degree of job completeness expected prior to your requesting a final job observation.

1. Penetrations fire sealed and labeled in accordance with specifications.
2. All air handling units operating and balanced.
3. All miscellaneous mechanical systems (unit heaters, fan coil units, cabinet heaters, etc.) operating.
4. All temperature control systems operating, programmed and calibrated.
5. Fire damper and fire/smoke damper access doors labeled in accordance with specifications.

Accepted by:

Prime Contractor _____

By _____ Date _____

Upon Contractor certification that the project is complete and ready for a final job observation, we require the Contractor to sign this agreement and return it to the Architect/Engineer so that the final observation can be scheduled.

It is understood that if the Architect/Engineer finds the job not ready for the final observation and that additional trips and observations are required to bring the project to completion, the costs incurred by the Architect/Engineers for additional time and expenses will be deducted from the Contractor's contract retainage prior to final payment at the completion of the job.

END OF SECTION

SECTION 23 05 03 - THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 - Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. The Building Officials and Code Administrators National Building Code

J. 1997 Uniform Building Code

K. 2021 International Building Code

L. NFPA 5000 - Building Construction Safety Code

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

1.5 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.6 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division.
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk.
4. Tremco; Sealant/Weatherproofing Division.
5. Johns-Manville.
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products

8. AD Firebarrier Protection Systems
9. Dow Corning Corp.
10. Fire Trak Corp.
11. International Protective Coating Corp.
12. HoldRite

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.

E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

F. Provide firestopping systems allowing continuous insulation for all insulated pipes.

G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

a. F Rating = Floor/Wall Rating

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

a. F Rating = Wall Rating

H. Any opening in walls not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

END OF SECTION

SECTION 23 05 05 - HVAC DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Mechanical demolition.

B. Cutting and Patching.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The drawings are intended to indicate the general scope of work and do not show every pipe, duct, or piece of equipment that must be removed. The contractor shall visit the site and verify conditions prior to submitting a bid.

B. Where walls, ceilings, etc., are shown as being removed on general drawings, the Contractor shall remove all mechanical equipment, devices, fixtures, piping, ducts, systems, etc., from the removed area.

C. Where ceilings, walls, partitions, etc., are temporarily removed and replaced by others, This Contractor shall remove, store, and replace equipment, devices, fixtures, pipes, ducts, systems, etc.

D. Verify that abandoned utilities serve only abandoned equipment or facilities. Extend services to facilities or equipment that shall remain in operation following demolition.

E. Coordinate work with all other Contractors and the Owner. Schedule removal of equipment to avoid conflicts.

F. This Contractor shall verify all existing equipment sizes and capacities where equipment is scheduled to be replaced or modified, prior to ordering new equipment.

G. Bid submittal shall mean the Contractor has visited the project site and verified existing conditions and scope of work.

3.2 PREPARATION

A. Disconnect mechanical systems in walls, floors, and ceilings scheduled for removal.

B. Provide temporary connections to maintain existing systems in service during construction. When work must be performed on operating equipment, use personnel experienced in such operations.

C. Existing Heating System: Maintain existing system in service until new system is complete and ready for service. Drain system only to make switchovers and connections. Obtain permission from the Owner at least 48 hours before partially or completely draining system. Minimize outage duration.

3.3 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

A. Demolish and extend existing mechanical work under provisions of Division 2 and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned ducts and piping to source of supply and/or main lines.

D. Remove exposed abandoned pipes and ducts, including abandoned pipes and ducts above accessible ceilings. Cut ducts flush with walls and floors, cap duct that remains, and patch surfaces. Cut pipes above ceilings, below floors and behind walls. Cap remaining lines. Repair building construction to match original. Remove all clamps, hangers, supports, etc. associated with pipe and duct removal.

E. Disconnect and remove mechanical devices and equipment serving equipment that has been removed.

F. Repair adjacent construction and finishes damaged during demolition and extension work.

G. Maintain access to existing mechanical installations which remain. Modify installation or provide access panels as appropriate.

H. Remove unused sections of supply and return air ductwork back to mains. Patch opening with sheet metal and seal airtight. Patch existing insulation to match existing. Where existing ductwork is to be capped and reused, locate the end cap within 6" of the last branch. End caps shall be 3" pressure class and seal class "A".

I. Extend existing installations using materials and methods compatible with existing installations, or as specified.

3.4 CUTTING AND PATCHING

A. This Contractor is responsible for all penetrations of existing construction required to complete the work of this project. Refer to Section 23 05 29 for additional requirements.

B. Penetrations in existing construction should be reviewed carefully prior to proceeding with any work.

C. Penetrations shall be neat and clean with smooth and/or finished edges. Core drill where possible for clean opening.

D. Repair existing construction as required after penetration is complete to restore to original condition. Use similar materials and match adjacent construction unless otherwise noted or agreed to by the Architect/Engineer prior to start of work.

E. This Contractor is responsible for all costs incurred in repair, relocation, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.5 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or are to be reused.

B. Clean all systems adjacent to project that are affected by the dust and debris caused by this construction.

C. Mechanical items removed and not relocated remain the property of the owner. Contractor shall place items retained by the owner in a location coordinated with the owner. The contractor shall dispose of material that the owner does not want to reuse or retain for maintenance purposes.

3.6 SPECIAL REQUIREMENTS

A. Install temporary filter media over outside air intakes which are within 100 feet of the limits of construction or as noted on the drawings. This Contractor shall complete any cleaning required for existing systems that are affected by construction dust and debris.

B. Review locations of all new penetrations in existing floor slabs or walls. Determine construction type and review for possible interferences. Bring all concerns to the attention of the Architect/Engineer before proceeding.

END OF SECTION

SECTION 23 05 29 - HVAC SUPPORTS AND ANCHORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Hangers, Supports, and Associated Anchors.

B. Equipment Bases and Supports.

C. Sleeves and Seals.

D. Flashing and Sealing of Equipment and Pipe Stacks.

E. Cutting of Openings.

F. Escutcheon Plates and Trim.

1.2 REFERENCES

A. ANSI/ASME B31.1 - Power Piping.

B. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation.

C. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.

D. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

1.3 WORK FURNISHED BUT INSTALLED UNDER OTHER SECTIONS

A. Furnish sleeves and hanger inserts to General Contractor for placement into formwork.

PART 2 - PRODUCTS

2.1 HANGER RODS

A. Hanger rods for single rod hangers shall conform to the following:
   1. Steel Pipe:
      a. Hanger Rod Diameter:
         1) 2-1/2" and smaller: 3/8"
         2) 3" through 3-5/8": 3/8"
   2. Copper Pipe:
      a. Hanger Rod Diameter:
         1) 2-1/2" and smaller: 3/8"
         2) 3" through 3-5/8": 3/8"

B. Rods for double rod hangers may be reduced one size. Minimum rod diameter is 3/8 inches.

C. Hanger rods and accessories used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.

2.2 PIPE AND STRUCTURAL SUPPORTS

A. General:

1. Pipe hangers, clamps, and supports shall conform to Manufacturers Standardization Society MSS SP-58, 69, 89, and 127 (where applicable).
2. On all insulated piping, provide at each support an insert of same thickness and contour as adjoining insulation, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Refer to insulation specifications for materials and additional information.

B. Hangers and Clamps:

1. Oversize all hangers, clamps, and supports on insulated piping to allow insulation and jacket to pass through unbroken. This applies to both hot and cold pipes.
2. On all insulated piping, provide a semi-cylindrical metallic shield and vapor barrier jacket.
3. Unless otherwise indicated, hangers shall be as follows:

a. Clevis Type: Service: Bare Metal Pipe, Insulated Hot Pipe - 3 inches and Smaller:

1) Products: Bare Steel or Insulated Pipe:

a) Anvil Fig. 260
b) Eaton Fig. 3100
c) nVent Model 400

b. Adjustable Swivel Ring Type: Service: Bare Metal Pipe - 4 inches and Smaller:

1) Products: Bare Steel Pipe:

a) Anvil Fig. 69
b) Eaton Fig. B3170NF
c) nVent Model 115

4. Support may be fabricated from U-channel strut or similar shapes. Piping less than 4" in diameter shall be secured to strut with clamps of proper design and capacity as required to maintain spacing and alignment. Strut shall be independently supported from hanger drops or building structure. Size and support shall be per manufacturer's installation requirements for structural support of piping. Clamps shall not interrupt piping insulation.

a. Strut used in mechanical spaces or otherwise dry areas shall have ASTM B633 electro-plated zinc finish.
b. Strut used in damp areas listed in hanger rods shall have ASTM A123 hot-dip galvanized finish applied after fabrication.

5. Unless otherwise indicated, pipe supports for use with struts shall be as follows:

a. Clamp Type: Service: Bare Metal Pipe, Rigid Plastic Pipe, Insulated Cold Pipe, Insulated Hot Pipe - 3 inches and smaller:

1) Pipes subject to expansion and contraction shall have oversized clamps to allow limited pipe movement.
2) Products: Bare Steel, Plastic, or Insulated Pipe:

a) Unistrut Fig. P1100 or P2500
b) Eaton Fig. B2000 or B2400
c) Anvil Fig. AS1200
d) nVent USC

3) Products: Bare Copper Pipe:

a) Eaton Fig. BVT
b) nVent CADDY Cushion Clamp

C. Upper (Structural) Attachments:

1. Unless otherwise shown, upper attachments for hanger rods or support struts shall be as follows:

a. Steel Structure Clamps: C-Type Wide Flange Beam Clamps (for use on top and/or bottom of wide flanges. Not permitted for use with bar joists.):

1) Products:

a) Anvil Fig. 86
b) Eaton Fig. B3033/B3034
c) nVent Model 300 & 310

b. Scissor Type Beam Clamps (for use with bar joists and wide flange):

1) Products:

a) Anvil Fig. 228, 292
b) Eaton Fig. B3054
c) nVent Model 360

c. Concentrically Loaded Open Web Joist Hangers (for use with bar joists):

1) Products:

a) MCL. M1, M2 or M3

2.3 FOUNDATIONS, BASES, AND SUPPORTS

A. Basic Requirements:

1. Furnish and install foundations, bases, and supports (not specifically indicated on the Drawings or in the Specifications of either General Construction or Mechanical work as provided by another Contractor) for mechanical equipment.
2. All concrete foundations, bases and supports, shall be reinforced. All steel bases and supports shall receive a prime coat of zinc chromate or red metal primer. After completion of work, give steel supports a final coat of gray enamel.

B. Supports:

1. Provide sufficient clips, inserts, hangers, racks, rods, and auxiliary steel to securely support all suspended material, equipment and conduit without sag.
2. Hang heavy equipment from concrete floors or ceilings with Architect/Engineer-approved concrete inserts, furnished and installed by the Contractor whose work requires them, except where indicated otherwise.

2.4 OPENINGS IN FLOORS, WALLS AND CEILINGS

A. Exact locations of all openings for the installation of materials shall be determined by the Contractor and given to the General Contractor for installation or construction as the structure is built.

B. Coordinate all openings with other Contractors.

C. Hire the proper tradesman and furnish all labor, material and equipment to cut openings in or through existing structures, or openings in new structures that were not installed, or additional openings. Repair all spalling and damage to the satisfaction of the Architect/Engineer. Make saw cuts before breaking out concrete to ensure even and uniform opening edges.

D. Said cutting shall be at the complete expense of each Contractor. Failure to coordinate openings with other Contractors shall not exempt the Contractor from providing openings at Contractor's expense.

E. Do not cut structural members without written approval of the Architect or Structural Engineer.

2.5 SLEEVES AND LINTELS

A. Each Contractor shall provide sleeves and lintels for all duct and pipe openings required for the Contractor's work in masonry walls and floors, unless specifically shown as being by others.

B. Fabricate all sleeves from standard weight black steel pipe or as indicated on the drawings. Provide continuous sleeve. Cut or split sleeves are not acceptable.

C. Openings through unexcavated floors and/or foundation walls below the floor shall have a smooth finish with sufficient annular space around material passing through opening so slight settling will not place stress on the material or building structure.

D. Where pipes rise through concrete floors that are on earthen grade, provide 3/4" resilient expansion joint material (e.g., foam, rubber, asphalt-coated fiber, bituminous-impregnated felt, or cork) wrapped around the pipe, the full depth of concrete, at the point of penetration. Secure to prevent shifting during concrete placement and finishing.

E. Size sleeves large enough to allow expansion and contraction movement. Provide continuous insulation wrapping.

2.6 ESCUTCHEON PLATES AND TRIM

A. Fit escutcheons to all insulated or uninsulated exposed pipes passing through walls, floors, or ceilings of finished rooms.

B. Escutcheons shall be heavy gauge, cold rolled steel, copper coated under a chromium plated finish, heavy spring clip, rigid hinge and latch.

C. Install galvanized steel (unless otherwise indicated) trim strip to cover vacant space and raw construction edges of all rectangular openings in finished rooms. This includes pipe openings.

2.7 PIPE PENETRATIONS

A. Seal all pipe penetrations. Seal non-rated walls and floor penetrations with grout or caulk. Backing material may be used.

B. Seal fire rated wall and floor penetrations with fire seal system as specified.

2.8 PIPE ANCHORS

A. Provide all items needed to allow adequate expansion and contraction of all piping. All piping shall be supported, guided, aligned, and anchored as required.

B. Repair all piping leaks and associated damage. Pipes shall not rub on any part of the building.

2.9 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

PART 3 - EXECUTION

3.1 HVAC SUPPORTS AND ANCHORS

A. General Installation Requirements:

1. Install all items per manufacturer's instructions.
2. Coordinate the location and method of support of piping systems with all installations under other Divisions and Sections of the Specifications.
3. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.
4. Supports shall extend directly to building structure. Do not support piping from duct hangers unless coordinated with Sheet Metal Contractor prior to installation. Do not allow lighting or ceiling supports to be hung from piping supports.

B. Supports Requirements:

1. Furnish, install and prime all auxiliary structural steel for support of piping systems that are not shown on the Drawings as being by others.
2. Install hangers and supports complete with lock nuts, clamps, rods, bolts, couplings, swivels, inserts and required accessories.
3. Hangers for horizontal piping shall have adequate means of vertical adjustment for alignment.

C. Pipe Requirements:

1. Support all piping and equipment, including valves, strainers, traps and other specialties and accessories to avoid objectionable or excessive stress, deflection, swaying, sagging or vibration in the piping or building structure during erection, cleaning, testing and normal operation of the systems.

2. Do not, however, restrain piping to cause it to snake or buckle between supports or to prevent proper movement due to expansion and contraction.
3. Support piping at equipment and valves so they can be disconnected and removed without further supporting the piping.
4. Piping shall not introduce strains or distortion to connected equipment.
5. Parallel horizontal pipes may be supported on trapeze hangers made of structural shapes and hanger rods; otherwise, pipes shall be supported with individual hangers.
6. Trapeze hangers may be used where ducts interfere with normal pipe hanging.
7. Provide additional supports where pipe changes direction, adjacent to flanged valves and strainers, at equipment connections and heavy fittings.
8. Provide at least one hanger adjacent to each joint in grooved end steel pipe with mechanical couplings.

D. Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:

    a. The hanger is attached within 6" from a web/chord joint.
    b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

E. After piping and insulation installation are complete, cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

F. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (limitation not required with concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and architectural items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

G. Do not exceed the manufacturer's recommended maximum load for any hanger or support.

H. Steel/Concrete Structure: Spacing of hangers shall not exceed the compressive strength of the insulation inserts, and in no case shall exceed the following:

1. Steel (Std. Weight or Heavier - Liquid Service):

    a. Maximum Spacing:

        1) 1-1/4" & under: 7'-0"
        2) 1-1/2": 9'-0"
        3) 2": 10'-0"
        4) 2-1/2": 11'-0"
        5) 3": 12'-0"

6) 4" & larger: 12'-0"

2. Steel (Std. Weight or Heavier - Vapor Service):

a. Maximum Spacing:

1) 1-1/4" and under: 9'-0"
2) 1-1/2": 12'-0"
3) 2" & larger: 12'-0"

3. Hard Drawn Copper & Brass (Liquid Service):

a. Maximum Spacing:

1) 3/4" and under: 5'-0"
2) 1": 6'-0"
3) 1-1/4": 7'-0"
4) 1-1/2" 8'-0"
5) 2": 8'-0"

I. Installation of hangers shall conform to MSS SP-58, 69, and 89.

END OF SECTION

SECTION 23 05 53 - HVAC IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Identification of products installed under Division 23.

1.2 REFERENCES

A. ANSI/ASME A13.1 - Scheme for the Identification of Piping Systems.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. 3M

B. Bunting

C. Calpico

D. Craftmark

E. Emedco

F. Kolbi Industries

G. Seton

H. W.H. Brady

I. Marking Services.

2.2 MATERIALS

A. General:

1. Plastic Nameplates: Laminated three-layer phenolic with engraved black, 1/4" minimum letters on light contrasting background.
2. Aluminum Nameplates: Black enamel background with natural aluminum border and engraved letters furnished with two mounting holes and screws.
3. Plastic Tags: Minimum 1-1/2" square or round laminated three-layer phenolic with engraved, 1/4" minimum black letters on light contrasting background.
4. Brass Tags: Brass background with engraved black letters. Tag size minimum 1-1/2" square or 1-1/2" round.

B. Pipe Markers:

1. All pipe markers shall conform to ANSI A13.1. Marker lengths and letter sizes shall be at least the following:

OD of Pipe or Insulation	Marker Length	Size of Letters
Up to and including 1-1/4"	8"	1/2"
1-1/2" to 2"	8"	3/4"
Plastic tags may be used for outside diameters under 3/4"		

2. Plastic Pipe Markers: Semi-rigid plastic, preformed to fit around pipe or pipe covering; indicating flow direction and fluid conveyed.
3. Vinyl Pipe Markers: Colored vinyl with permanent pressure-sensitive adhesive backing.
4. Underground Pipe Markers: Bright colored continuously printed plastic ribbon tape 6" wide by 3.5 mils thick, manufactured for direct burial, with aluminum foil core for location by non-ferric metal detectors and bold lettering identifying buried item.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all products per manufacturer's recommendations.

B. Degrease and clean surfaces to receive adhesive for identification materials.

C. Valves:

1. All valves (except shutoff valves at equipment) shall have numbered tags.
2. Provide or replace numbered tags on all existing valves that are connected to new systems or that have been revised.
3. Provide all existing valves used to extend utilities to this project with numbered tags. Review tag numbering sequence with the Owner prior to ordering tags.
4. Secure tags with heavy-duty key chain and brass "S" link or with mechanically fastened plastic straps.
5. Attach to handwheel or around valve stem.
6. Number all tags and show the service of the pipe.
7. Add to existing valve directory listing all valves, with respective tag numbers, uses and locations. Mount directory in location chosen by the Architect/Engineer.

D. Pipe Markers:

1. Adhesive Backed Markers: Use Brady Style 1, 2, or 3 on pipes 3" diameter and larger. Use Brady Style 4, 6, or 8 on pipes under 3" diameter. Similar styles by other listed manufacturers are acceptable. Secure all markers at both ends with a wrap of pressure-sensitive tape completely around the pipe.
2. Snap-on Markers: Use Seton "Setmark" on pipes up to 5-7/8" OD. Use Seton "Setmark" with nylon or Velcro ties for pipes 6" OD and over. Similar styles by other listed manufacturers are acceptable.
3. Apply markers and arrows in the following locations where clearly visible:

    a. At each valve.
    b. On both sides of walls, pipes penetrate.
    c. At least every 20 feet along all pipes.
    d. At least once in every room.

4. Underground Pipe Markers: Install 8" to 10" below grade, directly above buried pipes.

E. Equipment:

1. All equipment not easily identifiable such as controls, relays, gauges, etc.; and all equipment in an area remote from its function such as air handling units, exhaust fans, filters, reheat coils, dampers, etc.; shall have nameplates or plastic tags listing name, function, and drawing symbol. Do not label exposed equipment in public areas.
2. Fasten nameplates or plastic tags with stainless steel self-tapping screws or permanently bonding cement.
3. Mechanical equipment that is not covered by the U.S. National Appliance Energy Conservation Act (NAECA) of 1987 shall carry a permanent label installed by the manufacturer stating that the equipment complies with the requirements of ASHRAE 90.1.

F. Miscellaneous:

1. Attach self-adhesive vinyl labels at all duct access doors used to reset fusible links or actuators on fire, fire/smoke, or smoke dampers. Lettering shall be a minimum of 1/2" high. Labels shall indicate damper type.
2. Provide engraved plastic tags at all hydronic or steam system make-up water meters.

3.2 SCHEDULE

A. Pipes to be marked shall be labeled with text as follows, regardless of which method or material is used:

1. HEATING WATER SUPPLY: White lettering; green background
2. HEATING WATER RETURN: White lettering; green background
3. NATURAL GAS: Black lettering; yellow background
4. Underground Piping: Varies

END OF SECTION

SECTION 23 05 93 - TESTING, ADJUSTING, AND BALANCING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Testing, adjusting, and balancing of air systems.

B. Testing, adjusting, and balancing of heating systems.

C. Measurement of final operating condition of HVAC systems.

1.2 QUALITY ASSURANCE

A. Agency shall be a company specializing in the adjusting and balancing of systems specified in this section with minimum three years' experience. Perform work under supervision of AABC Certified Test and Balance Engineer, NEBB Certified Testing, Balancing and Adjusting Supervisor, or TABB Certified Supervisor.

B. Work shall be performed in accordance with the requirements of the references listed at the start of this section.

1.3 REFERENCES

A. AABC - National Standards for Total System Balance, Seventh Edition.

B. ADC - Test Code for Grilles, Registers, and Diffusers.

C. AMCA - Publication 203-90; Field Performance Measurement of Fan Systems.

D. ASHRAE - 2019 HVAC Applications Handbook; Chapter 39, Testing, Adjusting and Balancing.

E. ASHRAE/ANSI - Standard 111-2008; Practices for Measurement, Testing, Adjusting and Balancing of Building HVAC&R Systems.

F. NEBB - Procedural Standards for Testing, Adjusting and Balancing of Environmental Systems, Ninth Edition, 2019.

G. SMACNA - HVAC Systems; Testing, Adjusting and Balancing (latest edition).

H. TABB - International Standards for Environmental Systems Balance.

1.4 SUBMITTALS

A. Submit copies of report forms, balancing procedures, and the name and qualifications of testing and balancing agency for approval within 30 days after award of Contract.

B. Electronic Copies:

1. Submit a certified copy of test reports to the Architect/Engineer for approval. Electronic copies shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Copies that are not legible will be returned to the Contractor for resubmittal. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
2. Electronic file size shall be limited to a maximum of 10MB. Larger files shall be divided into files that are clearly labeled as "1 of 2", "2 of 2", etc.
3. All text shall be searchable.
4. Bookmarks shall be used. All bookmark titles shall be an active link to the index page and index tabs.

1.5 REPORT FORMS

A. Submit reports on AABC, SMACNA, or NEBB forms. Use custom forms approved by the Architect/Engineer when needed to supply specified information.

B. Include in the final report a schematic drawing showing each system component, including balancing devices, for each system. Each drawing shall be included with the test reports required for that system. The schematic drawings shall identify all testing points and cross-reference these points to the report forms and procedures.

C. Refer to PART 4 for required reports.

1.6 WARRANTY/GUARANTEE

A. The TAB Contractor shall include an extended warranty of 90 days after owner receipt of a completed balancing report, during which time the Owner may request a recheck of terminals or resetting of any outlet, coil, or device listed in the test report. This warranty shall provide a minimum of 24 manhours of onsite service time. If it is determined that the new test results are not within the design criteria, the balancer shall rebalance the system according to design criteria.

B. Warranty/Guarantee must meet one of the following programs: TABB International Quality Assurance Program, AABC National Project Performance Guarantee, NEBB's Conformance Certification.

1.7 SCHEDULING

A. Coordinate schedule with other trades. Provide a minimum of seven days' notice to all trades and the Architect/Engineer prior to performing each test.

B. Project will be constructed in phases. Provide balancing report after each phase is complete.

PART 2 - PRODUCTS (Not Used)

PART 3 - EXECUTION

3.1 GENERAL REQUIREMENTS

A. All procedures must conform to a published standard listed in the References article of this section. All equipment shall be adjusted in accordance with the manufacturer's recommendations. Any system not listed in this specification but installed under the contract documents shall be balanced using a procedure from a published standard listed in the References article.

B. The Balancing Contractor shall incorporate all pertinent documented construction changes (e.g. submittals/shop drawings, change orders, RFIs, ASIs, etc.) and include in the balancing report.

C. Recorded data shall represent actual measured or observed conditions.

D. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary to allow adequate performance of procedures. After testing and balancing is complete, close probe holes and patch insulation with new materials as specified. Restore vapor barrier and finish as specified.

E. Permanently mark setting of valves, dampers, and other adjustment devices allowing for settings to be restored. Set and lock memory stops.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, plugging test holes, and restoring thermostats to specified settings.

G. The Balancing Contractor shall measure terminal air box air flow, and the TCC shall adjust DDC readout to match. Refer to Section 23 09 00 for additional information.

H. Installations with systems consisting of multiple components shall be balanced with all system components operating.

3.2 EXAMINATION

A. Before beginning work, verify that systems are complete and operable. Ensure the following:

1. General Equipment Requirements:

a. Equipment is safe to operate and in normal condition.
b. Equipment with moving parts is properly lubricated.
c. Temperature control systems are complete and operable.
d. Proper thermal overload protection is in place for electrical equipment.
e. Direction of rotation of all fans and pumps is correct.
f. Access doors are closed and end caps are in place.

2. Duct System Requirements:

a. All filters are clean and in place. If required, install temporary media.
b. Duct systems are clean and free of debris.
c. Fire/smoke and manual volume dampers are in place, functional and open.

d. Air outlets are installed and connected.
e. Duct system leakage has been minimized.

3. Pipe System Requirements:

a. Coil fins have been cleaned and combed.
b. Hydronic systems have been cleaned, filled, and vented.
c. Strainer screens are clean and in place.
d. Shutoff, throttling and balancing valves are open.

B. Report any defects or deficiencies to Architect/Engineer.

C. Promptly report items that are abnormal or prevent proper balancing.

D. If, for design reasons, system cannot be properly balanced, report as soon as observed.

E. Beginning of work means acceptance of existing conditions.

3.3 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Architect/Engineer for spot checks during testing.

B. Instruments shall be calibrated within six months of testing performed for project, or more recently if recommended by the instrument manufacturer.

3.4 INSTALLATION TOLERANCES

A. ± 10% of scheduled values:

1. Adjust air inlets and outlets to ± 10% of scheduled values.
2. Adjust piping systems to ±10% of design values.

3.5 ADJUSTING

A. After adjustment, take measurements to verify balance has not been disrupted or that disruption has been rectified.

B. Once balancing of systems is complete, at least one damper or valve must be 100% open.

C. After testing, adjusting and balancing are complete, operate each system and randomly check measurements to verify system is operating as reported in the report. Document any discrepancies.

D. Contractor responsible for each motor shall also be responsible for replacement sheaves. Coordinate with contractor.

E. Contractor responsible for pump shall trim impeller to final duty point as instructed by this contractor on all pumps not driven by a VFD. Coordinate with contractor.

3.6 SUBMISSION OF REPORTS

A. Fill in test results on appropriate forms.

PART 4 - SYSTEMS TO BE TESTED, ADJUSTED AND BALANCED

4.1 Verification of existing systems.

A. Perform a pre-balance of systems serving the area of construction prior to the start of any other work. Do not make adjustments to the systems. If the systems are not operating at maximum capacity, temporarily drive system to maximum and take readings for the system. Return the system to its original state when measurements are complete.

1. Air Terminal (Inlet or Outlet):

a. Room number/location.
b. Terminal type and size.
c. Velocity.
d. Flow rate (cfm)
e. Percent of design flow rate.

2. Air Terminal Unit (Terminal Air Box) Data:

a. General Requirements:

1) Drawing symbol.
2) Location.
3) Manufacturer and model.
4) Size.
5) Type: constant, variable, single, dual duct.

b. Flow Rate:

1) Cooling maximum flow rate (cfm).
2) Heating maximum flow rate (cfm).
3) Minimum flow rate (cfm).
4) Water flow rate (gpm).

c. Temperature:

1) Entering air temperature.
2) Leaving air temperature (in heating mode).
3) Entering water temperature.
4) Leaving water temperature.

d. Pressure Drop and Pressure:

1) Inlet static pressure during testing.
2) Coil air pressure drop.
3) Water pressure drop.

B. Report findings to Architect/Engineer on standard forms. Provide [four (4)] copies of report.

4.2 GENERAL REQUIREMENTS

A. Title Page:

1. Project name.

2. Project location.
3. Project Architect.
4. Project Engineer (IMEG Corp.).
5. Project General Contractor.
6. TAB Company name, address, phone number.
7. TAB Supervisor's name and certification number.
8. TAB Supervisor's signature and date.
9. Report date.

B. Report Index

C. General Information:

1. Test conditions.
2. Nomenclature used throughout report.
3. Notable system characteristics/discrepancies from design.
4. Test standards followed.
5. Any deficiencies noted.
6. Quality assurance statement.

D. Instrument List:

1. Instrument.
2. Manufacturer, model, and serial number.
3. Range.
4. Calibration date.

4.3 AIR SYSTEMS

A. Air Moving Equipment:

1. General Requirements:

a. Drawing symbol.
b. Location.
c. Manufacturer, model, arrangement, class, discharge.
d. Fan RPM.
e. Multiple RPM fan curve with operating point marked. (Obtain from equipment supplier).
f. Final frequency of motor at maximum flow rate (on fans driven by VFD).

2. Flow Rate:

a. Supply flow rate (cfm): specified and actual.
b. Return flow rate (cfm): specified and actual.
c. Outside flow rate (cfm): specified and actual.
d. Exhaust flow rate (cfm): specified and actual.

3. Pressure Drop and Pressure:

a. Filter pressure drop: specified and actual.
b. Total static pressure: specified and actual. (Indicate if across fan or external to unit).
c. Inlet pressure.

d. Discharge pressure.

B. Fan Data:

1. Drawing symbol.
2. Location.
3. Manufacturer and model.
4. Flow rate (cfm): specified and actual.
5. Total static pressure: specified and actual. (Indicate measurement locations).
6. Inlet pressure.
7. Discharge pressure.
8. Fan RPM.

C. Electric Motors:

1. Drawing symbol of equipment served.
2. Manufacturer, Model, Frame.
3. Nameplate: HP, phase, service factor, RPM, operating amps, efficiency.
4. Measured: Amps in each phase.

D. Air Terminal (Inlet or Outlet):

1. Drawing symbol.
2. Room number/location.
3. Terminal type and size.
4. Velocity: specified and actual.
5. Flow rate (cfm): specified and actual.
6. Percent of design flow rate.

E. Air Terminal Unit (Terminal Air Box) Data:

1. General Requirements:

a. Drawing symbol.
b. Location.
c. Manufacturer and model.
d. Size.
e. Type: constant, variable, single, dual duct.

2. Flow Rate:

a. Cooling maximum flow rate (cfm): specified and actual.
b. Heating maximum flow rate (cfm): specified and actual.
c. Minimum flow rate (cfm): specified and actual.
d. Water flow rate (gpm): specified and actual with system performance adjusted as follows:

1) Adjust heating water system pump to maintain maximum system differential pressure.
2) Set calibrated balance valve fully open.
3) Command terminal air box control valve to fully open.
4) Measure heating coil flow using calibrated balance valve.

5) Note: Commanding terminal air box control valve to be fully open shall be done on a valve-by-valve basis. Do not command all control valves to be fully open at the same time, as the heating water system may not have sufficient capacity.
6) Note: After Balancing of all terminal air boxes is complete, release the heating water pump to automatically reset the system DP based on control valve position per sequence of operation requirements.

3. Temperature:

a. Entering air temperature: specified and actual.
b. Leaving air temperature (in minimum airflow/heating mode): specified and actual.
c. Entering water temperature: specified and actual.
d. Leaving water temperature: specified and actual.

4. Pressure Drop and Pressure:

a. Inlet static pressure during testing cooling maximum airflow rate (maximum and minimum).
b. Water pressure drop: specified and actual.

4.4 HEATING SYSTEMS

A. Terminal Heat Transfer Units:

1. General Requirement:

a. Drawing symbol.
b. Location.
c. Manufacturer and model.
d. Include air data only for forced air units.

2. Flow Rate:

a. Flow rate (cfm): specified and actual.
b. Water flow rate (cfm): specified and actual.

3. Temperature:

a. Entering air temperature: specified and actual.
b. Leaving air temperature: specified and actual.
c. Entering water temperature: specified and actual.
d. Leaving water temperature: specified and actual.

4. Energy:

a. Air Btuh (cfm x temperature rise x 1.09).
b. Water Btuh (gpm x temperature drop x 500). Repeat tests if not within 10% of air Btuh.

END OF SECTION

SECTION 23 07 13 - DUCTWORK INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Ductwork Insulation.

B. Insulation Jackets.

1.2 QUALITY ASSURANCE

A. Applicator: Company specializing in ductwork insulation application with five years minimum experience. When requested, installer shall submit manufacturer's certificate indicating qualifications.

B. Materials:

1. Listed and labeled for flame spread/smoke developed rating of no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.
2. Fungal Resistance: No growth when tested in accordance with ASTM G21 (antifungal test).
3. Rated velocity on coated air side for air erosion in accordance with UL 181 at 5,000 fpm minimum.
4. UL listed in Category HNKT.

C. Adhesives: UL listed, meeting NFPA 90A/90B requirements.

1.3 REFERENCES

A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ANSI/ASTM C553 - Mineral Fiber Blanket and Felt Insulation.

C. ANSI/ASTM C612 - Mineral Fiber Block and Board Thermal Insulation.

D. ASTM E84 - Surface Burning Characteristics of Building Materials.

E. ASTM E136 - Standard Test Method for the Behavior of Materials in a Vertical Tube Furnace at 750°C.

F. ASTM E814 - Fire Tests of Through Penetrations Firestops.

G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi.

H. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

I. NFPA 255 - Surface Burning Characteristics of Building Materials.

J. UL - XHEZ - Through Penetration Firestop Systems.

K. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors.

L. UL 263 - Full Scale External Fire Tests with Hose Stream.

M. UL 723 - Surface Burning Characteristics of Building Materials.

N. UL 1479 - Fire Tests of Through Penetrations Firestops.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Type A: Flexible Fiberglass - Outside Wrap; ANSI/ASTM C553; commercial grade; 0.28 / 0.26 (Out-Of-Package/Installed-Compressed 25%) maximum 'K' value at 75°F; foil scrim Kraft facing, 1.0 lb./cu. ft. density. Submit both "Out of Package" and "Installed-Compressed 25%" K and R-values.

B. Type C: Flexible Fiberglass Liner; ANSI/ASTM C1071; 0.28 maximum 'K' value at 75°F; 1.5 lb/cu ft minimum density; coated air side for 5000 fpm air velocity.

C. Type E: Double wall ductwork insulation; fiberglass; 0.27 maximum 'K' value at 75°F mean temperature; 1.5 lb/cu ft density.

D. Type G: Preformed rigid fiberglass acoustical liner. ANSI/ASTM C1071; 0.23 maximum 'K' value at 75°F mean temperature; Noise Reduction Coefficient (NRC) per ASTM C423 Type "A" mounting of 0.70 [0.75] for 1" thickness, 0.90 for 1.5" thickness. Liner shall be factory coated with an anti-microbial agent to prevent fungus and bacteria growth per ASTM G-21 and G-22. Listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.

2.2 JACKETS

A. Vapor Barrier Jackets: Kraft reinforced foil scrim vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 25 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install materials in accordance with manufacturer's instructions, codes, and industry standards.

B. Install materials after ductwork has been tested.

C. Clean surfaces for adhesives.

D. Provide insulation with vapor barrier when air conveyed may be below ambient temperature.

E. Exterior Duct Wrap - Flexible, Type A:

1. Apply with edges tightly butted.
2. Cut slightly longer than perimeter of duct to insure full thickness at corners. Do not wrap excessively tight.
3. Seal joints with adhesive backed tape.
4. Apply so insulation conforms uniformly and firmly to duct.
5. Seal all penetrations of the vapor barrier by strap hangers or slip cable hangers with adhesive backed tape.
6. Provide high-density insulation inserts on rectangular ducts at trapeze duct hangers to prevent crushing of insulation. Provide high-density insulation inserts with clamp-on round ducts requiring two (2) rods or straps to prevent crushing of insulation. Maintain continuous vapor barrier through the hanger.
7. Tape all joints with Royal Tapes #RT 350 (216-439-7229), Venture Tape 1525CW, or Compac Type FSK. No substitutions will be accepted without written permission from the Architect/Engineer.
8. Press tape tightly to the duct covering with a squeegee for a tight continuous seal. Fish mouths and loose tape edges are not acceptable.
9. Staples may be used, but must be covered with tape.
10. Vapor barrier must be continuous.
11. Mechanically fasten on 12" centers at bottom of ducts over 24" wide and on all sides of vertical ducts.

F. Interior Insulation - Flexible Duct Liner, Type C:

1. Observation of Duct Lining:

    a. After installation of ductwork, Architect/Engineer may select random observation points in each system.

        1) At each observation point, cut and remove an 18" x 18" section of ductwork and liner for verification of installation.
        2) Random observation points based on one opening per 75 lineal ft. of total duct run.

    b. When any of the observation points shows non-compliance, additional points will be designated by the Architect/Engineer, and observation repeated.
    c. If 20% of points observed do not comply, remove and replace all lined ducts and repeat tests. Where replacement is not required, correct all non-compliances.
    d. At end of observation, repair all duct lining and observation holes by installing standard, insulated, hinged access doors per Section 23 33 00.
    e. Paint or finish to match adjacent duct surfaces.

2. Impale on spindle anchors welded or mechanically fastened to the duct. Adhesive or glue fastened anchors are not acceptable. Maximum anchor spacing per SMACNA Duct Construction Standards or manufacturer's recommendations, whichever is more restrictive. Locate pins less than 3" from corners and at intervals not over 6" around the perimeter at leading and trailing edges. Locate pins within 3" of transverse joints and at intervals not over 16" long the length of the duct. Pins must be long enough to prevent compressing the insulation.
3. In addition to anchors, secure liner with UL listed adhesive covering over 90% of the duct surface.
4. Install per the latest edition of the SMACNA Manual.

5. Leading edges shall be covered as follows:

    a. For duct velocities below 3000 fpm, coat leading edges with adhesive. Neatly butt liner without gaps at transverse joints. Cut liner flush with end of the duct section for tight joints with no exposed duct. If adhesive is shop installed, field apply additional adhesive to the end of each duct section for complete adhesion of the liner. Protect edges from dirt and debris.
    b. For duct velocities above 3000 fpm, cover leading edges with metal nosing. Use nosing on upstream edges of each section of duct. If the duct can be installed in either direction, provide nosing on each end or clearly mark the duct to allow visual verification after installation. Verify duct velocities based on the scheduled air flow rates and determine where metal nosing is required.
    c. Install metal nosing in the following locations (regardless of velocity):

        1) The first three fittings downstream of all fans.
        2) At all duct liner interruptions. This includes fire dampers, access doors, branch connections, and all other locations where the edge of the liner is exposed.
        3) Trailing edges of transverse joints do not require metal nosings.

6. Overlap liner at longitudinal joints. Make longitudinal joints at corners of the duct unless the duct size does not allow this. Coat longitudinal joints with adhesive at velocities over 2500 fpm.
7. Seal all damaged duct liner with adhesive and glass cloth. Do not damage duct liner surface coatings.
8. Duct dimensions given are net inside dimensions. Increase sheet metal to allow for insulation thickness.

G. Double-Wall Ductwork Insulation - Type E:

1. Install insulation per manufacturer's recommendations.
2. Duct dimensions given are net inside dimensions of inner wall.

H. Preformed Fiberglass Acoustical Liner, Rigid - Type G:

1. Cut and secure duct liner inside duct.
2. Install insulation pins or adhesives in locations as recommended by the manufacturer.
3. Seal all damaged duct liner and fill all gaps with manufacturer approved sealant. Do not damage duct liner surface coatings.
4. Where edges show evidence of delamination, the damaged areas shall be secured by manufacturer-approved sealant.
5. Duct dimensions given are net inside dimensions. Increase sheet metal to allow for insulation thickness.

I. Continue insulation with vapor barrier through penetrations unless code prohibits.

J. Provide 2" wide, 24" high, 26 gauge, galvanized sheet metal corner protection angles for all externally insulated ductwork extending to a floor or curb.

3.2 SCHEDULE

A. Refer to Section 23 31 00 for scheduling of insulation.

END OF SECTION

SECTION 23 07 19 - HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping Insulation.

B. Insulation Jackets.

1.2 QUALITY ASSURANCE

A. Applicator: Company specializing in piping insulation application with five years minimum experience.

B. Materials: Listed and labeled for flame spread/smoke developed rating of no more than 25/50 when tested per ASTM E84 or UL 723 as required by code. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers with appropriate markings of applicable testing agency.

C. Products shall not contain asbestos, lead, mercury, or mercury compounds.

D. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

E. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

1.3 REFERENCES

A. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

B. ANSI/ASTM C195 - Mineral Fiber Thermal Insulation Cement.

C. ANSI/ASTM C534 - Elastomeric Foam Insulation.

D. ANSI/ASTM C547 - Mineral Fiber Preformed Pipe Insulation.

E. ASTM C449 - Mineral Fiber Hydraulic-setting Thermal Insulating and Finishing Cement.

F. ASTM E84 - Surface Burning Characteristics of Building Materials.

G. NFPA 255 - Surface Burning Characteristics of Building Materials.

H. UL 723 - Surface Burning Characteristics of Building Materials.

I. National Commercial & Industrial Insulation Standards - 1999 Edition - as published by Midwest Insulation Contractors Association and endorsed by National Insulation Contractors Association.

PART 2 - PRODUCTS

2.1 INSULATION

A. Type A: Glass fiber; ANSI/ASTM C547; 0.24 maximum 'K' value at 75°F; non-combustible. All-purpose polymer or polypropylene service jacket, listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code.

B. Type C: Molded rigid cellular glass; ANSI/ASTM C-552; 0.29 maximum 'K' value at 75°F; density 7.3lb/ft; minimum compressive strength 90 psi parallel to rise; moisture resistant, non-combustible; suitable for -100°F to +900°F. For below grade installations use asphaltic mastic paper vapor barrier jacket. Use self-seal all-purpose polymer or polypropylene service jacket for above grade installations.

C. Type E: Preformed rigid cellular polyisocyanurate insulation; ANSI/ASTM C591; maximum 'K' value of 0.19 at 75°F; density 4.0lb/ft; minimum compressive strength 95 psi parallel to rise; moisture resistant; listed and labeled at no more than 25/50 when tested per ASTM E84 or UL 723 as required by code; suitable for -297°F to +300°F.

2.2 VAPOR BARRIER JACKETS

A. All-purpose polymer or polypropylene service jacket vapor barrier with self-sealing adhesive joints. Beach puncture resistance ratio of at least 50 units. Tensile strength: 35 psi minimum. Single, self-seal acrylic adhesive on longitudinal jacket laps and butt strips.

B. Polyvinylidene Chloride (PVDC or Saran) film and tape: Durable and highly moisture and moisture vapor resistant. Please refer to manufacturer's recommended installation guidelines.

2.3 REMOVABLE INSULATION JACKETS

A. Removable insulation jackets shall consist of outer covering, interstitial insulation material, and inner covering.

B. Inner and outer covering shall be constructed from a minimum 16.5 oz./yd2 PTFE fiberglass composite and suitable for insulating surface temperatures up to 550°F.

C. Interstitial insulation blanket shall be minimum 1-1/2" thick and shall consist of either:

1. Silica and glass-fiber insulation felts and blankets - minimum 6 lb./ft3 density.
2. E-type glass-fiber felts and blankets - minimum 6 lb./ft3 density.

D. Construction: Inner and outer covering with interstitial insulation material shall be joined into a single assembly using a double sewn lock stitch with 4-6 stitches/inch. The thread used shall be able to withstand minimum 550°F surface temperatures without degradation. The use of hog rings, staples, and wires for closure of assembly are not acceptable. The interstitial insulation shall be sewn as an integral part of the inner and outer coverings to prevent shifting of the insulation. Insulation pins are not an allowable method of preventing the insulation from shifting and shall not be used.

E. No raw cut jacket edges shall be exposed.

F. Jackets shall be fastened to equipment and piping components using hook and loop (Velcro) straps and minimum 1" slide buckles.

G. Jacket coverings shall have an inner covering edge with a continuous strip of hook & loop closure (Velcro) that is parallel to the seam and overlaps the outer covering by a minimum of 2 inches.

H. Manufacturers:

1. Firwin Corp
2. Lewco Specialty Products
3. ThermaXX Jackets LLC
4. Approved equivalent

PART 3 - EXECUTION

3.1 PREPARATION

A. Install insulation after piping has been tested. Pipe shall be clean, dry and free of rust before applying insulation.

B. Patch and repair torn insulation. Paint to match adjacent insulation surface.

3.2 INSTALLATION

A. General Installation Requirements:

1. Install materials per manufacturer's instructions, building codes and industry standards.
2. Continue insulation with vapor barrier through penetrations. This applies to all insulated piping. Maintain fire rating of all penetrations.
3. All piping and insulation that does not meet 25/50 that is in an air plenum shall have written approval from the Authority Having Jurisdiction and the local fire department for authorization and materials approval. If approval has been allowed, the non-rated material shall be wrapped with a product that has been listed and labeled having a flame spread index of not more than 25 and a smoke-developed index of not more than 50 when tested as a composite in accordance with ASTM E84 or UL 723.
4. On 1" and smaller piping routed through metal wall studs, provide a plastic grommet to protect the piping. The piping shall be insulated between the wall studs, and the insulation shall butt up to each stud.

B. Insulated Piping Operating Above 140°F:

1. Insulate fittings, valves, flanges, float & thermostatic steam traps, and strainers. On gate valves, the insulation shall be extended to cover the entire valve bonnet, leaving only the portion of the stem that is above the bonnet and valve operator exposed.
2. All balance valves with fluid operating above 140°F shall be insulated and an opening shall be left in the insulation to allow for reading and adjusting the valve.
3. The use of removable insulation jackets is acceptable for insulating large and non-cylindrical shaped piping components (e.g., check valves, pressure regulating valves, calibrated balance valves, gate valve bonnets, F&T traps, strainers, line sets, and the like).

3.3 SUPPORT PROTECTION

A. Provide a shield on all insulated piping at each support between the insulation jacket and the support.

B. On all insulated piping greater than 1-1/2", provide shield with insulation insert of same thickness and contour as adjoining insulation at each support, between the pipe and insulation jacket, to prevent insulation from sagging and crushing. Inserts shall be as follows:

1. The insert shall be suitable for planned temperatures, be suitable for use with specific pipe material, and shall be a minimum 180° cylindrical segment the same length as metal shields. Inserts shall be:

a. Cellular glass (Type C) (for all temperature ranges) with a minimum compressive strength of 90 psi is acceptable for pipe sizes 14" and below. For pipe sizes larger than 14, provide rolled steel plate in addition to the shield.
b. As an alternative to separate pipe insulation insert and saddle, properly sized manufactured integral rigid insulation insert and shield assemblies may be used.

1) Products:

a) Buckaroo CoolDry
b) Cooper/B-Line Fig. B3380 through B3384
c) Pipe Shields A1000, A2000

c. Insulation Couplings:

1) Molded thermoplastic slip coupling, -65°F to 275°F, sizes up to 4-1/8" OD, and receive insulation thickness up to 1". Suitable for use indoors or outdoors with UV stabilizers. Vertical insulation riser clamps shall have a 1,000lb vertical load rating. On cold pipes operating below 60°F, cover joint and coupling with vapor barrier mastic to ensure continuous vapor barrier.
2) PET thermoplastic foam load bearing core with elastomeric foam ends and lap-seal jacket.
3) Horizontal Strut Mounted Insulated Pipe Manufacturers:

a) Klo-Shure or equal
b) Armafix Ecolight

4) Vertical Manufacturers:

a) Manufacturers: Klo-Shure Titan or equal

d. Rectangular blocks, plugs, or wood material are not acceptable.
e. Temporary wood blocking may be used by the Piping Contractor for proper height; however, these must be removed and replaced with proper inserts by the Insulation Contractor. Refer to Supports and Anchors specification section for additional information.

C. Neatly finish insulation at supports, protrusions, and interruptions.

D. Install metal shields between all hangers or supports and the pipe insulation. Shields shall be galvanized sheet metal, half-round with flared edges. Adhere shields to insulation. On cold piping, seal the shields vapor-tight to the insulation as required to maintain the vapor barrier, or add separate vapor barrier jacket.

E. Shields shall be at least the following lengths and gauges:

Pipe Size	Shield Size

1/2" to 3-1/2"	12" long x 18 gauge
4"	12" long x 16 gauge

F. Minimum 1/4" rolled galvanized steel plates shall be provided in addition to the sleeves as reinforcement on large pipes to reduce point loading on roller, trapeze hanger and strut support locations depending on insulation compressive strength. Refer to section above for exact locations.

3.4 INSULATION

A. Type A Insulation:

1. All Service Jackets: Seal all longitudinal joints with self-seal laps using a single pressure sensitive adhesive system. Do not staple.
2. Insulation without self-seal lap may be used if installed with Benjamin Foster 85-20 or equivalent Chicago Mastic, 3M or Childers lap adhesive.
3. Apply insulation with laps on top of pipe.
4. Fittings, Valve Bodies and Flanges: For 4" and smaller pipes, insulate with 1 lb. density insulation wrapped under compression to a thickness equal to the adjacent pipe insulation. For pipes over 4", use mitered segments of pipe insulation. Finish with preformed plastic fitting covers. Secure fitting covers with pressure sensitive tape at each end. Overlap tape at least 2" on itself. For pipes operating below 60°F, seal fitting covers with vapor retarder mastic in addition to tape.

B. Type C Insulation:

1. Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner.
2. Insulate fittings with prefabricated fittings.

C. Type E Insulation:

1. Indoors, above grade or below grade, Polyvinylidene chloride (PVDC or Saran) vapor retarder film and tape: Seal all longitudinal joints with manufacturer approved adhesive. Secure butt joint strips in a similar manner. Refer to manufacturer's recommendations for installation guidelines.
2. Insulate pipe fittings with prefabricated insulation fittings.

3.5 SCHEDULE

A. Refer to drawings for insulation schedule.

END OF SECTION

SECTION 23 09 00 - CONTROLS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Complete System of Automatic Controls.

B. Control Devices, Components, Wiring and Material.

C. Instructions for Owners.

D. Remodeling.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing the products specified in this Section with minimum five years' experience.

B. TCC: Company specializing in the work of this section with minimum five years temperature control experience.

C. Technician: Minimum five years' experience installing commercial temperature control systems.

D. TCCs are limited to firms regularly employing a minimum of five full-time temperature control technicians within 100 miles of the job site.

1.3 REFERENCES

A. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. ANSI/ASHRAE Standard 135-2020: BACnet® - A Data Communication Protocol for Building Automation and Control Networks, including all amendments.

D. ANSI/NEMA 250 - Enclosures for Electrical Equipment (1000 volts Maximum).

E. ANSI/NFPA 70 - National Electrical Code.

F. ANSI/NFPA 90A - Installation of Air-Conditioning and Ventilation Systems.

G. ASHRAE 62.1 - Ventilation for Acceptable Indoor Air Quality.

H. ASHRAE 85 - Automatic Control Terminology for Heating, Ventilating, Air Conditioning.

1.4 SUBMITTALS

A. Equipment Coordination:

1. The Controls Contractor shall obtain approved equipment submittals from other contractors to determine equipment wiring connections, to choose appropriate controllers, and to provide programming.
2. Control valve selections shall be based on flow rates shown in approved shop drawings.
3. Coordinate the control interface of all equipment with the equipment manufacturers prior to submittal submission.

B. Shop Drawings:

1. Submit shop drawings per Section 23 05 00. In addition, submit an electronic copy of the shop drawings in Adobe Acrobat (.pdf) format to the Owner for review.
2. Cross-reference all control components and point names in a single table located at the beginning of the submittal with the identical nomenclature used in this section.
3. Submittal shall also include a trunk cable schematic diagram depicting operator workstations, control panel locations and a description of the communication type, media and protocol.
4. System Architecture: Provide riser diagrams of wiring between central control unit and all control panels. This shall include specific protocols associated with each level within the architecture. Identify all interface equipment between CPU and control panels. The architecture shall include interface requirements with other systems including, but not limited to, security systems, lighting control, fire alarm, elevator status, and power monitoring system.
5. Diagrams shall include:

    a. Wiring diagrams and layouts for each control panel showing all termination numbers.
    b. Schematic diagrams for all control, communication, and power wiring. Provide a schematic drawing of the central system installation. Label all cables and ports with computer manufacturers' model numbers and functions. Show all interface wiring to the control system.
    c. Identification of all control components connected to emergency power.
    d. Schematic diagrams for all field sensors and controllers.
    e. A schematic diagram of each controlled system. The schematics shall have all control points labeled. The schematics shall graphically show the location of all control elements in the system.
    f. A schematic wiring diagram for each controlled system. Each schematic shall have all elements labeled. Where a control element is the same as that shown on the control system schematic, label it with the same name. Label all terminals.
    g. A tabular instrumentation list for each controlled system. The table shall show element name, type of device, manufacturer, model number and product data sheet number.
    h. All installation details and any other details required to demonstrate that the system will function properly.
    i. All interface requirements with other systems.

6. The network infrastructure shall conform to the published guidelines for wire type, length, number of nodes per channel, termination, and other relevant wiring and infrastructure criteria as published. The number of nodes per channel shall be no more than 80% of the defined segment (logical or physical) limit in order to provide future system enhancement with minimal infrastructure modifications.

7. Sequences: Submit a complete description of the operation of the control system, including sequences of operation. The description shall include and reference a schematic diagram of the controlled system. The wording of the control sequences in the submittal shall match verbatim that included in the construction documents to ensure there are no sequence deviations from that intended by the Architect/Engineer. Clearly highlight any deviations from the specified sequences on the submittals.
8. Points List Schedule: Submit a complete points list of all points to be connected to the TCS and FMCS. The points list for each system controller shall include both inputs and outputs (I/O), point number, the controlled device associated with the I/O point, the location of the I/O device, and reference drawings. Where a control point is the same as that shown on the control system schematic, label it with the same name. Points list shall specifically identify alarms, trends, event history, archive, totalization, graphic points, and all mapped points from other systems (security systems, lighting control, fire alarm, etc.). Provide points lists, point naming convention, and factory support information for systems provided and integrated into the FMCS.
9. Valve Schedule: Valve manufacturer shall size valves and create a valve schedule. Schedule shall include a separate line for each valve and a column for each of the valve attributes:

    a. Valve Identification Tag.
    b. Location.
    c. Valve Type.
    d. Valve Size.
    e. Pipe Size.
    f. Configuration.
    g. Flow Characteristics.
    h. Capacity.
    i. Valve C_V.
    j. Design Pressure Drop.
    k. Pressure Drop at Design Flow.
    l. Fail Position.
    m. Close-off Pressure.
    n. Valve and Actuator Model Number and Type.

10. Product Data Sheets: Required for each component that includes: unique identification tag that is consistent throughout the submittal, manufacturer's description, technical data, performance curves, installation/maintenance instructions, and other relevant items. When manufacturer's literature applies to a product series rather than a specific product, the data specifically applicable to the project shall be highlighted or clearly indicated by other means. Each submitted piece of literature and drawings shall clearly reference the specification and/or drawing that the submittal is to cover. General catalogs shall not be accepted as cutsheets to fulfill submittal requirements.
11. Provide PICS files indicating the BACnet functionality and configuration of each device.
12. Provide documentation of submitted products that have been tested and listed by the BACnet Testing Laboratory (BTL), or provide a letter on the manufacturer's company letterhead indicating the anticipated date by which testing is expected to be completed. If, for any reason, BTL testing and listing has not been completed, a written commitment to upgrade installed controls to a version that meets BTL testing and listing requirements if problems are found during BTL testing is required.
13. Graphic Display: Include a sample graphic of each system and component identified in the points list with a flowchart (site map) indicating how the graphics are to be linked to each other for system navigation.
14. Control System Demonstration and Acceptance: Provide a description of the proposed process, along with all reports and checklists to be used.
15. Clearly identify work by others in the submittal.

16. Quantities of items submitted may be reviewed but are the responsibility of the Contractor to verify.

C. Operation and Maintenance Manual:

1. In addition to the requirements of Section 23 05 00, submit an electronic copy of the O&M manuals in PDF format.
2. Provide three complete sets of manuals.
3. Each O&M manual shall include:

    a. Table of contents with indexed tabs dividing information as outlined below.
    b. Definitions: List of all abbreviations and technical terms with definitions.
    c. Warranty Contacts: Names, addresses, and 24-hour telephone numbers of contractors installing equipment and controls and service representatives of each.
    d. Licenses, Guarantees, and Warranties: Provide documentation for all equipment and systems.
    e. System Components: Alphabetical list of all system components, with the name, address, and telephone number of the vendor.
    f. Operating Procedures: Include procedures for operating the control systems; logging on/off; enabling, assigning, and reporting alarms; generating reports; collection, displaying, and archiving of trended data; overriding computer control; event scheduling; backing up software and data files; and changing setpoints and other variables.
    g. Programming: Description of the programming language (including syntax), statement descriptions (including algorithms and calculations used), point database creation and modification, program creation and modification, and use of the editor.
    h. Engineering, Installation, and Maintenance: Explain how to design and install new points, panels, and other hardware; recommended preventive maintenance procedures for all system components, including a schedule of tasks (inspection, cleaning, calibration, etc.), time between tasks, and task descriptions; how to debug hardware problems; and how to repair or replace hardware. A list of recommended spare parts.
    i. Graphics: A glossary or icon symbol library detailing the function of each graphic icon and graphics creation and modification. One set of CDs containing files of all color graphic screens created for the project.

D. Training Manual:

1. Provide a course outline and training manuals for each training class.

E. Record Documents:

1. Submit record documentation per Section 23 05 00.
2. Provide a complete set of "as-built" drawings and application software on CDs. Provide drawings as AutoCAD™ or Visio™ compatible files. Provide two copies of the "as-built" drawings with revisions clearly indicated in addition to the documents on compact disk. All as-built drawings shall also be installed on the FMCS server in a dedicated directory. Provide all product data sheets in PDF format.
3. Submit two hard copies and one electronic copy of as-built versions of the shop drawings, including product data and record drawings with revisions clearly indicated. Provide floor plans showing actual locations of control components including panels, thermostats, sensors, and hardware.
4. Provide all completed testing and commissioning reports and checklists, along with all trend logs for each system identified in the points lists.

5. Submit printouts of all graphic screens with current values (temperatures, pressures, etc.) to the Architect/Engineer verifying completion and proper operation of all points.

1.5 DELIVERY, STORAGE AND HANDLING

A. Provide factory-shipping cartons for each piece of equipment and control device. Maintain cartons through shipping, storage, and handling as required to prevent equipment damage. Store equipment and materials inside and protected from weather.

B. Factory-Mounted Components: Where control devices specified in this section are indicated to be factory mounted on equipment, arrange for shipping control devices to unit manufacturer.

1.6 PRODUCTS FURNISHED BUT NOT INSTALLED UNDER THIS SECTION

A. Control Valves.

B. Flow Switches.

C. Temperature Sensor Sockets.

D. Gauge Taps.

E. Automatic Dampers.

F. Flow Meters.

1.7 AGENCY AND CODE APPROVALS

A. All products shall have the following agency approvals. Provide verification that the approvals exist for all submitted products with the submittal package.

1. UL-916; Energy Management Systems.
2. C-UL listed to Canadian Standards Association C22.2 No. 205-M1983 "Signal Equipment."
3. EMC Directive 89/336/EEC (European CE Mark).
4. FCC, Part 15, Subpart J, Class A Computing Devices.

1.8 ACRONYMS

A. Acronyms used in this specification are as follows:

1. B-AAC BACnet Advanced Application Controller
2. B-ASC BACnet Application Specific Controller
3. BTL BACnet Testing Laboratories
4. DDC Direct Digital Controls
5. FMCS Facility Management and Control System
6. GUI Graphic User Interface
7. IBC Interoperable BACnet Controller
8. IDC Interoperable Digital Controller
9. LAN Local Area Network
10. NAC Network Area Controller
11. ODBC Open DataBase Connectivity
12. OOT Object Oriented Technology
13. OPC Open Connectivity via Open Standards

14. PICS Product Interoperability Compliance Statement
15. PMI Power Measurement Interface
16. POT Portable Operator's Terminal
17. TCC Temperature Control Contractor
18. TCS Temperature Control System
19. WAN Wide Area Network
20. WBI Web Browser Interface

1.9 SUMMARY

A. Extend Existing System:

1. Extend the existing FMCS for this project.
2. All controllers and accessories shall interface with the existing FMCS.

B. TCC shall furnish all labor, materials, equipment, and service necessary for a complete and operating Temperature Control System (TCS) and Facility Management and Control System (FMCS) using Direct Digital Controls as shown on the drawings and as described herein.

C. All labor, material, equipment and software not specifically referred to herein or on the plans that is required to meet the intent of this specification shall be provided without additional cost to the Owner.

D. The Owner shall be the named license holder of all software associated with any and all incremental work on the project.

1.10 SYSTEM DESCRIPTION

A. The entire TCS shall be comprised of a network of interoperable, standalone digital controllers communicating via the following protocol to an NAC. Temperature Control System products shall be as specified below.

B. The FMCS shall include Network Area Controller or Controllers (NAC) within each facility. The NAC shall connect to the Owner's local or wide area network, depending on configuration. Provide access to the system, either locally in each building or remotely from a central site or sites, through standard Web browsers, via the Internet, and/or via local area network.

C. Provide materials and labor necessary to connect factory supplied control components.

D. Provide central and remote hardware, software, and interconnecting wire and conduit.

E. The FMCS shall include automated alarming software capable of calling e-mail compatible cellular telephones and pagers. The e-mail alarm paging system shall be able to segregate users, time schedules, and equipment and be capable of being programmed by the Owner.

F. For the dedicated configuration tool provided, it is preferable that it be launched from within the applicable Network Management Software. If not, include any software required for controller configuration as a leave-behind tool with enough license capability to support the installation.

G. For each operator workstation provided, furnish one legal copy of all software tools, configuration tools, management tools, and utilities used during system commissioning and installation. All tools shall be readily available in the market. Contractor shall convey to the Owner all software tools and their legal licenses at project closeout.

H. Connection:

1. System shall be a complete hard-wired system. Wireless control systems/functions are NOT acceptable.

1.11 JOB CONDITIONS

A. Cooperation with Other Trades: Coordinate the Work of this section with that of other sections to ensure that the Work will be carried out in an orderly fashion. It is this Contractor's responsibility to check the Contract Documents for possible conflicts between the Work of this section and that of other crafts in equipment location; pipe, duct and conduit runs; electrical outlets and fixtures; air diffusers; and structural and architectural features.

1.12 WARRANTY

A. Refer to Section 23 05 00 for warranty requirements.

B. Within the warranty period, any defects in the work provided under this section due to faulty materials, methods of installation or workmanship shall be promptly (within 48 hours after receipt of notice) repaired or replaced by this Contractor at no expense to the Owner.

C. Warranty requirements include furnishing and installing all FMCS software upgrades issued by the manufacturer during the one-year warranty period.

D. Update all software and back-ups during warranty period and all user documentation on the Owner's archived software disks.

1.13 WARRANTY ACCESS

A. The Owner shall grant to this Contractor reasonable access to the TCS and FMCS during the warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. BACnet Protocol with Tridium Niagara Platform:
1. Trane Tracer SC

a. Contact Austin Fiegel - austin.fiegel@trane.com 312 833-7968

2.2 SYSTEM ARCHITECTURE

A. General:

1. The Temperature Control System (TCS) and Facility Management Control System (FMCS) shall consist of a network of interoperable, standalone digital controllers, a computer system, graphic user interface software, printers, network devices, valves, dampers, sensors, and other devices as specified herein.
2. The installed system shall provide secure password access to all features, functions and data contained in the overall FMCS.

B. Open, Interoperable, Integrated Architectures:

1. All components and controllers supplied under this Division shall be true "peer-to-peer" communication devices. Components or controllers requiring "polling" by a host to pass data are not acceptable.
2. The supplied system must be able to access all data using standard Web browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) or Structured Query Language (SQL) compliant server database is required for all system database parameter storage. This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs are not acceptable.
3. Hierarchical or "flat" topologies are required to have system response times as indicated below and to manage the flow and sharing of data without unduly burdening the customer's internal intranet network.

    a. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 5 seconds for network-connected user interfaces.
    b. Maximum acceptable response time from any alarm occurrence (at the point of origin) to the point of annunciation shall not exceed 60 seconds for remote or dial-up connected user interfaces.

2.3 NETWORKS

A. The Local Area Network (LAN) shall be a 100 megabits/sec Ethernet network supporting BACnet, Java, XML, HTTP, and SOAP. Provide support for multiple Network Area Controllers (NACs), user workstations, and, if specified, a local server.

B. Local area network has minimum physical and media access requirements:

1. Ethernet; IEEE Standard 802.3.
2. Cable: 100 Base-T, UTP-8 wire, Category 6.
3. Minimum throughput: 100 Mbps.

C. Communication conduits shall not be installed closer than six feet from 110VAC or higher transformers or run parallel within six feet of electrical high-power cables. Route the cable as far from interference-generating devices as possible. Where communication wire must cross 110VAC or higher wire, it must do so at right angles.

D. Ground all shields (earth ground) at one point only to eliminate ground loops. Provide all shield grounding at the controller location, with the shield at the sensor/device end of the applicable wire being left long and "safed" off in an appropriate manner.

E. There shall be no power wiring more than 30 VAC rms run in conduit with communications wiring. In cases where signal wiring is run in conduit with communication wiring, run all communication wiring and signal wiring using separate twisted pairs (24awg) in accordance with the manufacturer's wiring practices.

2.4 NETWORK AREA CONTROLLER (NAC)

A. The TCC shall supply one or more Network Area Controllers (NAC) as part of this contract. Number of NACs required depends on the type and quantity of devices provided under Divisions 23 and 26. The TCC shall determine the quantity and type of devices.

B. NAC shall be provided with open connectivity to any manufacturer's BACnet programmable or application specific direct digital controllers. These controllers shall be JACE 8000 Series models or the identical hardware private label equivalent. The programmable controllers and application specific controllers provided under this section shall be able to be programmed by their respective engineering software application tools through the Niagara-based supervisory controllers from the Ethernet level network. The engineering software application tools shall be able to be loaded on a personal computer with Ethernet connectivity, and no additional hardware shall be required to connect to and download any programmable or application specific controller.

C. Each NAC shall provide the interface between the LAN or WAN and the field control devices and shall provide global supervisory control functions over the control devices connected to the NAC. It shall execute application control programs to provide:

1. Calendar functions.
2. Scheduling.
3. Trending.
4. Alarm monitoring and routing.
5. Time synchronization.
6. Integration of all controller data.
7. Network Management functions.

D. The Network Area Controller shall provide the following hardware features as a minimum:

1. One Ethernet Port - 10/100 Mbps.
2. One RS-232 port.
3. One LonWorks Interface Port - 78KB FTT-10A (for LonWorks systems only).
4. One RS-485 port.
5. Battery backup.
6. Flash memory for long-term data backup. (If battery backup or flash memory is not supplied, the controller shall contain a hard disk with at least 1 gigabyte storage capacity.)
7. The NAC must be capable of operation over a temperature range of 32°F to 122°F.
8. The NAC must be capable of withstanding storage temperatures of between 0°F and 158°F.
9. The NAC must be capable of operation over a humidity range of 5% RH to 95% RH, non-condensing.

E. The NAC shall provide multiple user access to the system and support for ODBC or SQL. Databases resident on the NAC shall be ODBC-compliant or must provide an ODBC data access mechanism to read and write data stored within it.

F. The NAC shall support standard Web browser access via the Internet or an intranet and a minimum of five (5) simultaneous users.

G. Event Alarm Notification and Actions:

1. The NAC shall provide alarm recognition, storage; routing, management, and analysis to supplement distributed capabilities of equipment or application specific controllers.
2. The NAC shall be able to route any alarm condition to any defined user location whether connected to a LAN, remote via dial-up telephone connection, or WAN.
3. Alarm generation shall be selectable for annunciation type and acknowledgement requirements including, but not limited to:

    a. Alarm

b. Normal

4. Provide for the creation of a minimum of eight alarm classes with different routing and acknowledgement properties, e.g. security, HVAC, Fire, etc.
5. Provide timed (scheduled) routing of alarms by class, object, group, or node.
6. Provide alarm generation from binary object "runtime" and/or event counts for equipment maintenance. The user shall be able to reset runtime or event count values with appropriate password control.

H. Treat control equipment and network failures as alarms and annunciated.

I. Annunciate alarms in any of the following manners as defined by the user:

1. Screen message text.
2. E-mail of the complete alarm message to multiple recipients. Provide the ability to route and e-mail alarms based on:

a. Day of week.
b. Time of day.
c. Recipient.

3. Pagers via paging services that initiate a page on receipt of e-mail message.
4. Graphic with flashing alarm object(s).
5. Printed message, routed directly to a dedicated alarm printer.

J. The FMCS shall record the following for each alarm:

1. Time and date.
2. Location (building, floor, zone, office number, etc.).
3. Equipment tag.
4. Acknowledge time, date, and user who issued acknowledgement.
5. Number of occurrences since last acknowledgement.

K. Give defined users proper access to acknowledge any alarm.

L. A log of all alarms shall be maintained by the NAC and/or a server (if configured in the system) and shall be available for review by the user.

M. Provide a "query" feature to allow review of specific alarms by user-defined parameters.

N. A separate log for system alerts (controller failures, network failures, etc.) shall be provided and available for review by the user.

O. An error log to record invalid property changes or commands shall be provided and available for review by the user.

2.5 BACNET FMCS

A. The intent of this specification is to provide a peer-to-peer networked, standalone, distributed control system with the capability to integrate ANSI/ASHRAE Standard 135-2001 BACnet, MODBUS, OPC, and other open and proprietary communication protocols in one open, interoperable system.

B. The supplied computer software shall employ object-oriented technology (OOT) for representation of all data and control devices in the system. Adherence to industry standards including the latest ANSI/ASHRAE Standard 135 (BACnet) to assure interoperability between all system components is required. For each BACnet device, the device supplier must provide a PICS document showing the installed device's compliance level. Minimum compliance is Level 3; with the ability to support data read and write functionality. Physical connection of BACnet devices shall be via Ethernet (BACnet Ethernet/IP) and/or RS-485 (BACnet MSTP).

C. Interoperable BACnet Controller (IBC):

1. Controls shall be microprocessor based Interoperable BACnet Controllers (IBC) in accordance with the latest ANSI/ASHRAE Standard 135. Provide IBCs for unit ventilators, fan coils, heat pumps, terminal air boxes (TAB) and other applications. The application control program shall reside in the same enclosure as the input/output circuitry that translates the sensor signals. Provide a PICS document showing the installed system's compliance level to ANSI/ASHRAE Standard 135. Minimum compliance is Level 3.
2. The IBCs shall be listed by the BACnet Testing Laboratory (BTL) as follows:

    a. BACnet Building Controller(s) (B-BC).
    b. BACnet Advanced Application Controller(s) (B-AAC).
    c. BACnet Application Specific Controller(s) (B-ASC).

3. The IBCs shall communicate with the NAC.
4. Each IBC sensor shall connect directly to the IBC and shall not use any of the I/O points of the controller. The IBC Sensor shall provide a two-wire connection to the controller that is polarity and wire type insensitive. The IBC sensor shall provide a communications jack for connection to the BACnet communication trunk to which the IBC controller is connected. The IBC sensor, the connected controller, and all other devices on the BACnet bus shall be accessible by the POT.
5. All IBCs shall be fully application programmable and shall at all times maintain their BACnet Level 3 compliance. Controllers offering application selection only (non-programmable) require a 10% spare point capacity to be provided for all applications. Store all control sequences within or programmed into the IBC in non-volatile memory that does not depend on a battery to be retained.
6. The Contractor supplying the IBCs shall provide documentation for each device, with the following information at a minimum:

    a. BACnet Device; MAC address, name, type and instance number.
    b. BACnet Objects; name, type and instance number.

7. It is the responsibility of the Contractor to ensure that the proper BACnet objects are provided in each IBC.

D. Object Libraries:

1. A standard library of objects shall be included for development and setup of application logic, user interface displays, system services, and communication networks.
2. The objects in this library shall be capable of being copied and pasted into the user's database and shall be organized according to their function. In addition, the user shall have the capability to group objects created in their application and store the new instances of these objects in a user-defined library.
3. In addition to the standard libraries specified here, the system supplier shall maintain an on-line accessible (over the Internet) library, available to all registered users, to provide new or updated objects and applications as they are developed.

4. All control objects shall conform to the control objects specified in the BACnet specification.
5. The library shall include applications or objects for the following functions, at a minimum:

    a. Scheduling Object: The schedule must conform to the schedule object as defined in the BACnet specification, providing seven-day plus holiday and temporary scheduling features and a minimum of 10 on/off events per day. Data entry to be by graphic sliders to speed creation and selection of on-off events.
    b. Calendar Object: The calendar must conform to the calendar object as defined in the BACnet specification, providing 12-month calendar features to allow for holiday or special event data entry. Data entry to be by graphic "point-and-click" selection. This object must be "linkable" to any or all scheduling objects for effective event control.
    c. Override Object: Provide override object that is capable of restarting equipment turned off by other energy saving programs to maintain occupant comfort or for equipment protection.
    d. Start-Stop Time Optimization Object: Provide a start-stop time optimization object to start equipment just early enough to bring space conditions to desired conditions by the scheduled occupancy time. Also, allow equipment to be stopped before the scheduled unoccupied time just far enough ahead to take advantage of the building's "flywheel" effect for energy savings. Provide automatic tuning of all start-stop time object properties based on historical performance.
    e. Demand Limiting Object: Provide a demand-limiting object that is capable of controlling demand for any selected energy utility (electric, oil, gas, etc.). The object shall be able to monitor a demand value and predict (using a sliding window prediction algorithm) the demand at the end of the user-defined interval period (1 to 60 minutes). This object shall also accommodate a utility meter time sync pulse for fixed interval demand control. Upon a prediction that will exceed the user-defined demand limit (supply a minimum of 6 per day), the demand limiting object shall issue shed commands to either turn off user specified loads or modify equipment setpoints to provide the desired energy reduction. If the list of sheddable equipment is not enough to reduce the demand to below the setpoint, display a message on the user's screen (as an alarm) instructing the user to take manual actions to maintain the desired demand. The shed lists are specified by the user and shall be selectable to be shed in either a fixed or rotating order to control which equipment is shed the most often. Upon suitable reductions in demand, the demand-limiting object shall restore the equipment that was shed in the reverse order in which it was shed. Each sheddable object shall have a minimum and maximum shed time property to provide both equipment protection and occupant comfort.

6. The library shall include control objects for the following functions:

    a. Analog Input Object: Minimum requirement is to comply with the BACnet standard for data sharing. Allow high, low and failure limits to be assigned for alarming. Also, provide a time delay filter property to prevent nuisance alarms caused by temporary excursions above or below the user defined alarm limits.
    b. Analog Output Object: Minimum requirement is to comply with the BACnet standard for data sharing.
    c. Binary Input Object: Minimum requirement is to comply with the BACnet standard for data sharing. The user must be able to specify either input condition for alarming. This object must also include the capability to record equipment runtime by counting the amount of time the hardware input is in an "on" condition. The user must be able to specify either input condition as the "on" condition.

d. Binary Output Object: Minimum requirement is to comply with the BACnet standard for data sharing. Properties to enable minimum on and off times for equipment protection as well as start-to-start delay must be provided. Incorporate the BACnet Command Prioritization priority scheme to allow multiple control applications to execute commands on this object with the highest priority command being invoked. Provide 16 levels of priority as a minimum. Systems not employing the BACnet method of contention resolution are not acceptable.
e. PID Control Loop Object: Minimum requirement is to comply with the BACnet standard for data sharing. Each individual property must be adjustable to allow proportional control only, or proportional with integral control, or proportional, integral and derivative control.
f. Comparison Object: Allow a minimum of two analog objects to be compared to select either the highest, lowest, or equality between the two linked inputs. Also, allow limits to be applied to the output value for alarm generation.
g. Math Object: Allow a minimum of four analog objects to be tested for the minimum or maximum, or the sum, difference, or average of linked objects. Also, allow limits to be applied to the output value for alarm generation.
h. Custom Programming Objects: Provide a blank object template for the creation of new custom objects to meet specific user application requirements. This object must provide a simple BASIC-like programming language that is used to define object behavior. Provide a library of functions including, but not limited to, math and logic functions and string manipulation. Also, provide a comprehensive on-line debug tool to allow complete testing of the new object. Allow new objects to be stored in the library for reuse.
i. Interlock Object: Provide an interlock object that provides a means of coordination of objects within a piece of equipment, such as an air handler or other similar types of equipment. An example is to link the return fan to the supply fan such that, when the supply fan is started, the return fan object is also started automatically without the user having to issue separate commands or to link each object to a schedule object. In addition, the control loops, damper objects, and alarm monitoring (such as return air, supply air, and mixed air temperature objects) will be inhibited from alarming during a user-defined period after startup to allow for stabilization. When the air handler is stopped, the interlocked return fan is also stopped, the outside air damper is closed, and other related objects within the air handler unit are inhibited from alarming, thereby eliminating nuisance alarms during the off period.
j. Temperature Override Object: Provide an object whose purpose is to override a binary output to an "on" state in the event a user-specified high or low limit value is exceeded. Link this object to the desired binary output object as well as to an analog object for temperature monitoring to cause the override to be enabled. This object will execute a start command at the Temperature Override level of start/stop command priority, unless changed by the user.
k. Composite Object: Provide a container object that allows a collection of objects representing an application to be encapsulated to protect the application from tampering or to more easily represent large applications. This object must have the ability to allow the user to select the appropriate parameters of the "contained" application that are represented on the graphic shell of this container.

7. The object library shall include objects to support the integration of devices connected to the Network Area Controller (NAC). Provide the following as part of the standard library included with the programming software:

    a. LonMark/LonWorks Devices: These devices shall include, but not be limited to, devices for control of HVAC, lighting, access, and metering. Provide LonMark manufacturer-specific objects to facilitate simple integration of these devices. Support all network variables defined in the LonMark profile. The device manufacturer shall provide information (type and function) regarding network variables not defined in the LonMark profile.
    b. For devices not conforming to the LonMark standard, provide a dynamic object that can be assigned to the device based on network variable information provided by the device manufacturer. Device manufacturer shall provide an XIF file, resource file, and documentation for the device to facilitate device integration.
    c. For BACnet devices, provide the following objects:

        1) Analog In.
        2) Analog Out.
        3) Analog Value.
        4) Binary.
        5) Binary In.
        6) Binary Out.
        7) Binary Value.
        8) Multi-State In.
        9) Multi-State Out.
        10) Multi-State Value.
        11) Schedule Export.
        12) Calendar Export.
        13) Trend Export.
        14) Device.

    d. For each BACnet object, provide the ability to assign the object a BACnet device and object instance number.
    e. For BACnet devices, provide the following support at a minimum:

        1) Segmentation.
        2) Segmented Request.
        3) Segmented Response.
        4) Application Services.
        5) Read Property.
        6) Read Property Multiple.
        7) Write Property.
        8) Write Property Multiple.
        9) Confirmed Event Notification.
        10) Unconfirmed Event Notification.
        11) Acknowledge Alarm.
        12) Get Alarm Summary.
        13) Who-has.
        14) I-have.
        15) Who-is.
        16) I-am.
        17) Subscribe COV.
        18) Confirmed COV notification.
        19) Unconfirmed COV notification.
        20) Media Types.

21) Ethernet.
22) BACnet IP Annex J.
23) MSTP.
24) BACnet Broadcast Management Device (BBMD) function.
25) Routing.

2.6 SYSTEM PROGRAMMING

A. The GUI software shall perform system programming and graphic display engineering. Access to the GUI software shall be through password access as assigned by the system administrator.

B. Provide a library of control, application, and graphic objects to enable creation of all applications and user interface screens. Applications shall be created by selecting the control objects from the library, dragging or pasting them on the screen, and linking them together using a built-in graphic connection tool. Completed applications may be stored in the library for future use. GUI screens shall be created in the same fashion. Data for the user displays shall be obtained by graphically linking the user display objects to the application objects to provide "real-time" data updates. Any real-time data value or object property may be connected to display its current value on a user display. Provide all software tools or processes to create applications and user interface displays.

C. Programming Methods:

1. Provide the capability to copy objects from the supplied libraries or from a user-defined library to the user's application. Link objects with a graphic linking scheme by dragging a link from one object to another. Object links will support one-to-one, many-to-one, or one-to-many relationships. Linked objects shall maintain their connections to other objects regardless of where they are positioned on the page and shall show link identification for links to objects on other pages for easy identification. Links will vary in color depending on the type of link; e.g., internal, external, hardware, etc.
2. Configuration of each object shall be done through the object's property sheet using fill-in-the-blank fields, list boxes, and selection buttons. Use of custom programming, scripting language, or a manufacturer-specific procedural language for configuration is not acceptable.
3. The software shall provide the ability to view the logic in a monitor mode. When on-line, the monitor mode shall provide the ability to view the logic in real time for easy diagnosis of the logic execution. When off-line (debug), the monitor mode shall allow the user to set values to inputs and monitor the logic for diagnosing execution before it is applied to the system.
4. All programming shall be done in real time. Systems requiring the uploading, editing, and downloading of database objects are not allowed.
5. The system shall support object duplication in a customer's database. An application, once configured, can be copied and pasted for easy reuse and duplication. All links, other than to the hardware, shall be maintained during duplication.

2.7 HYDRONIC CONTROL VALVES

A. General:

1. Two-position valves shall be a minimum of line size with a maximum allowable pressure drop of 1 psi.
2. Size two-way and three-way modulating valves to provide a pressure drop at full flow of 4 to 5 psi, except boiler three-way and cooling tower bypass valves shall not have a pressure drop over 4 psi.

3. Modulating two-way valves shall have equal percentage flow characteristics.
4. Modulating three-way valves shall have linear flow characteristics.
5. Piping geometry correction factors for C_v ratings shall be used and stated for ball valves, butterfly valves, or non-characterized valves.

B. Modulating:

1. Ball 2" and under:

a. Design Pressure: 400 psi

1) Design Temperature: 250°F
2) Design Flow Differential Pressure Rating: 35 psi
3) Leakage: 0%

b. Bronze or brass body, nickel plated brass or stainless steel stem, chrome plated brass or stainless steel ball, EPDM, PTFE or RTFE seats and seals, PTFE characterizing disc, screwed ends.

2.8 VALVE ACTUATORS

A. General:

1. Actuators shall be sized to operate the valve through its full range of motion and shall close against pump shutoff pressure without producing audible noise at any valve position.
2. Provide visual position indication.
3. Mount actuator directly on valve or provide linear motion assembly as required for valve type.

B. Valve Actuators - Electronic:

1. Actuator shall be UL 873 or 60730 listed and provided with NEMA housing for applicable environment, electronic overload protection to prevent actuator damage due to over-rotation. Mount actuator by means of a V-bolt dual nut clamp with a V-shaped toothed cradle, directly couple and mount to the valve bonnet stem, or ISO-style direct-coupled mounting pad. Actuators shall be capable of being mechanically and electrically paralleled to increase torque, if required.
2. Actuators shall be warranted for a period of five (5) years from the date of production, with the first two (2) years unconditional.
3. Proportional actuator position shall be proportional to analog or pulse width modulating signal from electronic control system.
4. Fail-Safe Valves: Where shown on the drawings or sequences, fail-safe mechanism shall operate the valve to the fail position following power interruption.

a. Mechanical/Spring: Mechanical spring return mechanism to drive controlled drive to an end position (open or close) on loss of power.
b. Electronic: Electronic fail-safe shall incorporate an active balancing circuit to maintain equal charging rates among the capacitors. The power fail position shall be proportionally adjustable between 0 to 100% in 10 percent increments with a 2 second10 second operational delay.

5. Feedback: Where shown on drawings or sequences, provide analog feedback signal for positive position indication.

2.9 CONTROL INSTRUMENTATION

A. Temperature Sensors:

1. Room Temperature Sensor:

a. Sensor Only: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range, ± 0.50°F accuracy, no setpoint adjustment or override button.
b. Sensor with Setpoint Adjustment: Two-piece construction, ventilated plastic enclosure, off-white color, thermistor sensing element or resistance temperature device (RTD), 45°F to 90°F operating range, ± 0.50°F accuracy, with exposed single setpoint adjustment (no numeric temperature scale - provide with a single warmer/cooler or red/blue visual scale), no override button.

B. Humidity Measuring Devices:

1. Humidity Sensors:

a. Duct Humidity Sensors: Fully electronic with no moving parts or parts requiring periodic service. Accuracy shall be ± 2% of reading.

C. Pressure Measuring Devices

1. Differential Pressure Switches:

a. Standard Pressure Switches:

1) Diaphragm-activated gauge with 4-3/4" dial, cast aluminum case, sealed interior, designed to resist shock and vibration, and rated for 15 psig.
2) Accuracy shall be ± 3% of full scale maximum throughout entire range at 70°F.
3) Provide mounting brackets, probes, and shutoff valves required for proper installation.
4) The range and service shall be as required for application or as noted on the drawings.
5) Provide two (2) photo-transistor-activated circuits and two (2) DPDT relays for both high or low limit alarms or controls.
6) Provide latching relays that require manual reset once activated.
7) Acceptable Manufacturer: Dwyer Photohelic Series 3000.

D. Carbon Dioxide Sensors:

1. Microprocessor based non-dispersive infrared sensor with range of 0 to 2,000 ppm CO2 with ± 100 ppm accuracy, maximum drift (compensated) of ± 5% full scale in five years, VOC software and hardware sensing, duct mounting where applicable, 0-10V dc or 4-20 mA output directly proportional to ppm, adjustable alarm limit, membrane filter, and terminal block. The diffusion gas chamber in the sensor shall incorporate a reflective light pipe or wave guide surrounded by a gas permeable membrane that prevents particulate contamination of the sensor. Unit shall have selectable IAQ mode with output signal and sum of CO2 and VOC levels.

2.10 CONDUIT AND BOXES

A. Conduit and Boxes: Refer to Electrical Section 26 05 33 for materials, sizing, and other requirements

B. Conduit and Box Identification (Color and Labeling):

1. Provide blue conduit for temperature controls wiring.

2. Refer to Electrical Section 26 05 53 for raceway and box labeling requirements.

2.11 WIRE AND CABLE

A. Wire and Cable: Refer to Electrical Section 26 05 13 for wire and cable materials.

1. Wire and Cable Color: Refer to the Temperature Control Contractor notes located on the cover sheet for wire and cable color requirements.

PART 3 - EXECUTION

3.1 GENERAL INSTALLATION

A. Verify that systems are ready to receive work. Beginning of installation means installer accepts existing conditions.

B. Install system and materials in accordance with manufacturer's instructions.

C. Drawings of the TCS and FMCS network are diagrammatic only. Any apparatus not shown but required to meet the intent of the project documents shall be furnished and installed without additional cost.

D. Install all operators, sensors, and control devices where accessible for service, adjustment, calibration, and repair. Do not install devices where blocked by piping or ductwork. Devices with manual reset or limit adjustments shall be installed below 6'-0" if practical to allow inspection without using a ladder.

E. Verify locations of wall-mounted devices (such as thermostats, temperature and humidity sensors, and other exposed sensors) with drawings and room details before installation. Coordinate mounting heights to be consistent with other wall-mounted devices. Maximum height above finished floor shall not exceed ADA mounting requirements.

F. Provide valves over 3/4" size with position indicators and pilot positioners where sequenced with other controls.

G. Mount control panels adjacent to associated equipment on vibration-free walls or freestanding angle iron supports. One cabinet may accommodate more than one system in same equipment room.

H. After completion of installation, test and adjust control equipment.

I. Check calibration of instruments. Recalibrate or replace.

J. Furnish and install conduit, wire, and cable per the National Electric Code, unless noted otherwise in this section.

K. All hardware, software, equipment, accessories, wiring (power and sensor), piping, relays, sensors, power supplies, transformers, and instrumentation required for a complete and operational FMCS system, but not shown on the electrical drawings, are the responsibility of the TCC.

L. Remodeling:

1. All room devices as indicated on the drawings shall be removed by this Contractor. The Contractor shall also prepare the wall for finishes. Preparing the wall shall include patching old anchor holes (after the anchoring device has been removed) and sanding the wall to remove old paint outlines remaining from original devices. The wall shall be painted to match the existing wall prior to the installation of the new room device. If wall covering requires patching, the Contractor shall furnish new wall covering to match existing. If new wall covering is not available to match existing, the Contractor shall furnish a white acrylic or Plexiglas plate, 1/4" thick and sized to cover the void.

M. Labels For Control Devices:

1. Provide labels indicating service of all control devices in panels and other locations.
2. Labels may be made with permanent marking pen in the control panels if clearly legible.
3. Use engraved labels for items outside panel such as outside air thermostats.
4. Labels are not required for room thermostats, damper actuators and other items where their function is obvious.

3.2 GRAPHIC DISPLAY

A. Create a customized graphic for each piece of equipment indicated on the itemized points list.

B. Components shall be arranged on graphic as installed in the field.

C. Include each graphic point listed in the itemized points list using real time data.

D. The FMCS shall include full graphic operator interface to display the following graphics as a minimum:

1. Home page to include a minimum of six critical points: Outside Air Temperature, Outside Air Relative Humidity, Enthalpy, KWH, KW, etc.
2. Graphic floor plans accurately depicting rooms, walls, hallways, and showing accurate locations of space sensors and major mechanical equipment.
3. Detailed graphics for each mechanical system including AHUs, ERUs, EFs, chillers, and boilers, as a minimum.
4. Access corresponding system drawings, technical literature, and sequences of operations directly from each system graphic.

E. The FMCS shall include individual graphical buttons to access the following data stored in PDF format:

1. Project control as-built documentation including all TCS drawings, diagrams and sequences of operation.
2. TCS Bill of Material for each system, e.g. AHU, RTU, FCU, boiler, etc.

3. Technical literature specification data sheets for all components listed in the TCS Bill of Material.

3.3 CONDUIT AND BOXES INSTALLATION

A. Conduit and Box Installation: Refer to Electrical Section 26 05 33 for execution and installation.

B. Conduit and Box Identification (color and labeling) installation. Refer to Electrical Section 26 05 53 for raceway and box identification installation.

C. Outlet Box Schedule: Thermostat/temperature sensor:

1. Dry Interior Locations: Provide 4" square galvanized steel with raised cover to fit flush with finished wall line. When located in concrete block walls, provide square edge title cover of sufficient depth to extend out to face of block or masonry boxes.
2. Other Conditions: Refer to Electrical Section 26 05 33 for requirements.

3.4 WIRE AND CABLE INSTALLATION

A. Wire and Cable Installation: Refer to Electrical Section 26 05 13 for execution and installation.

B. Field Quality Control:

1. Inspect wire and cable for physical damage and proper connection.
2. Torque test conductor connections and terminations to manufacturer's recommended values.
3. Perform continuity test on all conductors.
4. Protection of cable from foreign materials:

a. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
b. Overspray of paint on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

C. Installation Schedule:

1. Conduit terminations to all devices installed in applications with rotating equipment, expansion/contraction or vibration shall be made with flexible metallic conduit, unless noted otherwise. Final terminations to exterior devices installed in damp or wet locations shall be made with liquidtight flexible metallic conduit. Terminations in hazardous areas, as defined in the National Electrical Code, shall be made with flexible conduit rated for the environment.

3.5 FMCS INSTALLATION

A. Coordinate voltage and ampacity of all contacts, relays, and terminal connections of equipment being monitored or controlled. Voltage and ampacity shall be compatible with equipment voltage and be rated for full ampacity of wiring or overcurrent protection of circuit controlled.

B. Naming Conventions: Coordinate all point naming conventions with Owner standards. In the absence of Owner standards, naming conventions shall use equipment designations shown on plans.

3.6 COMMISSIONING

A. Upon completion of the installation, this Contractor shall load all system software and start up the system. This Contractor shall perform all necessary calibration, testing and de-bugging and perform all required operational checks to ensure that the system is functioning in full accordance with these specifications.

B. This Contractor shall perform tests to verify proper performance of components, routines, and points. Repeat tests until proper performance results. This testing shall include a point-by-point log to validate 100% of the input and output points of the FMCS system operation.

C. This Contractor shall prove that the controls network is functioning correctly and within acceptable bandwidth criteria and shall test the system with an approved protocol analysis tool. Provide a log and statistics summary showing that each channel is within acceptable parameters. Each channel shall be shown to have at least 25% spare capacity for future expansion.

D. Upon completion of the performance tests described above, repeat these tests, point by point, as described in the validation log above in the presence of Owner's Representative, as required. Properly schedule these tests so testing is complete at a time directed by the Owner's Representative. Do not delay tests so as to prevent delay of occupancy permits or building occupancy.

E. System Acceptance: Satisfactory completion is when this Contractor has performed successfully all the required testing to show performance compliance with the requirements of the Contract Documents to the satisfaction of the Owner's Representative. System acceptance shall be contingent upon completion and review of all corrected deficiencies.

3.7 PREPARATION FOR BALANCING

A. Verify that all dampers are in the position indicated by the controller (e.g., open, closed or modulating).

B. Check the calibration and setpoints of all controllers.

C. Check the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts, or cold walls.

D. Check that all sequences operate as specified. Verify that no simultaneous heating and cooling occurs, unless specified. Observe that heating cannot begin at TAB reheat terminals until the unit is at the minimum CFM.

E. Verify the operation of all interlock systems.

3.8 TEST AND BALANCE COORDINATION

A. The Contractor shall furnish a single set of all tools necessary to interface to the control system for test and balance purposes.

B. The Contractor shall provide a minimum of four (4) hours training for the Balancing Contractor in the use of these tools.

C. In addition, the Contractor shall provide a qualified technician to assist in the test and balance process until the first 20 terminal units are balanced.

D. The tools used during the test and balance process shall be returned at the completion of the testing and balancing.

3.9 DEMONSTRATION AND ACCEPTANCE

A. At completion of installation, provide two days minimum instruction for operators. Demonstrate operation of all controls and systems. Describe the normal operation of all equipment.

3.10 TRAINING

A. On-Site:

1. After completion of commissioning, the manufacturer shall provide 8 hours of training on consecutive days for 4 Owner's representatives. The training course shall enable the Owner's representatives to perform Day-to-Day Operations as defined herein. A factory-trained instructor with experience in presenting the training material and the system programmer for this project shall perform the training.

B. Day-to-Day Operations - Training Description:

1. Proficiently operate the system.
2. Understand control system architecture and configuration.
3. Understand FMCS systems components.
4. Understand system operation, including FMCS system control and optimizing routines (algorithms).
5. Operate the workstation and peripherals.
6. Log-on and off the system.
7. Access graphics, point reports, and logs.
8. Adjust and change system setpoints, time schedules, and holiday schedules.
9. Recognize malfunctions of the system by observation of the printed copy and graphic visual signals.
10. Understand system drawings and Operation and Maintenance manual.
11. Understand the job layout and location of control components.
12. Access data from FMCS controllers and ASCs.

13. Operate portable operator's terminals.

3.11 INSTALLATION OF SENSORS

A. Install sensors in accordance with the manufacturer's recommendations.

B. Mount sensors rigidly and adequately for the environment within which the sensor operates.

C. Room temperature sensors shall be installed on concealed junction boxes properly supported by the wall framing.

D. All wires attached to sensors shall be air sealed in their raceways or in the wall to stop air transmitted from other areas affecting sensor readings.

E. Install all wall-mounted CO2 sensors between 3 feet and 6 feet above the floor.

END OF SECTION

SECTION 23 11 23 - NATURAL GAS PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and Pipe Fittings.

B. Valves.

C. Natural Gas Piping System.

1.2 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.

B. Welding Materials, Procedures, and Operators: Conform to ASME Section 9, ANSI/AWS D1.1, and applicable state labor regulations.

C. Welders Certification: In accordance with ANSI/ASME Sec 9 or ANSI/AWS D1.1.

1.3 REFERENCES

A. ANSI/AWS D1.1 - Structural Welding Code.

B. ANSI/AWWA C111/A21.11 - Rubber Gasket Joints for Ductile Iron Pressure Pipe and Fittings.

C. ASME - Boiler and Pressure Vessel Code - Section 9.

D. ASME B1.20.1 - Pipe Threads, General Purpose.

E. ASME B16.3 - Malleable Iron Threaded Fittings Class 150 and 300.

F. ASME B16.39 - Malleable Iron Threaded Pipe Unions.

G. ASTM A53 - Pipe, Steel, Black and Hot-Dipped Zinc Coated, Welded and Seamless.

H. ASTM A105 - Standard Specification for Carbon Steel Forgings for Piping Applications.

I. ASTM A181 - Forgings, Carbon Steel for General Purpose Piping.

J. ASTM A197 - Standard Specification for Cupola Malleable Iron.

K. ASTM A234 - Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service.

L. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials.

M. NFPA 54 - National Fuel Gas Code.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store and protect piping to prevent entrance of foreign matter into pipe and to prevent exterior corrosion.

B. Deliver and store valves in shipping containers with labeling in place.

PART 2 - PRODUCTS

2.1 NATURAL GAS (0 TO 125 PSI)

A. Design Pressure: 125 psi.

1. Maximum Design Temperature: 350°F

B. Piping - 2" and Under:

1. Pipe: Standard weight black steel, threaded and coupled, ASTM A53.
2. Joints: Screwed. (NOTE: For below ground, all sizes to have welded joints.)
3. Fittings: 150# steam - 300# CWP, black malleable iron, banded, ASTM A197, ANSI B16.3.
4. Unions: 250# - 500# CWP, black malleable iron, ANSI B16.39, ground joint with brass seat.

C. Piping - 2-1/2" and Over:

1. Pipe: Standard weight black steel, beveled ends, ASTM A53.
2. Joints: Butt welded or flanged.
3. Fittings: Standard weight seamless steel, butt weld type, ASTM A234, Grade I, ANSI B16.9.
4. Flanges: 150# forged steel, weld neck or slip-on, ASTM A181, Grade I, ANSI B16.5. Flange face seal weld (backweld) is required for slip-on flanges.

D. Shutoff Valves:

1. BA-13: 2" and under, threaded 600 psi CWP; UL listed for 250# LP, flammable liquid, heating oil, natural and manufactured gases, 150 psi steam, bronze body and chrome plated brass ball, Teflon seats and packing.

a. Body: Bronze.

1) Manufacturers:

a) Apollo #80-100
b) Nibco #T580-70-UL or #T585-70-UL

b. Body: Dezincification resistant brass alloy. Jomar T-100NE.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends, remove burrs, bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.

D. Connect to all equipment with flanges or unions.

3.2 TESTING PIPING

A. Low Pressure - Up to 1 psi:

1. Test piping with 20 psi air pressure. System must hold this pressure without adding air for two hours.

B. High Pressure - Above 1 psi:

1. Test piping with compressed air at twice the operating gas pressure, but at least 20 psi. System must hold this pressure without adding air for two hours.

C. A non-combustible odorant, such as oil of wintergreen, may be added to help locate leaks.

3.3 CLEANING PIPING

A. Assembly:

1. Prior to assembly of pipe and piping components, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer. Blow chips and burrs out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping and wire brushing to the degree consistent with good piping practices.
3. Notify the Architect/Engineer prior to starting any post erection cleaning operation in time to allow witnessing the operation. Properly dispose of cleaning and flushing fluids.
4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, control valves, and balance valves, and verify all strainer screens are in place.

3.4 INSTALLATION

A. Route piping in orderly manner, straight, plumb, with consistent pitch, parallel to building structure, with minimum use of offsets and couplings. Provide only offsets required for needed headroom or clearance and needed flexibility in pipe system.

B. Install piping to conserve building space, and not interfere with other work.

C. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Provide clearance for access to valves and fittings.

G. Provide access doors where valves are not exposed.

H. Prepare pipe, fittings, supports, and accessories for finish painting.

I. Install valves with stems upright or horizontal, not inverted.

J. Provide shutoff valves and flanges or unions at all connections to equipment, traps, and items that require servicing.

K. Arrange piping and piping connections so equipment may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.

L. Reducers are generally not shown. Where pipe sizes are not shown, the larger size in either direction shall continue through the fitting nearest to the indication of a smaller pipe size.

3.5 PIPE ERECTION AND LAYING

A. Carefully inspect all pipe, fittings, valves, equipment and accessories prior to installation. Immediately reject and remove from the job any items which are unsuitable, cracked or otherwise defective.

B. All pipe, fittings, valves, equipment and accessories shall have factory-applied markings, stampings, or nameplates sufficient to determine their conformance with specified requirements.

C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any unclean item.

D. During construction, until system is fully operational, keep all openings in piping and equipment closed at all times except when actual work is being performed on that item. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.

E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. All fittings shall be long radius type, unless otherwise shown on the drawings or specified. Construct welded elbows of angles not available as standard fittings by cutting and welding standard elbows to form smooth, long radius fittings.

F. Use full and double lengths of pipe wherever possible.

G. Cut all pipe to exact measurement and install without springing or forcing.

H. Do not create, even temporarily, undue loads, forces or strains on valves, equipment or building elements.

3.6 DRAINING AND VENTING

A. Unless otherwise indicated on the drawings, all horizontal pipes, including branches, shall pitch 1" in 40 feet to low points for complete drainage.

B. Use eccentric reducing fittings on horizontal runs when changing size for proper drainage and venting. Install gas pipes with bottom of pipe and eccentric reducers in a continuous line.

3.7 BRANCH CONNECTIONS

A. Make branch connections with standard tee or cross fittings of the type required for the service unless otherwise specified herein or detailed on the drawings.

B. At the option of the Contractor, branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.

C. Use of forged weld-on fittings is also limited as follows:

1. Must have at least same pressure rating as the main.
2. Header or main must be 2-1/2" or over.
3. Branch line is at least two pipe sizes under header or main size.

D. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it.

E. All branch piping connections for natural gas shall take off on the top or on the side of the main.

3.8 JOINING OF PIPE

A. Threaded Joints:

1. Ream pipe ends and remove all burrs and chips.
2. Protect plated pipe and valve bodies from wrench marks when making up joints.
3. Apply gas-rated Teflon tape or thread compound to male threads.

B. Flanged Joints:

1. Steel flanges shall be raised face.
2. Bolting for services up to 500°F shall be ASTM A307 Grade B with square head bolts and heavy hexagonal nuts conforming to ANSI B18.2.1 "Square and Hex Bolts" and B18.2.2 "Square and Hex Nuts".
3. Torque bolts in at least three passes, tightening to 1/3, 2/3, and final torque in a cross pattern with an indicating torque wrench for equal tension in all bolts.
4. Gaskets for flat face flanges shall be full face type. Gaskets for raised faced flanges shall conform to requirements for "Group I Gaskets" in ANSI B16.5. Unless otherwise specified gaskets shall meet the following requirements:

    a. Gasket material and thickness approved by manufacturer for intended service, chemical compatibility, pipe system test pressure, and operating temperature range.
    b. Maximum pressure rating of at least 250 psig.

c. Minimum temperature rating: -10°F.
d. Maximum temperature rating of at least 170°F for water systems operating 140°F and less.

C. Welded Joints:

1. Welding of all pipe joints, both as to procedures and qualification of welders, shall be in accordance with Section IX, ASME "Boiler & Pressure Vessel Code" unless local codes take precedence.
2. Furnish certificates qualifying each welder to the Owner's Representative prior to start of work.
3. The Owner's Representative reserves the right to require qualifying demonstration, at the Contractor's expense, of any welders assigned to the job.
4. Ends of pipe and fittings to be joined by butt-welding shall be beveled, cleaned to bare metal and internal diameters aligned before tack welding.

3.9 PAINTING EXPOSED PIPE

A. Paint all outdoor exposed natural gas piping the color selected by Owner or Architect/Engineer.

END OF SECTION

SECTION 23 21 00 - HYDRONIC PIPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Pipe and Pipe Fittings

B. Valves

C. Check Valves

D. Strainers

E. System Piping Schedule

1.2 QUALITY ASSURANCE

A. Valves: Manufacturer's name and pressure rating marked on valve body. Remanufactured valves are not acceptable.

B. Welding Materials, Procedures, and Operators: Conform to ASME Section 9, ANSI/AWS D1.1, and applicable state labor regulations.

C. All grooved couplings, fittings, valves, and specialties shall be the products of a single manufacturer. Grooving tools shall be of the same manufacturer as the grooved components.

1. All castings used for couplings housings, fittings, or valve and specialty bodies shall be date stamped for quality assurance and traceability.

1.3 REFERENCES

A. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings

B. ASME B16.22 - Wrought Copper and Copper Alloy Solder Joint Pressure Fittings.

C. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV.

D. ASME B16.51 - Copper And Copper Alloy Press-Connect Pressure Fittings.

E. ASTM B32 - Standard Specification for Solder Metal.

F. ASTM B88 - Seamless Copper Water Tube.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Store and protect piping to prevent entrance of foreign matter into pipe and to prevent exterior corrosion.

B. Deliver and store valves in shipping containers with labeling in place.

1.5 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 23 05 00 for required hydronic systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

PART 2 - PRODUCTS

2.1 COPPER PIPE (ABOVE GRADE)

A. Design Pressure 125 psig. Maximum Design Temperature 225°F.

B. Copper Pipe; Type L; Soldered Joints:

1. Tubing: Type L drawn temper seamless copper tube, ASTM B88.
2. Joints: Solder with Type 95-5 solder. 50-50 solder is not acceptable.
3. Fittings: Wrought copper solder joint, ASME B16.22.

C. Copper Pipe; Type L; Mechanical Press Connection:

1. Tubing: Type L hard drawn seamless copper tube, ASTM B88.
2. Joints: Mechanical press connection.
3. Fittings: Copper, ASME B-16.51, with embedded EPDM O-ring, NSF-61.
4. Fitting Identification: Press ends shall provide the ability to identify an unpressed fitting from the floor prior to testing. The function of this feature is to provide the installer quick and easy identification of connections that have not been pressed prior to putting the system into operation.
5. Special Requirements: Mechanical press fitting manufacturer shall provide contractor training prior to installation.
6. Manufacturers:

    a. Viega ProPress.
    b. Elkhart Xpress.
    c. NIBCO Press System Fittings and Valves.
    d. Merit Brass
    e. Mueller Streamline PRS.

2.2 COPPER TUBING (UNDERGROUND INSIDE BUILDING)

A. Design Pressure 150 psig, Maximum Design Temperature 200°F.

B. Copper Pipe; Type K; Solder Joints:

1. Pipe: Type K annealed copper tube, ASTM B88.
2. Joints: Solder with 100% lead-free solder and flux, ASTM B32, BCup silver braze, AWS A5.8.
3. Fittings: Wrought copper solder joint, ANSI B16.22.

C. Joints are permitted only if the maximum available coil length is exceeded. Fittings are permitted only if tees are shown on the drawings.

2.3 VALVES

A. Shutoff Valves:

1. For pipe systems where mechanical press connections are allowed, shutoff valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.
2. Ball Valves:

a. BA-1 (Steel and Copper): 3" and under, 125 psi saturated steam, 600 psi WOG, full port, screwed or solder ends (acceptable only if rated for soldering in line with 470°F melting point of lead-free solder), bronze body of a copper alloy containing less than 15% zinc, stainless steel ball and trim, Teflon seats and seals.

1) Body: Bronze of a copper alloy containing less than 15% zinc.

a) Manufacturers: Apollo #77C-140, Stockham #S-206 BR1-R, Milwaukee #BA-400, Watts, Nibco #585-70-66, National Utilities Co., RUB, Jomar T/S-200CSS.

2) Body: Dezincification resistant brass alloy. Jomar T/S-100CSSG.
3) Provide extended shaft with operating handle of non-thermal conductive material and protective sleeve that allows operation of valve, adjustment of the packing, and adjustment of the memory stop without breaking the vapor seal or disturbing the insulation for all valves in insulated piping. (For example, Jomar modifies valve part number with -IH for insulated handle.)
4) Provide lock out trim for all valves opening to atmosphere installed in domestic water piping over 120°F, heating water piping over 120°F, steam, condensate, boiler feed water piping, compressed air piping and gasoline/kerosene piping, and as indicated on the drawings. Solid extended shaft is not required on valves with lock out trim. (For example, Jomar modifies valve part number with -LH for locking handle.)

2.4 LOCK OUT TRIM

A. Provide lock out trim for all quarter turn valves opening to atmosphere installed in heating water piping over 120°F and as indicated on the drawings.

2.5 CHECK VALVES

A. For pipe systems where mechanical press connections are allowed, check valves with mechanical press connections are acceptable subject to the requirements in the paragraphs below.

B. CK-1: Check Valves (Steel Pipe); 2" and under, 125 psi S @ 353°F, 200 psi WOG @ 150°F, screwed, bronze, horizontal swing.

1. Manufacturers:

a. Crane #37
b. Hammond #IB904
c. Walworth #3406
d. Milwaukee #509
e. NIBCO #T-413

f. Jomar T-511G

2.6 STRAINERS

A. For pipe systems where mechanical press connections are allowed, strainers with mechanical press connections are acceptable subject to the requirements in the paragraphs below.

B. ST-1: Bronze body, screwed ends, screwed cover, 125 psi S @ 353°F, 200 psi WOG @ 150°F

1. Manufacturers:

a. Armstrong #F4SC
b. Metraflex #TS
c. Mueller Steam Specialty Co. #351
d. Sarco #BT
e. Watts #777
f. NIBCO T-221-A.

C. Furnish pipe nipple with ball valve, threaded hose connection, and cap to blow down all strainer screens.

D. Use bronze body strainers in copper piping and iron body strainers in ferrous piping.

PART 3 - EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends, remove burrs, bevel plain-end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Remove all scale, rust, dirt, oils, stickers and thoroughly clean exterior of all bare metal exposed piping, hangers, and accessories in preparation to be painted.

D. Connect to all equipment with flanges or unions. Unions or flanges for servicing and disconnect are not required in installations using grooved joint couplings.

E. Flush and clean piping as defined below. When system water is clear, remove, clean and replace all strainer screens (blowing down strainer without removing and cleaning screen is not acceptable).

3.2 SYSTEMS, PIPING, AND VALVE SCHEDULE

A. Heating Water:

1. Copper Pipe; Type L; Soldered Joints: 2" and Under
2. Copper Pipe; Type L; Mechanical Press Connection: 4" and Under
3. Shutoff Valves: , BA-1
4. Check Valves: CK-1
5. Strainers: ST-1

B. Heating Water (Underground):

1. Copper Pipe; Type K; Solder Joints: 2" and Under

3.3 TESTING PIPING

A. Test pipes underground or in chases and walls before piping is concealed.

B. Complete testing before insulation is applied. If insulation is applied before pipe is tested and a leak ruins the insulation, replace all damaged insulation.

C. Test the pipe with water at 1.5 times the design pressure, but not less than 125 psig pressure. Hold pressure for at least two hours.

D. Tests to be witnessed by the Architect/Engineer or their representative, if requested by the Architect/Engineer.

3.4 CLEANING PIPING

A. Assembly:

1. Prior to assembly of pipe and piping components, remove all loose dirt, scale, oil and other foreign matter on internal or external surfaces by means consistent with good piping practice subject to approval of the Architect/Engineer. Blow chips and burrs out of pipe before assembly. Wipe cutting oil from internal and external surfaces.
2. During fabrication and assembly, remove slag and weld spatter from both internal and external joints by peening, chipping, and wire brushing to the degree consistent with good piping practices.
3. Notify the Architect/Engineer prior to starting any post-erection cleaning operation in time to allow witnessing the operation. Properly dispose of cleaning and flushing fluids.
4. Prior to blowing or flushing erected piping systems, disconnect all instrumentation and equipment, open wide all valves, control valves, and balance valves, and verify all strainer screens are in place.

3.5 INSTALLATION

A. General Installation Requirements:

1. Route piping in orderly manner, straight, plumb, with consistent pitch, parallel to building structure, with minimum use of offsets and couplings. Provide only offsets required for needed headroom or clearance and needed flexibility in pipe system.
2. Install piping to conserve building space and not interfere with other work.
3. Group piping whenever practical at common elevations.
4. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
5. Reducers are generally not shown. Where pipe sizes change at tee, the tee shall be the size of the largest pipe shown connecting to it. Where pipe sizes are not shown, the larger size in either direction shall continue through the fitting nearest to the indication of a smaller pipe size.
6. Branch takeoffs shall be from the top side (if branch is two sizes smaller than main), or any angle from the horizontal plane to the top of piping.

B. Installation Requirements in Electrical Rooms:

1. Do not install piping or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the equipment plus its required clearance space.

C. Valves/Fittings and Accessories:

1. Provide chain operators for all valves over 2" size that are over 10'-0" above finished floor. Extend to 7'-0" above finished floor.
2. Provide clearance for installation of insulation, and access to valves and fittings.
3. Prepare pipe, fittings, supports, and accessories for finish painting.
4. Install valves with stems upright or horizontal, not inverted, except install manual quarter turn valves in radiation cabinets and all butterfly valves with stems horizontal.
5. Provide shutoff valves and flanges or unions at all connections to equipment, traps, and items that require servicing.
6. Provide flanges or unions at all final connections to equipment, traps and valves.
7. Arrange piping and piping connections so equipment may be serviced or totally removed without disturbing piping beyond final connections and associated shutoff valves.
8. Horizontal swing check valves may only be installed in horizontal position. Do not install horizontal swing check valves in upward or downward flow direction. Where upward or downward flow installation is required, use spring-assisted, non-slam check valve.

D. Underground Piping:

1. Lay all underground piping in trenches. Provide and operate pumping equipment to keep trenches free of water.
2. Install thrust blocking and restraints on all underground piping at elbows and other changes in pipe direction.
3. Refer to Section 23 05 00 for Excavation, Fill, Backfill and Compaction requirements.

3.6 PIPE ERECTION AND LAYING

A. Carefully inspect all pipe, fittings, valves, equipment and accessories prior to installation. Immediately reject and remove from the job any items which are unsuitable, cracked or otherwise defective.

B. All pipe, fittings, valves, equipment and accessories shall have factory-applied markings, stampings, or nameplates sufficient to determine their conformance with specified requirements.

C. Exercise care at every stage of storage, handling, laying and erecting to prevent entry of foreign matter into piping, fittings, valves, equipment and accessories. Do not erect or install any unclean item.

D. During construction, until system is fully operational, keep all openings in piping and equipment closed at all times except when actual work is being performed on that item. Closures shall be plugs, caps, blind flanges or other items designed for this purpose.

E. Change direction of pipes only with fittings or pipe bends. Change size only with fittings. Do not use miter fittings, face or flush bushings, or street elbows. 2-1/2" and larger fittings shall be long radius type, unless otherwise shown on the drawings or specified. Construct welded elbows of angles not available as standard fittings by cutting and welding standard elbows to form smooth, long radius fittings.

F. Use full and double lengths of pipe wherever possible.

G. Unless otherwise indicated, install all inlet and outlet piping, including shutoff valves and strainers, to coils, pumps and other equipment at line size with reduction in size being made only at control valve or pump.

H. Cut all pipe to exact measurement and install without springing or forcing except in the case of expansion loops where cold springing is indicated on the drawings.

I. Do not create, even temporarily, undue loads, forces or strains on valves, equipment or building elements.

3.7 DRAINING AND VENTING

A. Unless otherwise indicated on the drawings, all horizontal pipes, including branches, shall pitch 1" in 40 feet to low points for complete drainage, removal of condensate, and venting.

B. Provide drain valves at all low points of water piping systems or where indicated on drawings for complete or sectionalized draining. Drain valves are defined above.

C. Use eccentric reducing fittings on horizontal runs when changing size for proper drainage and venting. Install all liquid lines with top of pipe and eccentric reducers in a continuous line.

D. Provide air vents at all high points and wherever else required for elimination of air in all water piping systems. Do not use automatic air vents in glycol systems unless they are piped to the fill tank.

E. Air vents shall be in accessible locations. If needed to trap and vent air in a remote location, a 1/8" pipe shall connect the tapping location to a venting device in an accessible location.

F. All vent and drain piping shall be of same materials and construction as the service involved.

3.8 BRANCH CONNECTIONS

A. Make branch connections with standard tee or cross fittings of the type required for the service unless otherwise specified herein or detailed on the drawings.

B. At the option of the Contractor, branch connections from headers and mains may be cut into black steel pipe using forged weld-on fittings.

C. Use of forged weld-on fittings is also limited as follows:

1. Must have at least same pressure rating as the main.
2. Header or main must be 2-1/2" or over.
3. Branch line is at least two pipe sizes under header or main size.

3.9 JOINING OF PIPE

A. Solder Joints (Copper Pipe):

1. Make up joints with 95% tins and 5% antimony (95-5) solder conforming to ASTM B32 Grade 95TA. Cut copper tubing ends perfectly square and remove all burrs inside and outside. Thoroughly clean sockets of fittings and ends of tubing to remove all oxide, dirt, and grease just prior to soldering. Apply flux evenly, but sparingly, to all surfaces to be joined. Heat joints uniformly to proper soldering temperature so solder flows to all mated surfaces. Wipe excess solder, leaving a uniform fillet around cup of fitting.
2. Flux shall be non-acid type conforming to ASTM B813.
3. Solder end valves may be installed directly in the piping system if the entire valve is suitable for use with 470°F melting point solder. Remove composition discs and all seals during soldering if not suitable for 470°F.

B. Mechanical Press Connection (Copper):

1. Copper press fitting shall be made in accordance with the manufacturer's installation instructions.
2. Fully insert tubing into the fitting and mark tubing.
3. Prior to making connection, the fitting alignment shall be checked against the mark made on the tube to ensure the tubing is fully engaged in the fitting.
4. Joint shall be pressed with a tool approved by the manufacturer. Installers shall be trained by manufacturer personnel or representatives. Provide documentation upon request.

END OF SECTION

SECTION 23 31 00 - DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Galvanized Ductwork

B. Ductwork Reinforcement

C. Ductwork Sealants

D. Rectangular Ductwork

E. Round and Flat Oval Ductwork

F. Exposed Ductwork (Rectangular, Round, or Oval)

G. Flexible Duct

H. Leakage Testing

I. Duct Cleaning

J. Painting

1.2 REFERENCES: Conform to all applicable requirements of the following publications:

A. ADC Flexible Duct Performance and Installation Standards, 3rd Edition 1996.

B. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

C. ASHRAE - Handbook 2020 Systems and Equipment; Chapter 19 - Duct Construction.

D. ASHRAE - Handbook 2021 Fundamentals; Chapter 21 - Duct Design.

E. ASTM A90 - Standard Test Method for Weight (Mass) of Coating on Iron and Steel Articles with Zinc or Zinc-Alloy Coatings.

F. ASTM A167- Stainless & Heat-Resisting Chromium-Nickel Steel Plate, Sheet, & Strip.

G. ASTM A653 - Steel Sheet, Zinc-Coated (Galvanized) or zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

H. ASTM A924 - Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.

I. ASTM E90-02 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions.

J. ASTM E413-87 - Classification for Rating Sound Insulation.

K. AWS D9.1M/D9.1 - Sheet Metal Welding Code.

L. IECC - International Energy Conservation Code (latest published edition)

M. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.

N. NFPA 90B - Installation of Warm Air Heating and Air- Conditioning Systems.

O. SMACNA - Air Duct Leakage Test Manual.

P. SMACNA - HVAC Duct Construction Standards.

Q. UL 181 - Factory-Made Air Ducts and Air Connectors.

R. UL 181A - Closure Systems for Use with Rigid Air Ducts and Air Connectors

S. UL 181B - Closure Systems for Use with Flexible Air Ducts and Air Connectors.

1.3 SUBMITTALS

A. Submit shop drawings per Section 23 05 00.

B. The Architect/Engineer may require field verification of sheet metal gauges and reinforcing to verify compliance with these specifications. At the request of the Architect/Engineer, the contractor shall remove a sample of the duct for verification. The contractor shall repair as needed.

C. Duct Layout Drawings: Submit detailed duct layout drawings at 1/4" minimum scale complete with the following information:

1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.
2. Differentiate ducts that are wrapped. Include insulation thickness, type of insulation, and acoustical lagging.
3. Room names and numbers, ceiling types, and ceiling heights.
4. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.
5. Verify clearances and interferences with other trades prior to preparing drawings. IMEG will provide electronic copies of ventilation drawings for contractor's use if the contractor signs and returns the "Electronic File Transfer" waiver. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for this submittal. Refer also to Section 23 05 00.

D. Duct Leakage Test Summary Report: Upon completion of the pressure test described in Part 3, the Contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.

1.4 DEFINITIONS

A. Duct Sizes shown on drawings are inside clear dimensions. Maintain clear dimensions inside any lining.

B. Transitions are generally not shown in single-line ductwork. Where sizes change at a divided flow fitting, the larger size shall continue through the fitting.

C. Interior Duct: Ductwork located within the conditioned envelope including return air plenums and indirectly conditioned spaces.

1.5 COORDINATION DRAWINGS

A. Reference Coordination Drawings article in Section 23 05 00 for required duct systems electronic CAD drawings to be provided to Coordinating Contractor for inclusion into composite coordination drawings.

B. Duct drawings shall be at 1/4" minimum scale complete with the following information:

1. Actual duct routing, ductwork fittings, actual sheet metal dimensions including insulation liner and wrap, duct hanger and support types, ductwork accessories, etc. with lengths and weights noted.
2. Differentiate ducts that are lined or wrapped. Include insulation thickness, type of insulation, and acoustical lagging.
3. Location and size of all duct access doors.
4. Room names and numbers, ceiling types, and ceiling heights.
5. Indicate location of all beams, bar joists, etc. along with bottom of steel elevations for each member.
6. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings. Architectural plans will need to be obtained from the Architect.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS AND SUPPORTS

A. Rectangular Duct - Single Wall:

1. General Requirements:

a. All ductwork gauges and reinforcements shall be as listed in SMACNA Duct Construction Standards Chapter 2. Where necessary to fit in confined spaces, furnish heaviest duct gauge and least space consuming reinforcement.
b. Transitions shall not exceed the angles in Figure 4-7.

2. Exceptions and modifications to the 2005 HVAC Duct Construction Standards are:

a. All ducts shall be cross-broken or beaded.
b. Snap lock seams are not permitted.

c. Turning vanes shall be used in all 90° mitered elbows, unless clearly noted otherwise on the drawings. Vanes shall be as follows:

1) Type 1:

a) Description: Single wall type with 22-gauge (0.029") or heavier vanes, 3-1/4" blade spacing, and 4" to 4-1/2" radius. Vanes hemmed if recommended by runner manufacturer. Runners shall have extra-long locking tabs. C-value independently tested at below 0.26. EZ Rail II by Sheet Metal Connectors or equal.
b) Usage: Limited to 3,000 fpm and vane lengths 36" and under.

2) Type 2:

a) Description: Double wall type with 3-1/4" blade spacing, 4-1/2" radius, 24-gauge minimum, and SMACNA Type 1 runners. C-value below 0.27.
b) Usage: No limits other than imposed by the manufacturer. Provide intermediate support for vanes over 48" long.

3) Turning vanes shall operate quietly. Repair or replace vanes that rattle or flutter.
4) Runners must be installed at a 45° angle. Elbows with different size inlet and outlet must be radius type.
5) Omitting every other vane is prohibited.

d. Where smooth radius rectangular elbows are shown, they shall be constructed per SMACNA Figure 4-2. Type RE1 shall be constructed with a centerline duct radius R/W of 1.0. Where shown on drawings, Type RE3 elbows with 3 vanes shall be used with centerline duct radius R/W of 0.6 (SMACNA r/W=0.1). RE1 or RE3 elbows may be used where mitered elbows are shown if space permits. Mitered elbows (with or without turning vanes) may not be substituted for radius elbows. Do not make branch takeoffs within 4 duct diameters on the side of the duct downstream from the inside radius of radius elbows.
e. Rectangular branch and tee connections in ducts over 1" pressure class shall be 45° entry type per Figs. 4-5 and 4-6. Rectangular straight taps are not acceptable above 1" pressure class.
f. Bellmouth fittings shown on return duct inlets shall expand at a 60-degree total angle horizontally and vertically (space permitting) and have length of at least 25% of the smallest duct dimension.
g. Duct offsets shall be constructed as shown on drawings. Additional offsets required in the field shall be formed of mitered elbows without turning vanes for offsets up to 30° maximum angle in accordance with SMACNA offset Type 2. Offsets of greater than 30° angle shall be formed of radius elbows with centerline radius R/W=1.0 or greater. SMACNA Type 1 offsets are not permitted.
h. All lined duct shall utilize dovetail joints where round or conical taps occur. The dovetail joints shall extend past the liner before being folded over.
i. Cushion heads are acceptable only downstream of TAB devices in ducts up to ± 2" pressure class, and must be less than 6" in length.
j. Slide-on flanged transverse joint systems are acceptable, provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.

1) Apply sealant to all inside corners. Holes at corners are not acceptable.

2) Manufacturers:

a) Ductmate Industries - 25/35/45
b) Nexus
c) Mez
d) WDCI
e) Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.

k. Formed-on flanged transverse joint systems are acceptable, provided they are a manufactured product that has been tested for conformance with Chapter 2 of the SMACNA HVAC Duct Construction Standards for sheet and joint deflection at the specified pressure class.

1) Apply sealant to all inside corners. Holes at corners are not acceptable.
2) Flanges shall be 24-gauge minimum (not 26-gauge).
3) Manufacturers:

a) Lockformer TDC
b) TDF
c) United McGill
d) Sheet Metal Connectors
e) Other manufacturers must submit test data and fabrication standards and receive Architect/Engineer's approval before any fabrication begins.

B. Round Spiral Seam Ductwork - Single Wall:

1. Conform to applicable portions of Rectangular Duct Section. Round or flat oval ductwork may be substituted for rectangular ductwork where approved by the Architect/Engineer. The spiral seam ductwork shall meet the standards set forth in this specification. The ductwork shall meet or exceed the specified cross-sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation.

2. Flat oval duct in negative pressure applications shall have flat sides reinforced as required for rectangular ducts of the same gauge with dimensions equal to the flat span of the oval duct.
3. 90° elbows shall be smooth radius or have a minimum of five sections with mitered joints and R/D of at least 1.5.
4. Duct and fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA requirements for the specified pressure class. Ribbed and lightweight duct are not permitted.
5. Ductwork shall be suitable for velocities up to 5,000 fpm.
6. Divided flow fittings may be made as separate fittings or factory-installed taps with sound, airtight, continuous welds at intersection of fitting body and tap.
7. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
8. Ducts with minor axis less than 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.
9. Reinforce flat oval ducts with external angles. Internal tie rods are permitted only as indicated for rectangular ductwork.
10. Transverse Joint Connections:

a. Crimped joints are not permitted.
b. Ducts and fittings 36" in diameter and smaller shall have slip joint connections. Size fitting ends to slip inside mating duct sections with minimum 2-inch insertion length and a stop bead. Use inside slip couplings for duct-to-duct joints, and outside slip couplings for fitting-to-fitting joints.
c. Ducts and fittings larger than 36" shall have flanged connections.
d. Secure all joints with at least 3 sheet metal screws before sealing.
e. Manufacturers, Slide-on Flanges:

1) Ductmate Industries - SpiralMate
2) Accuflange
3) Sheet Metal Connectors are acceptable.

f. Manufacturers, Self-Sealing Duct Systems:

1) Lindab
2) Ward "Keating Coupling"

C. Round and Flat Oval Spiral Seam Ductwork - Double Wall:

1. Conform to applicable portions of Rectangular Duct Section. Spiral seam round or flat oval double wall ductwork may be substituted for double wall rectangular ductwork where approved by the Architect/Engineer. Double wall spiral seam ductwork shall meet the standards set forth in this specification. Ductwork shall meet or exceed the specified cross-sectional area and insulation requirements. The substitution shall be coordinated with all other trades prior to installation.

2. Interior ducts shall have an airtight outer pressure shell, a 1" insulation layer, and a perforated inner wall that completely covers the insulation.
3. Exterior ducts shall have an airtight outer pressure shell, a 2" insulation layer, and a solid inner wall that completely covers the insulation.
4. All perforated inner walls shall have a 25/50 compliant liner between the insulation and the perforated inner wall to prevent contact between fiberglass and air stream. For exterior ductwork this shall form a continuous vapor barrier.
5. Insulation shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.
6. 90° elbows shall be smooth radius or have a minimum of 5 mitered joints, and R/D of at least 1.5.
7. Duct and Fittings shall meet the required minimum gauges listed in chapter 3 of the SMACNA standards for the specified pressure class. Ribbed and lightweight duct are not permitted.
8. Ductwork shall be suitable for up to 5,000 fpm velocity.
9. Divided flow fittings may be separate fittings or factory installed taps with the following construction requirements:

a. Sound airtight, continuous welds at intersection of fitting body and tap.
b. Tap liner welded to inner liner with weld spacing not over 3".
c. Insulation packed around the tap area for complete cavity filling.
d. Carefully fit branch connections to cut-out openings in inner liner without spaces for air erosion of insulation or sharp projections for noise and airflow disturbance.

10. Spot weld and bond all fitting seams in the pressure shell. Coat galvanizing damaged by welding with corrosion resistant paint to match galvanized duct color.
11. Support inner liner of ducts and fittings with metal spacers welded to maintain spacing and concentricity.

12. Ducts with minor axis under 22" shall be spiral seam type. Larger ducts may be rolled, longitudinal welded seam type. SMACNA seams RL-2 and RL-3 are not permitted.
13. Transverse Joint Connections:

    a. Crimped joints are not permitted.
    b. Provide couplings to align the inner liners. Butt joints are not permitted for inner liners. Make alignment by extending the liner of the fitting into the duct or by using a double concentric coupling with the two couplings held by spacers for rigidity and wall spacing.
    c. Above 34" ID provide a separate coupling for inner alignment with the pressure shells joined by angle ring flanged connections.
    d. Use outside slip couplings for fitting-to-fitting joints.
    e. Secure all joints with at least 3 sheet metal screws before sealing.
    f. Manufacturers, Slide-on Flanges:

        1) Ductmate Industries - SpiralMate
        2) Accuflange
        3) Sheet Metal Connectors

    g. Manufacturers, Self-Sealing Duct System:

        1) Lindab
        2) Ward "Keating Coupling"

D. Hangers and Supports General Requirements:

1. Hanger and support materials shall be as defined within Materials and Application Specific section below.
2. Strap Hangers: Strap hanger shall be a minimum of 1 inch, 18 gauge attached to the bottom of ducts.
3. Cable Hangers:

    a. Aircraft cable and slip cable hangers are acceptable for ducts up to 18" diameter. Protective sleeve tubing shall be used on the cable when supporting duct with exterior insulation. Corner saddles are required when supporting rectangular ductwork.
    b. Manufacturers; Supports:

        1) Gripple
        2) Ductmate
        3) Duro Dyne
        4) Architect/Engineer approved

4. Integral Corner Connector Hanger: Integral hanger and corner assembly for use with TDC/TDF style duct flanges. Die stamped offset hanger connects to the flanged corner assembly. For use with aircraft cable or 1/4" or 3/8" diameter threaded rods. Tested to hold up to 1,400 lbs.. Install per manufacturer’s ratings and instructions.

    a. Manufacturers; Supports:

        1) EZ Hanger

2.2 MATERIAL AND APPLICATION SPECIFIC

A. Galvanized Steel:

1. General Requirements:

a. Duct and reinforcement materials shall conform to ASTM A653 and A924.
b. Interior Ductwork and reinforcements: G60 galvanized (0.60 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise.
c. Exterior Ductwork: G90 galvanized (0.90 ounces per square foot total zinc coating for two sides per ASTM A90) unless noted otherwise. G60 is not acceptable for exterior use.
d. Ductwork reinforcement shall be of galvanized steel.

2. Duct Hangers and Support Material:

a. Ductwork hangers and supports shall be of galvanized or painted steel.
b. All fasteners shall be galvanized or cadmium plated.

B. Duct Hangers and Support Material:

1. Ductwork hangers and supports shall be of galvanized or painted steel.
2. All fasteners shall be galvanized or cadmium plated.

C. Exposed Ductwork (Rectangular, Round, and Flat Oval):

1. The following applies to all ductwork exposed in finished areas in addition to requirements noted above:

a. Provide extra shipping protection. Use Cardboard or other protective means to prevent dents and deformed ends.
b. Provide cardboard or other means of protection during field fabrication. Protect from scratches. Provide stiffeners to retain shape during fabrication.
c. Remove all identification stickers and thoroughly clean exterior of all ducts.
d. Locate fitting seams on least visible side of duct.
e. Provide exterior finish suitable for field painting without further oil removal.
f. Provide ramp-type internal joint couplings. Provide bead of sealant around the inside of the duct about 1/2" from the end of the duct.
g. Manufacturers, Slide-on Flanges:

1) Ductmate Industries
2) Accuflange
3) Sheet Metal Connectors

h. Manufacturers, Self-Sealing Duct System:

1) Lindab
2) Ward "Keating Koupling"

i. The system shall be free of visible dents and scratches when viewed from normal occupancy.
j. All insulation shall be internal, except at reheat coils.

2. In addition to the paragraphs above, this section applies to all ductwork specified or shown as "Architecturally Exposed":

    a. All spiral ductwork fittings shall be carbon arc welded.
    b. Grind all welds to remove irregularities.
    c. Conical taps shall be one piece. Taps for grilles and takeoffs shall be factory installed with a continuous weld and ground smooth.
    d. Welds shall be ground smooth and painted.
    e. All architecturally exposed ducts shall be round or flat oval except where not possible (grilles, reheat coils, etc.).

3. Alternate manufacturers, including shop fabricated duct, must be reviewed before installation. The following information is required:

    a. Metal gauge of duct and fittings.
    b. Fitting type and construction.
    c. Type and size of reinforcement.

4. Hangers for Exposed Ductwork:

    a. Round Ducts:

        1) Threaded rod with duct fixing bracket and metal strap. Provide single threaded rod centered on the duct. Strap hanger shall be a minimum of 1 inch, 18 gauge galvanized steel wrapping the circumference of the duct. Spacing as required by SMACNA guidelines.

        2) Aircraft cable with 2-point support in standard horseshoe arrangement.

    b. Rectangular Ducts:

        1) Aircraft cable and slip cable hangers are acceptable for ducts up to 18" in maximum dimension. Corner saddles are required when supporting rectangular ductwork. Spacing and cable size as required by SMACNA guidelines.

            a) Manufacturers, Supports: Gripple, Ductmate, Duro Dyne, Architect/Engineer approved.

        2) Aircraft cable with 2-point support in standard horseshoe arrangement. Corner saddles are required when supporting rectangular ductwork.

    c. Strut-channel and all-thread rod is not acceptable for exposed ductwork.
    d. All fasteners shall be galvanized or cadmium plated.

2.3 DUCTWORK REINFORCEMENT

A. All reinforcement shall be external to the duct except that tie rods may be used with the following limitations.

1. Ducts must be over 18" wide.
2. Duct dimensions must be increased 2" in one dimension (h or w) for each row of tie rods installed.
3. Tie rods must not exceed 1/2" diameter.

4. Manufacturer of tie rod system must certify pressure classifications of various arrangements, and this must be in the shop drawings.

2.4 DUCTWORK SEALANTS

A. One-part joint sealers shall be water-based mastic systems that meet the following requirements: maximum 48-hour cure time, service temperature of -20°F to +175°F, resistant to mold, mildew and water, flame spread rating below 25 and smoke-developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes. Mastic used to seal flexible ductwork shall be marked UL 181B-M.

B. Two-part joint sealers shall consist of a minimum 3" wide mineral-gypsum compound impregnated fiber tape and a liquid sealant. Sealant system shall meet the following requirements: maximum 48-hour cure time, service temperature of 0°F to 200°F, resistant to mold, mildew, and water, flame spread rating below 25 and smoke developed rating below 50 when tested in accordance with ASTM E84, suitable for all SMACNA seal classes and pressure classes.

C. Pressure sensitive tape used for sealing ductwork shall be minimum 2.5-inch wide, listed and marked UL 181A-P, having minimum 60 oz/inch peel adhesion to steel, and service temperature range from -20°F to +250°F.

D. Where pressure sensitive tape is called for on drawings and specifications for sealing flexible ductwork, tape shall be minimum 2.5-inch wide, UL 181 B-FX listed, and marked tape having minimum 60 oz/inch peel adhesion to steel and service temperature range from -20°F to +250°F.

1. Manufacturers, Pressure-Sensitive Tape:

a. Venture Tape 1581A
b. Compac #340
c. Scotch Foil Tape 3326
d. Polyken 339

2.5 FLEXIBLE DUCT

A. Flexible duct shall be listed and labeled as UL 181 Class 1 Air Duct Material, and shall comply with NFPA 90A and 90B, and meet GSA, FHA and other U.S. Government agency standards. Flexible duct shall bear the ADC Seal of Certification.

B. Flame Spread/Smoke Developed: Not over 25/50.

C. Stretch all flexible duct to prevent sags and reduce air friction. Shorten and reinstall all sagging or loose flexible duct. Avoid sharp elbows. Elbows shall maintain 1.5 diameter centerline turning radius.

D. Install per the SMACNA Flexible Duct Manual. Secure inner layer with draw band. Wrap with pressure sensitive tape for protection prior to installing draw band. Pressure sensitive tape alone is not acceptable.

E. Acoustic:

1. Flexible duct shall be acoustic rated in accordance with ASTM E477 and ADC Test Code FD 72-RI by ETL. Insertion loss values noted below are for flow velocities less than 2,500 fpm. Submittals shall include insertion losses ratings per sizes and lengths listed below regardless of sizes shown on the drawings.
2. Flexible have corrosion-resistant wire helix, bonded to a nylon fabric core inner liner that prevents air from contacting the insulation, covered with minimum 1-1/2", 3/4 lb/cf density fiberglass insulation blanket, sheathed in a vapor barrier of metalized polyester film laminated to glass mesh. .
3. Inner liner shall be airtight and suitable for 6" WC static pressure through 16" diameter. Outer jacket shall act as a vapor barrier only with permeance not over 0.1 perm per ASTM E96, Procedure A. "R" value shall not be less than 4.0 ft2*ºF*hr/Btuh. Temperature range of at least 0-180ºF. Maximum velocity of 4,000 fpm. "R" value shall not be less than 4.0 ft2*°F*hr/Btuh. Ducts in unconditioned spaces and ventilated attics: "R" value shall not be less than 6.0 ft2*°F*hr/Btuh.

4. Usage:

    a. Take-offs from supply ducts to inlets of terminal air boxes. Do not exceed 36" in length.
    b. Connections to air inlets and outlets. Do not exceed 5'-0" in length.
    c. Acceptable Manufacturers:

        1) Flexmaster USA - Type 6
        2) Thermaflex M-Ke

F. Radius Forming Elbows:

1. Flexible plastic radius forming elbow for use with flexible ducts to create 90deg elbow. One size for 6" to 16" diameter ducts. UL listed for return plenum spaces.
2. Usage: All supply air terminals with flexible ductwork connection.
3. Installation: Attach to flex duct and secure draw bands without crushing flex duct to form smooth radius elbow. Suspend radius forming elbow to structure. Install per manufacturer's instructions.
4. Acceptable Manufacturers:

    a. Hart & Cooley - Smartflow
    b. Thermaflex - Flexflow
    c. Titus - Flexright

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide openings in ducts for thermometers and controllers.

B. Locate ducts with space around equipment for normal operation and maintenance.

C. Do not install ducts or other equipment above electrical switchboards or panelboards. This includes a dedicated space extending 25 feet from the floor to the structural ceiling with width and depth equal to the electrical equipment. Unless intended to serve these rooms, do not install any ductwork or equipment in electrical rooms, transformer rooms, electrical closets, telephone rooms or elevator machine rooms.

D. Provide temporary closures of metal or taped polyethylene on open ducts to prevent dust from entering ductwork.

E. Supply ductwork shall be free of construction debris, and shall comply with Level "B" of the SMACNA Duct Cleanliness for New Construction Guidelines.

F. Repair all duct insulation and liner tears.

G. Install manual volume dampers in branch supply ducts so all outlets can be adjusted. Do not install dampers at air terminal device or in outlets, unless specifically shown.

H. Install flexible duct in accordance with the ADC Flexible Duct Performance and Installation Standards.

I. Flexible duct shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required, to include, but not limited to, all connections to air inlets, air outlets, and terminal air boxes.

J. Support all duct systems in accordance with the SMACNA HVAC Duct Construction Standards: Metal and Flexible and the SMACNA Seismic Restraint Manual: Guidelines for Mechanical Systems, where applicable. Refer to Section 23 05 50 for seismic requirements.

K. Adhesives, sealants, tapes, vapor retarders, films, and other supplementary materials added to ducts, plenums, housing panels, silencers, etc. shall have flame spread/smoke developed ratings of under 25/50 per ASTM E84, NFPA 255, or UL 723.

L. All duct support shall extend directly to building structure. Do not support ductwork from pipe hangers unless coordinated with piping contractor prior to installation. Do not allow lighting or ceiling supports to be hung from ductwork or ductwork supports.

3.2 DUCTWORK APPLICATION SCHEDULE

A. Refer to Ductwork Application Schedule below for specific requirements for system, material, shape, pressure class, seal class and insulation application.

B. Exposed Supply Duct from RTU to Outlet - Double Wall:

1. Shape:

a. Round and Flat Oval Spiral Seam Ductwork - Double Wall

2. Material: Galvanized Steel
3. Pressure Class: +3"
4. Seal Class: A
5. Insulation:

a. IECC-2021: 2" thick Type E (R=7.4)

6. Additional Requirements: None

C. Concealed duct from RTU to Outlets:

1. Shape:

a. Rectangular Duct - Single Wall
b. Round Spiral Seam Ductwork - Single Wall

2. Material: Galvanized Steel
3. Pressure Class: +2"
4. Seal Class: A
5. Insulation:

a. IECC-2021: 1-1/2" **thick Type A (R=4.5) - ROUND**1" **thick Type C (R=3.6) - RECTANGULAR**

6. Additional Requirements: None

D. Return Duct:

1. Shape:

a. Rectangular Duct - Single Wall

2. Material: Galvanized Steel
3. Pressure Class: -2"
4. Seal Class: A
5. Insulation:

a. ASHRAE 90.1-2022: None
b. IECC-2021: 1" thick Type C (R=3.6)

6. Additional Requirements: None

E. Transfer Ducts:

1. Shape:

a. Rectangular Duct - Single Wall

2. Material: Galvanized Steel
3. Pressure Class: -1/2"
4. Seal Class: N/A
5. Insulation: 1" thick Type C (R=3.6)

3.3 SPECIAL INSULATION REQUIREMENTS

A. Ductwork Accessories (Fabric Flex Connectors, Equipment Flanges, etc.):

1. Insulation:

a. IECC-2021: 1-1/2" thick Type A (R=4.5)

B. Linear Diffuser Supply Plenum:

1. Insulation:

a. IECC-2021: 1/2" thick Type C (R=1.8)

3.4 DUCTWORK SEALING

A. General Requirements:

1. Openings, such as rotating shafts, shall be sealed with bushings or similar.
2. Pressure sensitive tape shall not be used as the primary sealant unless it has been certified to comply with UL-181A or UL-181B by an independent testing laboratory and the tape is used in accordance with that certification.
3. All connections shall be sealed including, but not limited to, taps, other branch connections, access doors, access panels, and duct connections to equipment. Sealing that would void product listings is not required. Spiral lock seams need not be sealed.
4. Mastic-based duct sealants shall be applied to joints and seams in minimum 3 inch wide by 20 mil thick bands using brush, putty knife, trowel, or spray, unless manufacturer's data sheet specifies other application methods or requirements.

B. All ducts systems, regardless of pressure class, shall be Seal Class A as defined by Section 5-1 of SMACNA HVAC Air Duct Leakage Test Manual per the Energy Code, unless specifically noted otherwise. Seal Class A shall include sealing of all transverse joints, longitudinal seams, and duct wall penetrations with welds, gaskets, mastics, or fabric-embedded mastic system. Joints are inclusive of, but not limited to, girth joints, branch and sub-branch intersections, duct collar tap-ins, fitting subsections, louver and air terminal connections to ducts, access door and access panel frames and jambs, duct, plenum, and casing abutments to building structures.

C. Double-wall ductwork: Install insulation end fittings at all transitions from double to single-wall construction.

3.5 TESTING

A. Interior Duct - Less than 3" WG (positive or negative):

1. Leak testing of these pressure classes is not normally required for interior ductwork (inside the building envelope). However, leak tests will be required if, in the opinion of the Architect/Engineer, the leakage appears excessive. All exterior ductwork shall be tested. If duct has outside wrap, testing shall be done before it is applied.
2. Leak test shall be at the Contractor's expense and shall require capping and sealing all openings.
3. Seal ducts to bring the air leakage into compliance.
4. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing.

B. Test Procedure:

1. Testing shall be as listed in the latest edition of the SMACNA HVAC Duct Leakage Manual, with the following additional requirements:

    a. The required leakage class for Seal Class A, rectangular ducts, shall be 4; round shall be 2.
    b. Test pressure shall be the specified duct pressure class. Testing at reduced pressures and converting the results mathematically is not acceptable. This is required to test the structural integrity of the duct system.
    c. If any leak causes discernible noise at a distance of 3 feet, that leak shall be eliminated, regardless of whether that section of duct passed the leakage test.
    d. All joints shall be felt by hand, and all discernible leaks shall be sealed.

e. Totaling leakage from several tested sections and comparing them to the allowable leakage for the entire system is not acceptable. Each section must pass the test individually.
f. Contractor shall notify the Architect/Engineer five business days prior to pressurizing ductwork for testing. Failure to notify the Architect/Engineer of pressure testing may require the contractor to repeat the duct pressure test after proper notification.
g. Upon completion of the pressure test, the contractor shall submit an air duct leakage test summary report as outlined in the SMACNA HVAC Duct Leakage Test Manual.
h. All access doors, taps to terminal air boxes, and other accessories and penetrations must be installed prior to testing. Including terminal air boxes in the test is not required.
i. Positive pressure leakage testing is acceptable for negative pressure ductwork.

3.6 DUCTWORK PENETRATIONS

A. All duct penetrations of firewalls shall have fire or fire/smoke dampers where required by code.

B. Dampers shall be compatible with fire rating of wall assembly. Verify actual rating of any wall being penetrated with Architect/Engineer.

C. Seal all duct penetrations of walls that are not fire rated by caulking or packing with fiberglass. Install trim strip to cover vacant space and raw construction edges of all openings in finished rooms. Install escutcheon ring at all round duct openings in finished rooms. Trim strips and rings shall be same material and finish as exposed duct.

3.7 PAINTING

A. All exposed ductwork shall be painted. Provide duct with paintgrip. Paint color to be determined by architect.

END OF SECTION

SECTION 23 33 00 - DUCTWORK ACCESSORIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Manual Volume Dampers.

B. Fire Dampers.

1.2 REFERENCES

A. AMCA Guide for Commissioning and Periodic Performance Testing of Fire, Smoke and Other Life Safety Related Dampers.

B. ASTM E477-20 - Standard Test Method for Measuring Acoustical and Airflow Performance of Duct Liner Materials and Prefabricated Silencers.

C. ASTM E2336-04 - Standard Test Methods for Fire Resistive Grease Duct Enclosure Systems.

D. NFPA 72 - National Fire Alarm and Signaling Code

E. NFPA 80 - Standard for Fire Doors and Other Opening Protectives.

F. NFPA 90A - Installation of Air-Conditioning and Ventilating Systems.

G. SMACNA - HVAC Duct Construction Standards (latest edition).

H. UL 33 - Heat Responsive Links for Fire-Protection Service.

I. UL 555 - Fire Dampers and Ceiling Dampers.

1.3 SUBMITTALS

A. Submit shop drawings under provisions of Section 23 05 00.

B. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 MANUAL VOLUME DAMPERS

A. Fabricate in accordance with SMACNA Duct Construction Standards, and as indicated.

B. Fabricate single blade dampers for duct sizes to 9-1/2 x 30 inches.

C. Fabricate multi-blade damper of opposed blade pattern with maximum blade sizes 12" x 72". Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

D. Except in round ductwork 12 inches and smaller, provide end bearings. On multiple blade dampers, provide molded synthetic or oil-impregnated nylon or sintered bronze bearings.

E. Provide locking quadrant regulators on single and multi-blade dampers.

F. On insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

G. If blades are in open position and extend into the main duct, mount damper so blades are parallel to airflow.

H. Contractor assembled modular manual dampers are acceptable as long as it contains the components listed above.

2.2 DYNAMIC CURTAIN BLADE FIRE DAMPERS (FD)

A. Furnish and install fire dampers in ducts, where shown on the drawings, at the point where they pass through a fire wall or a floor and in all other locations required by the local fire department, The National Fire Protection Association's Pamphlet No. 90A and all other applicable codes.

B. Fire dampers shall be UL 555 listed for 1-1/2-hour fire resistance unless noted otherwise, dynamic rated with heated airflow at 2000 fpm and 4" WC, and have all blades stacked out of the airstream (Type B).

C. Fire dampers shall be held open by a fusible link rated at 165F unless otherwise called for on the drawings or by local codes.

D. Dampers shall be installed in sleeves of sufficient thickness to comply with the UL555 Standard for Safety Fire Dampers listing of the damper. Where UL555 permits sleeve thickness to be the same as that of the duct gauge, such thickness shall not be less than that specified in NFPA 90A for breakaway style sleeves. If a breakaway style duct/sleeve connection is not used, the sleeve shall be a minimum of 16 gauge for dampers up to 36" wide by 24" high and 14 gauge for dampers exceeding 36" wide by 24" high. Damper sleeve shall not extend more than 6" beyond the firewall or partition unless damper is equipped with a factory installed access door. Sleeve may extend up to 16" beyond the firewall or partition on sides equipped with the factory installed access door.

E. Maximum Curtain Damper Size (Multi-section) at less than 2000 fpm:

1. Vertical Installation: 72"w x 48"h or 48"w x 72"h or 120"w x 24"h.
2. Horizontal Installation: 36"w x 48"h or 48"w x 36"h.

F. Maximum Curtain Damper Size at greater than 2000 fpm: Vertical or horizontal - 24"w x 24"h.

G. Locate access door in the ductwork for visual inspection and on the latch side to replace link easily. Each access door shall have a label with letters at least 1/2" high, reading "FIRE DAMPER".

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Install accessories in accordance with manufacturer's instructions.
2. Where duct access doors are located above inaccessible ceilings, provide ceiling access doors. Coordinate location with the Architect/Engineer.
3. Coordinate and install access doors provided by others.
4. Provide access doors for all equipment requiring maintenance or adjustment above an inaccessible ceiling. Minimum size shall be 24" x 24".
5. Provide duct test holes where indicated and as required for testing and balancing purposes.

B. Manual Volume Damper:

1. Provide manual volume dampers at points on low pressure supply, return, and exhaust systems where branches are taken from larger ducts where indicated on drawings and as required for air balancing. Use splitter dampers only where indicated.
2. Provide ceiling access doors for manual volume dampers. When manual volume dampers are located above an inaccessible ceiling and an access door cannot be installed, provide a remote-controlled volume control device for operation of the damper. Coordinate location with the Architect/Engineer.

C. Fire Damper, :

1. Installation:

a. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves and duct connections.
b. Provide ceiling access doors for smoke and/or fire dampers. Coordinate location with the Architect/Engineer.
c. Provide manufacturer's maintenance instructions to Owner.
d. At fire dampers where duct is:

1) Internally insulated, exterior duct wrap shall be installed from the wall out to 1 foot from the wall. All edges shall be taped.
2) Externally insulated, the exterior duct wrap shall extend up to the wall.

2. Commissioning/Testing and Acceptance:

a. Dampers shall be tested for function in their installed condition. Cycle all dampers to ensure proper operation and signal reporting as required by the manufacturer, building codes, and NFPA, with the minimum following requirements:

1) Visually inspect damper to ensure they are free from obstructions, have appropriate access, and are labeled.
2) Demonstrate resetting of fire dampers to Authorities Having Jurisdiction and Owner's representative as described below.
3) Fusible Link Operated Dampers:

a) Ensure fan is off.
b) With damper full-open, remove fusible link.
c) Ensure damper closes completely without assistance.
d) Return damper to full-open position and replace fusible link.

4) Dampers with Position Indication Wired to Indication Lights, Control Panels or BAS:

a) Confirm damper is full-open using position indicator signal.
b) Remove power to allow spring return to close damper.
c) Confirm damper is full-closed using position indicator signal.
d) Reapply power to reopen damper.
e) Confirm damper is full-open using position indicator signal.

5) Dampers without Position Indication:

a) Visually confirm damper is full-open using position indicator signal.
b) Remove power to allow spring return to close damper.
c) Visually confirm damper is full-closed.
d) Reapply power to reopen damper.
e) Visually confirm damper is full-open.

3. Report:

a. Provide Commissioning/Testing and Acceptance Report documenting the following for all fire damper, fire smoke damper, smoke dampers.
b. A copy of the report shall be filed with the fire code official and an identical copy shall be maintained in an approved location at the building.
c. Report shall include the following:

1) Damper ID#
2) System identification (e.g. AHU-#)
3) Type (FD, FSD, SD)
4) Duct size
5) UL assembly number
6) Location of damper and access door
7) Location of position indicator
8) Fusible link temperature rating (if applicable)
9) Manufacturer and model
10) Commissioning testing and acceptance operation: Pass/Fail/Reset

END OF SECTION

SECTION 23 34 23 - POWER VENTILATORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. In-Line Cabinet Fan.

1.2 QUALITY ASSURANCE

A. Performance Ratings: Conform to AMCA 210 and bear AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300.

C. Fabrication: Conform to AMCA 99.

D. Fan Energy Index (FEI): Fans shall meet or exceed the minimum FEI scheduled at the specified airflow, pressure, and air density (duty point). In no case shall the FEI at the specified duty point fall below 1.0.

1.3 REFERENCES

A. AMCA 99 - Standards Handbook.

B. AMCA 208 - Calculation of the Fan Energy Index (FEI).

C. AMCA 210 - Laboratory Methods of Testing Fans for Rating Purposes.

D. AMCA 230 - AMCA 230 - Laboratory Methods of Testing Air Circulating Fans for Rating and Certification.

E. AMCA 300 - Test Code for Sound Rating Air Moving Devices.

F. AMCA 301 - Method of Publishing Sound Ratings for Air Moving Devices.

G. ANSI/AFBMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

H. ANSI/AFBMA 11 - Load Ratings and Fatigue Life for Roller Bearings.

I. SMACNA - HVAC Duct Construction Standards (latest edition).

1.4 SUBMITTALS

A. Submit shop drawings per Section 23 05 00. Include data on all fans and accessories. Submit sound power levels for both fan inlet and outlet at rated capacity. Submit motor ratings and electrical characteristics, plus motor and electrical accessories. Submit multi-speed fan curves including minimum and maximum fan speed with specified operating points clearly plotted. Submit the Fan Energy Index (FEI) at the selected duty point (ceiling and HVLS fans are exempt from FEI submittal requirements).

B. Submit manufacturer's installation instructions.

C. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

PART 2 - PRODUCTS

2.1 IN-LINE CABINET FAN

A. Fiberglass lined, sheet metal housing, arranged for in-line installation.

B. Rubber torsion motor mounts.

C. Manual Motor Starter: NEMA ICS 2; AC general-purpose Class A manually operated non-reversing full-voltage controller for fractional horsepower induction motors, with thermal overload relay, toggle operator.

D. Centrifugal fan.

E. Provide variable speed controller if shown on the drawings.

F. Manufacturers:

1. ACME
2. Broan
3. Carnes
4. Cook
5. Jenco
6. PennBarry
7. Greenheck
8. Soler-Palau
9. York
10. FloAire

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

END OF SECTION

SECTION 23 37 00 - AIR INLETS AND OUTLETS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Grilles And Registers.

B. Architectural Square Panel Diffusers.

C. Linear Diffusers.

D. Linear Diffuser Supply Plenum.

E. Roof Curbs.

1.2 QUALITY ASSURANCE

A. Test and rate performance of air inlets and outlets per ASHRAE 70.

B. Test and rate performance of louvers per AMCA 500L-99.

C. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

1.3 REFERENCES

A. AMCA 500-L-12 - Laboratory Methods of Testing Louvers for Rating.

B. ANSI/ASHRAE 70 - Method of Testing for Rating the Air Flow Performance of Inlets and Outlets.

C. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

D. ASHRAE 170 (latest published edition) - Ventilation of Health Care Facilities.

E. SMACNA - Duct Construction Standards.

1.4 SUBMITTALS

A. Submit product data under provisions of Section 23 05 00.

B. Submit schedule of inlets and outlets indicating type, size, location, application, and noise level.

C. Review requirements of inlets and outlets as to size, finish, and type of mounting prior to submitting product data and schedules of inlets and outlets.

D. Submit manufacturer's installation instructions.

E. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

1.5 REGULATORY REQUIREMENTS

A. Conform to ANSI/NFPA 90A.

B. Conform to ASHRAE 90.1.

PART 2 - PRODUCTS

2.1 AIR TERMINALS - GRILLES AND REGISTERS

A. Reference to a grille means an air supply, exhaust or transfer device without a damper.

B. Reference to a register means an air supply, exhaust or transfer device with a damper.

C. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule and suitable for the intended use.

D. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents shall be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.

E. The capacity and size of the unit shall be as shown on the drawings.

F. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10^{-12} watts with a 10 dB room effect. .

G. Refer to the drawings for construction material, color and finish, margin style, deflection, and sizes of grilles and registers.

H. Provide with 3/4" blade spacing. Blades shall have steel friction pivots to allow for blade adjustment, plastic pivots are not acceptable.

I. Corners of steel grilles and registers shall be welded and ground smooth before painting. Aluminum grilles and registers shall have staked corners.

J. Where specified to serve registers, provide opposed blade volume dampers operable from the face of the register.

K. Where specified to have filters, provide with filter rack suitable for 2" thick MERV-8 pleated media filters. Grille border shall be fabricated from minimum 22 gauge steel or minimum 0.040-inch thick for aluminum grilles. Provide removable grille face with metal knurled knob or quarter turn fastener to allow for filter media replacement.

L. Screw holes for surface fasteners shall be countersunk for a neat appearance. Provide concealed fasteners for installation in lay-in ceilings and as specified on the drawings.

M. Manufacturers:

1. Tuttle & Bailey

2. Titus
3. Price
4. Nailor
5. Carnes
6. Metalaire
7. Krueger
8. Anemostat
9. Raymon Donco

2.2 AIR TERMINALS - ARCHITECTURAL SQUARE PANEL DIFFUSERS

A. Reference to a diffuser means an air supply device, ceiling mounted, that shall diffuse air uniformly throughout the conditioned space.

B. The type of unit, margin, material, finish, etc., shall be as shown on the drawing schedule. Flat-oval inlets are not acceptable for connection to flexible ducts.

C. All margins shall be compatible with ceiling types specified (including 'Thin-Line' T-bar lay-in grid system). Any discrepancies in contract documents should be brought to the attention of the Architect/Engineer, in writing, prior to Bid Date. Submission of Bid indicates ceiling and air inlet and outlet types have been coordinated.

D. The capacity and size of the unit shall be as shown on the drawings.

E. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10^{-12} watts with a 10 dB room effect. .

F. Diffusers shall be architectural solid square panel and flush with ceiling.

G. The exposed surface shall be smooth, flat and free of visible fasteners. The face panel shall be 22 gauge steel with a rolled edge or shall be 18 gauge with a smooth ground, uniform edge.

H. The back pan shall be one piece 22 gauge stamped and shall include an integral inlet. (Welded inlets and corner joints are not acceptable).

I. Diffusers with a 24x24 back pan shall have a minimum 18x18 face panel size. Diffusers with a 12x12 back pan shall have a minimum 9x9 face panel size.

J. The face panel shall be mechanically fastened to the back panel with steel components. (Plastic fasteners are not acceptable.)

K. Manufacturers:

1. Tuttle & Bailey
2. Titus
3. Price
4. Nailor
5. Carnes
6. Metalaire
7. Krueger
8. Anemostat
9. Raymon Donco

2.3 AIR TERMINALS - LINEAR DIFFUSERS

A. Linear Slot Diffusers (Continuous):

1. The type of unit, margin size, material, finish, etc., shall be as shown on the Drawing Schedule. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
2. The capacity and size of the unit shall be as shown on the drawings.
3. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10-12 watts with a 10 dB room effect..
4. Install T-bars on both sides of diffusers for lay-in ceiling system, install manufacturer frame for sheetrock or plaster ceiling system. Diffuser margins system shall be compatible with ceiling types specified, color to match ceiling system. Contractor shall coordinate margin types with ceilings prior to submitting shop drawings.
5. Provide with concealed fasteners for installation in the field.
6. Linear diffusers and mounting frames shall be furnished as one piece up to 6' in length. Provide auxiliary support per manufacturer's recommendations for slot diffusers greater than 4' in length.
7. Diffusers shall be furnished with adjustable pattern deflectors capable of providing 180° pattern adjustment.
8. A manual volume damper shall be furnished and installed by the Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings.
9. Number and width of slots shall be as shown on the drawings.
10. Provide insulated plenum for each linear diffuser. Refer to linear diffuser supply plenum specification section for details.
11. Manufacturers:

    a. Tuttle & Bailey 6000/7000
    b. Carnes CH
    c. Price SDS
    d. Krueger 1900
    e. Nailor 5000
    f. Titus ML
    g. Anemostat SLAD
    h. Raymon Donco HPL
    i. Metalaire

B. Linear Slot Diffusers (High Performance):

1. The type of unit, margin size, material, finish, etc., shall be as shown on the Drawing Schedule. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.
2. The capacity and size of the unit shall be as shown on the drawings.
3. All units shall handle the indicated cfm as shown on the drawings while not exceeding an NC level of 25, referenced to 10^{-12} watts with a 10 dB room effect per ANSI/ASHRAE 70.
4. Install T-bars on both sides of diffusers for lay-in ceiling system, install manufacturer frame for sheetrock or plaster ceiling system. Diffuser margins system shall be compatible with ceiling types specified, color to match ceiling system. Contractor shall coordinate margin types with ceilings prior to submitting shop drawings.
5. Provide with concealed fasteners for installation in the field.
6. Linear slot diffusers and mounting frames shall be furnished as one piece up to 6' in length. Provide auxiliary support per manufacturer's recommendations for slot diffusers greater than 4' in length.
7. Diffusers shall be furnished with adjustable pattern deflectors.

8. A manual volume damper shall be furnished and installed by the Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings.
9. Number and width of slots shall be as shown on the drawings.
10. Provide insulated plenum for each linear diffuser. Refer to linear diffuser supply plenum specification section for details.
11. Manufacturers:

    a. Price JS
    b. Titus FL
    c. Krueger DF
    d. Anemostat FF
    e. Raymon Donco WF2000
    f. Metalaire

2.4 AIR TERMINALS - LINEAR DIFFUSER SUPPLY PLENUM

A. Linear diffusers shall be provided with field fabricated or prefabricated supply plenums. Plenum shall be a minimum of 2-1/2" wider than total slot width, minimum length of slot, and minimum height of 10". Plenums with end fed duct connections shall not exceed 8' in length. The cross sectional area of the plenum shall be designed for a maximum velocity of 500 fpm and the aspect ratio shall be limited to a width-to-height ratio of less than 1.5. Plenums with side outlets shall be designed for a maximum velocity of 600 fpm and inlet ducts to plenum shall be spaced 5' on center maximum. Inlet ducts to plenums shall have a maximum velocity of 900 fpm. Flat-oval inlets are NOT acceptable for connection to flexible ducts. Provide sheet metal oval-to-round transition if required.

B. Plenum shall be constructed with 24 gauge galvanized steel and shall have side inlets unless shown otherwise on the drawings. Refer to Ductwork Application Schedule in Section 23 31 00 for insulation requirements.

C. End caps and required accessories shall be integral with the plenum or furnished and installed by the Mechanical Contractor.

D. A manual volume damper shall be furnished and installed by the Mechanical Contractor in branch ductwork to each slot diffuser. Balancing dampers shall not be installed in supply plenum or at air outlet unless otherwise indicated on the drawings

E. Prefabricated plenums shall be by the same manufacturer as the linear diffuser or Kees Inc.

PART 3 - EXECUTION

3.1 INSTALLATION

A. General Installation Requirements:

1. Install items in accordance with manufacturers' instructions.
2. Check location of inlets and outlets and make necessary adjustments in position to conform to architectural features, symmetry, and lighting arrangement.
3. Install diffusers to ductwork with air tight connections.
4. Flexible ducts shall NOT be joined to flat-oval connections. Provide sheet metal oval-to-round transitions where required.

5. Supply air diffusers in operating rooms (Class B and C surgery) shall be opened and cleaned before the space is used.

B. Volume Damper:

1. Provide manual volume dampers on duct take-off to diffusers when there are multiple connections to a common duct. Locate volume dampers as far as possible from the air inlet or outlet.

C. Maintaining Duct Cleanliness:

1. When grilles, registers, and diffusers are installed, Contractor shall prevent construction dust, dirt, and debris from entering ductwork as required by Section 23 05 00.

END OF SECTION

SECTION 23 74 16.12 - PACKAGED ROOFTOP AIR CONDITIONING UNITS 25 TON AND BELOW

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Packaged Rooftop Unit.

B. Unit Controls.

C. Roof Mounting Frame and Base.

D. Economizers.

E. Power Exhaust.

1.2 QUALITY ASSURANCE

A. All insulation inside the unit and in the air stream must comply with the requirement of NFPA 90A (maximum flame spread of 25 and maximum smoke developed of 50).

B. All units must be UL or ETL listed and must contain UL labeled components.

C. Fans shall be tested and rated in cabinet in accordance with AMCA Standard 210. All fan assemblies shall be dynamically balanced in cabinet at final assembly.

D. Conform to ASHRAE 90.1.

E. All air handling and distribution equipment mounted outdoors shall be designed to prevent rain intrusion into the airstream when tested at design airflow and with no airflow, using the rain test apparatus described in Section 58 of UL 1995.

1.3 REFERENCES

A. AHRI 210 - Unitary Air Conditioning Equipment.

B. AHRI 270 - Sound Rating of Outdoor Unitary Equipment.

C. ASHRAE 37 - Methods of Testing for Rating Unitary Air Conditioning and Heat Pump Equipment.

D. ANSI/ASHRAE/IES Standard 90.1 (latest published edition) - Energy Standard for Buildings Except Low-Rise Residential Buildings.

E. NFPA 70 - National Electrical Code.

F. NFPA 90A - Installation of Air Conditioning and Ventilating System.

G. UL - Underwriters' Laboratory.

1.4 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 23 05 00.

B. Indicate electrical service and duct connections on shop drawings or product data.

C. Submit manufacturer's installation instructions.

D. Submit electrical power/controls wiring diagrams and product data indicating general assembly, components, safety controls, and service connections.

E. Submit fan curves, including minimum and maximum fan speed, with specified operating points clearly plotted.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting frames are in place, ready for immediate installation of units.

1.6 OPERATION AND MAINTENANCE DATA

A. Submit operation and maintenance data.

B. Include manufacturer's descriptive literature, installation instructions, maintenance and repair data, and parts listing.

1.7 WARRANTY

A. Provide five (5) year manufacturer's warranty for compressors.

B. Provide five (5) year manufacturer's warranty for heat exchanger.

C. Provide three (3) year manufacturer's warranty for controls and electrical components (thermostats, VFD, etc.).

1.8 MAINTENANCE SERVICE

A. Contractor shall furnish complete service and maintenance of packaged roof top units for one year from Date of Substantial Completion.

B. Provide maintenance service with a two-month interval as maximum time period between calls. Provide 24-hour emergency service on breakdowns and malfunctions.

C. Include maintenance items as outlined in manufacturer's operating and maintenance data, including minimum of four (quarterly) filter replacements, minimum of one fan belt replacement, and controls checkout, seasonal adjustments, and recalibrations.

D. Submit copy of service call work order or report and include description of work performed to Owner and Architect/Engineer.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: The scheduled manufacturer is the Basis of Design. The Contractor is responsible for all costs, schedule impacts, and construction coordination, including design costs and regulatory agency approvals, related to using a specified alternate product other than the Basis of Design. Refer to Section 23 05 00 for additional information.

B. Trane

C. York

D. Daikin

E. Carrier

2.2 MANUFACTURED UNITS

A. Provide roof-mounted units with a gas burner and electric refrigeration.

B. Units shall be self-contained, packaged, factory assembled, pre-wired and tested, consisting of cabinet and frame, supply fan, exhaust fan, heat exchanger and burner, controls, air filters, refrigerant cooling coil and compressor, condenser coil, condenser fan, and a full refrigerant charge.

C. Units shall be furnished with non-fused disconnect switches, short fuse protection of all internal electrical components, and all necessary motor starters, contactors, and over-current protection.

1. AHRI rated for direct expansion use with R-32 or R-454B.

2.3 FABRICATION

A. Cabinet: Galvanized steel with baked enamel finish, access doors with quick fasteners screwdriver operated flush cam type. Access doors shall be provided at each section (e.g., filter section, supply fan section, etc.). All exterior access must be permanently labeled on the outside indicating what is behind the panel. Structural members shall be minimum 18 gauge, with access doors of minimum 20 gauge.

B. Outside Air Intakes: The outside air intakes shall be located a minimum of 15 inches above the roof mounting curb to minimize the effect of heat pickup from the roof during the natural cooling cycle and the effects of snow on the roof during winter operation. Each air intake shall be furnished with rain eliminators.

C. Insulation: Minimum of 1/2" thick, 1.5 lb./cu.ft. density coated glass fiber insulation on surfaces where conditioned air is handled. Protect edges from erosion.

D. Heat Exchangers: Aluminized steel, of welded construction.

E. Air Filters: Two-inch thick glass fiber disposable media in metal frames.

2.4 ROOF MOUNTING FRAME AND BASE

A. Roof Mounting Curb: Minimum 12 inches high, minimum 14 gauge galvanized steel, one-piece construction, insulated, all welded, wood nailer.

2.5 FANS/MOTORS

A. Fans:

1. Supply Fans: centrifugal; SWSI plenum or vane axial fan.
2. Exhaust Fans: Propeller or SWSI plenum fan.
3. All fans shall be aluminum or composite construction with fan shaft: turned, ground and polished steel; keyed to wheel hub.
4. Fan and motor assemblies shall be resiliently mounted.
5. Direct drive motor or with V-belt drive and rubber isolated hinge mounted motor.
6. All fan bearings must be capable of being lubricated by easily accessible grease fittings.
7. All fans must be statically and dynamically balanced.

B. Motors:

1. Motors shall be open drip-proof with grease lubricated bearings.
2. No equipment shall be selected or operate above 90% of its motor nameplate rating.
3. Motor shall have 1.15 service factor.

2.6 BURNER

A. Gas Burner: Forced draft type burner with adjustable combustion air supply, pressure regulator, gas valves, manual shutoff, intermittent spark or glow coil ignition, flame sensing device, and automatic 100 percent shutoff pilot. fully modulating gas valve with minimum 4:1 turndown.

B. Gas Burner Safety Controls: Energize ignition, limit time for establishment of flame, prevent opening of gas valve until pilot flame is proven, stop gas flow on ignition failure, energize blower motor, and after airflow proven and slight delay, allow gas valve to open.

C. High Limit Control: Temperature sensor with fixed stop at maximum permissible setting, de-energize burner on excessive bonnet temperature and energize burner when temperature drops to lower safe value.

D. Supply Fan Control: Temperature sensor sensing bonnet temperatures and independent of burner controls, or adjustable time delay relays with switch for continuous fan operation.

2.7 EVAPORATOR COIL

A. Provide copper tube with aluminum fin coil assembly.

B. Install a drain pan under each cooling coil meeting requirements as outlined in ASHRAE 62.1. The drain pans shall extend the entire width of each coil, including piping and header if in the air stream. The length shall be as necessary to limit water droplet carryover beyond the drain pan to 0.0044oz per ft2 of face area per hour under peak sensible and peak dew point design conditions, considering both latent load and coil face velocity. Pitch drain pans in two directions towards the outlet, with a slope of at least 1/8" per foot.

C. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

D. Provide insulation on liquid refrigerant and suction piping between compressor and evaporator coil where not protected by drain pans. Insulation shall be elastomeric cellular foam; ANSI/ASTM C534; flexible plastic; 0.27 maximum 'K' value at 75°F, 25/50 flame spread/smoke developed rating when tested in accordance with ASTM E84 (UL 723). Maximum 1" thick per layer where multiple layers are specified.

E. Drain Pan Condensate Overflow Switch: Float with integral magnet overflow switch conforming to UL508. Factory installed in drain pan and wired to shut the rooftop unit down with a fault alarm. No standby power required.

2.8 HOT GAS REHEAT COIL

A. Provide copper tube with aluminum fin coil assembly.

B. Valves to reroute hot refrigerant gas from the discharge line of the compressor through the reheat coil.

2.9 COMPRESSOR

A. Provide hermetic or semi-hermetic compressors (quantity as scheduled on drawings), 3600 rev/min maximum, resiliently mounted with positive lubrication, crankcase heater for operation down to 0°F, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

B. Provide capacity control by staging multiple compressors, digital scrolls, inverter duty scroll compressors.

C. Five minute timed off circuit shall delay compressor start.

D. The use of hydrochlorofluorocarbon (HCFC) or chlorofluorocarbon (CFC) based refrigerants is prohibited.

2.10 CONDENSER

A. Condenser shall provide design capacity between the minimum and maximum ambient conditions scheduled on the drawings.

B. Condenser Coil:

1. Microchannel: All aluminum brazed fin construction. The maximum allowable working pressure of the condenser is 450 psig. Air test under water to 450 psig.

C. Condenser Fans: Provide direct drive low noise blade design propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor. Fan blade design shall be a dynamic profile for low tip speed. Fan blade shall be aluminum or composite material.

D. Condenser Motors: Fan motors shall be an ECM type motor for proportional control. The motor shall include thermal overload protection and protect the motor in the case of excessive motor temperatures. The motor shall have phase failure protection and prevent the motor from operation in the event of a loss of phase.

E. Entire fan assembly shall be statically and dynamically balanced.

F. Provide refrigerant pressure switches to cycle condenser fans.

G. Provide hail guards on all condenser coils.

H. Liquid and discharge isolation valves with staged and digital scrolls.

2.11 ECONOMIZERS

A. Factory installed by approved rooftop unit manufacturer with fully modulating motorized outside air and return air dampers.

B. To be controlled by differential enthalpy with fixed dry-bulb controller with minimum position setting.

C. Shall be equipped with 100% capable relief barometric damper relieving up to 100% return air and sealed to meet ASHRAE 90.1 requirements.

D. Shall be capable of introducing up to 100% outside air.

E. Shall maintain minimum airflow into the building during occupied period and provide design ventilation rate for full occupancy.

F. Dampers shall be capable of completely closing when unit is in unoccupied mode.

G. Outside air damper normally closed and return air damper normally open.

H. Provide factory installed and tested, outdoor air monitor that controls outdoor air ± 15% accuracy down to 40 CFM per ton.

I. Provide a field installed duct/space-mounted C02 sensor. Outside air damper position shall modulate between the demand control ventilation limit (minimum position setpoint) and the ventilation limit (maximum non-economizer position setpoint) to satisfy the space requirements. Damper position shall be controlled to the greater of the two command signals, either minimum outside airflow or space IAQ (CO2).

J. Economizer Fault Detection and Diagnostics (FDD):

1. Air-cooled unitary direct-expansion units that are equipped with an economizer shall include a fault detection and diagnostics system complying with the following:

a. The following temperature sensors shall be permanently installed to monitor system operation:

1) Outside air.
2) Supply air.
3) Return air.

b. Temperature sensors shall have an accuracy of ±2°F over the range of 40°F to 80°F.
c. Refrigerant pressure sensors, where used, shall have an accuracy of ± 3 percent of full scale.
d. The unit controller shall be configured to provide system status by indicating the following:

1) Free cooling available.
2) Economizer enabled.
3) Compressor enabled.
4) Heating enabled.
5) Mixed air low limit cycle active.
6) The current value of each sensor.

e. The unit controller shall be capable of manually initiating each operating mode so that the operation of compressors, economizers, fans, and the heating system can be independently tested and verified.
f. The fault detection and diagnostics system shall be configured to detect the following faults:

1) Air temperature sensor failure/fault.
2) Not economizing when the unit should be economizing.
3) Economizing when the unit should not be economizing.
4) Damper not modulating.
5) Excess outdoor air.

g. The unit shall be configured to report faults to a fault management application available for access by day-to-day operating or service personnel or annunciated locally on zone thermostats.

2.12 POWER EXHAUST

A. Factory installed by economizer supplier or compatible equivalent.

B. Controlled by economizer controls.

C. Power exhaust shall be factory wired to electrical section complete with conduit, feeders, disconnect, and overcurrent protection. Power exhaust shall be energized based on building pressure or when dampers open past the adjustable setpoint of the economizer control.

D. Must comply with Energy Code Fan Power Limitation formula.

E. Fans:

1. Exhaust Fans: Propeller
2. All fans shall be aluminum or composite construction with fan shaft: turned, ground and polished steel; keyed to wheel hub.
3. Fan and motor assemblies shall be resiliently mounted
4. Direct drive motor.
5. All fan bearings must be capable of being lubricated by easily accessible grease fittings.
6. All fans must be statically and dynamically balanced.

F. Motors:

1. Motors shall be open drip-proof with grease lubricated bearings.
2. Motors shall be "variable frequency drive rated" when controlled by VFDs. .
3. No equipment shall be selected or operate above 90% of its motor nameplate rating.

2.13 ELECTRICAL

A. Provide with single point power connection to service all controls, dampers, outlet, and fans, complete with non-fused disconnect switch, short circuit protection of all internal electrical components, and all necessary motor starters, contactors, and over-current protection, transformer, and convenience outlet.

B. All units must be so constructed that when the electrical section access panel is opened, all electrical power to the unit (with the exception of the 120 volt duplex convenience outlet) is disconnected by means of a single disconnect**.**

C. All wiring must be labeled, numbered, and terminate in "spade clips". All terminal strips must be keyed to the wiring numbers. Each control device must be permanently labeled to indicate its function.

D. Wiring diagrams for all circuits must be permanently affixed to the inside of the electrical section access panel. The markings of terminal strips and wiring must agree with the numbering on the wiring diagrams.

E. All units shall include a transformer for controls and convenience outlet.

F. Only one power cable connection to the unit shall be necessary.

G. Motor shall include phase failure protection and prevent the motor from operation in the event of phase loss.

2.14 DDC TEMPERATURE CONTROLS

A. Install standalone control module providing communication between unit controls and packaged DDC temperature control system.

B. Control module shall be compatible with temperature control system specified in Section 23 09 00. Provide BACnet gateway for communication.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings and illustrated by the manufacturer.

B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount units on factory built roof mounting curb and provide watertight enclosure to protect ductwork and utility services. Install unit level.

C. All field wiring shall be in accordance with the National Electrical Code.

D. P-traps must be provided for all drain pans.

E. Comb all coils to repair bent fins.

3.3 MANUFACTURER'S FIELD SERVICES

A. Provide initial start-up and shutdown during first year of operation.

END OF SECTION

SECTION 26 05 00 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Requirements applicable to all Division 26 Sections. Also refer to Division 1 - General Requirements. This section is also applicable to Fire Alarm and Detection Systems Section 28 31 00.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 REFERENCES

A. NFPA 70 - National Electrical Code (NEC)

1.3 SCOPE OF WORK

A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Electrical Systems.

B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Electrical Work a finished and working system.

1.4 WORK SEQUENCE

A. All work that will produce excessive noise or interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during unoccupied hours. The Owner reserves the right to determine when restricted construction hours are required.

1.5 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    b. Electrical trades shall include, but are not limited to, electrical equipment, conduit, conduit racks, cable trays, pull boxes, transformers, raceway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    d. Maintenance clearances and code-required dedicated space shall be included.

e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.
3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

   a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of ventilation drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

   a. Scale of drawings:

      1) General plans: 1/4 Inch = 1 '-0" (minimum).
      2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
      3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
      4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).
      5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
    b. Potential layout changes shall be made to avoid additional access panels.
    c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
    d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
    e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign-off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.6 QUALITY ASSURANCE

A. Contractor's Responsibility Prior to Submitting Pricing/Bid Data:

1. The Contractor is responsible for constructing complete and operating systems. The Contractor acknowledges and understands that the Contract Documents are a two-dimensional representation of a three-dimensional object, subject to human interpretation. This representation may include imperfect data, interpreted codes, utility guides, three-dimensional conflicts, and required field coordination items. Such deficiencies can be corrected when identified prior to ordering material and starting installation. The Contractor agrees to carefully study and compare the individual Contract Documents and report at once in writing to the Architect/Engineer any deficiencies the Contractor may discover. The Contractor further agrees to require each subcontractor to likewise study the documents and report at once any deficiencies discovered.
2. The Contractor shall resolve all reported deficiencies with the Architect/Engineer prior to awarding any subcontracts, ordering material, or starting any work with the Contractor's own employees. Any work performed prior to receiving instructions from the Architect/Engineer will be done at the Contractor's risk.

B. Qualifications:

1. Only products of reputable manufacturers, as determined by the Architect/Engineer, are acceptable.
2. All Contractors and subcontractors shall employ only workmen who are skilled in their trades. At all times, the number of apprentices at the job site shall be less than or equal to the number of journeymen at the job site.

C. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the Illinois Community College Board Codes, Laws, Ordinances and other regulations having jurisdiction.
2. If there is a discrepancy between the codes and regulations and these specifications, the Architect/Engineer shall determine the method or equipment used.
3. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting clarification. If there is insufficient time for this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
4. All changes to the system made after the letting of the contract to comply with codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.
5. If there is a discrepancy between manufacturer's recommendations and these specifications, the manufacturer's recommendations shall govern.
6. If there are no local codes having jurisdiction, the current issue of the National Electrical Code shall be followed.

D. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all laws, regulations, ordinances, and other rules of the State or Political Subdivision where the work is done, or as required by any duly constituted public authority.
3. Pay all charges for permits or licenses.
4. Pay all fees and taxes imposed by State, Municipal, and other regulatory bodies.
5. Pay all charges arising out of required inspections by an authorized body.

6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized agency/consultant.
7. Where applicable, all fixtures, equipment and materials shall be listed by Underwriter's Laboratories, Inc. or a nationally recognized testing organization.

E. Examination of Drawings:

1. The drawings for the electrical work are completely diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment, outlets, etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and rough-ins, and the exact routing of raceways to best fit the layout of the job. Conduit entry points for electrical equipment including, but not limited to, panelboards, switchboards, switchgear and unit substations, shall be determined by the Contractor unless noted in the contract documents.
3. Scaling of the drawings will not be sufficient or accurate for determining these locations.
4. Where job conditions require reasonable changes in arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
5. Because of the scale of the drawings, certain basic items, such as junction boxes, pull boxes, conduit fittings, etc., may not be shown, but where required by other sections of the specifications or required for proper installation of the work, such items shall be furnished and installed.
6. If an item is either shown on the drawings or called for in the specifications, it shall be included in this contract.
7. The Contractor shall determine quantities and quality of material and equipment required from the documents. Where discrepancies arise between drawings, schedules and/or specifications, the greater and better-quality number shall govern.
8. Where used in electrical documents the word "furnish" shall mean supply for use, the word "install" shall mean connect up complete and ready for operation, and the word "provide" shall mean to supply for use and connect up complete and ready for operation.
9. Any item listed as furnished shall also be installed unless otherwise noted.
10. Any item listed as installed shall also be furnished unless otherwise noted.

F. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG.
4. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
5. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
6. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
7. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
8. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

G. Field Measurements:

1. Verify all pertinent dimensions at the job site before ordering any conduit, conductors, wireways, bus duct, fittings, etc.

1.7 SUBMITTALS

A. Refer to individual specification section for the required submittal.

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

a. Date
b. Project title and number
c. Contractor's name and address
d. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
e. Description of items submitted and relevant specification number
f. Notations of deviations from the contract documents
g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

a. Date
b. Project title and number
c. Architect/Engineer
d. Contractor and subcontractors' names and addresses
e. Supplier and manufacturer's names and addresses
f. Division of work (e.g., electrical, plumbing, heating, ventilating, etc.)
g. Description of item submitted (using project nomenclature) and relevant specification number
h. Notations of deviations from the contract documents
i. Other pertinent data
j. Provide space for Contractor's review stamps

3. Composition:

a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.

5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.
    c. The Contractor's review shall include, but not be limited to, verification of the following:

        1) Only approved manufacturers are used.
        2) Addenda items have been incorporated.
        3) Catalog numbers and options match those specified.
        4) Performance data matches that specified.
        5) Electrical characteristics and loads match those specified.
        6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
        7) Dimensions and service clearances are suitable for the intended location.
        8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
        9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

    d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
    e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

    a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
    b. The Contractor shall clearly indicate the size, finish, material, etc.
    c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
    d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer before releasing any equipment for manufacture or shipment.

14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect™™s/Engineer's review and processing of each submittal, excluding mailing.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer™™s opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 26 XX XX.description.YYYYMMDD
    b. Transmittal file name: 26 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.8 SCHEDULE OF VALUES

A. The requirements herein are in addition to the provisions of Division 1.

B. Format:

1. Use AIA Document Continuation Sheets G703 or another similar form approved by the Owner and Architect/Engineer.
2. Submit in Excel format.
3. Support values given with substantiating data.

C. Preparation:

1. Itemize work required by each specification section and list all providers. All work provided by subcontractors and major suppliers shall be listed on the Schedule of Values. List each subcontractor and supplier by company name.
2. Break down all costs into:

    a. Material: Delivered cost of product with taxes paid.

b. Labor: Labor cost, excluding overhead and profit.

1.9 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.10 PRODUCT DELIVERY, STORAGE, HANDLING and MAINTENANCE

A. Exercise care in transporting and handling to avoid damage to materials. Store materials on the site to prevent damage.

B. Protect equipment, components, and openings with airtight covers and exercise care at every stage of storage, handling, and installation of equipment to prevent airborne dust and dirt from entering or fouling equipment to include, but not limited to:

1. Distribution equipment - branch panels, distribution panels, switchboards, motor control centers, etc.
2. Lighting luminaires and lighting control systems.

C. Equipment and components that are visibly damaged or have been subject to environmental conditions prior to building turnover to Owner that could shorten the life of the component (for example, water damage, humidity, dust and debris, excessive hot or cold storage location, etc.) shall be repaired or replaced with new equipment or components without additional cost to the building owner.

D. Keep all materials clean, dry and free from damaging environments.

E. Coordinate the installation of heavy and large equipment with the General Contractor and/or Owner. If the Electrical Contractor does not have prior documented experience in rigging and lifting similar equipment, he/she shall contract with a qualified lifting and rigging service that has similar documented experience. Follow all equipment lifting and support guidelines for handling and moving.

F. Contractor is responsible for moving equipment into the building and/or site. Contractor shall review site prior to bid for path locations and any required building modifications to allow movement of equipment. Contractor shall coordinate the work with other trades.

1.11 WARRANTY

A. Provide one-year warranty for all fixtures, equipment, materials, and workmanship.

B. The warranty period for all work in this specification Division shall commence on the date of Substantial Completion or successful system performance whichever occurs later. The warranty may also commence if a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization of the Owner. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner.

C. Warranty requirements extend to correction, without cost to the Owner, of all work found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage due to defects or nonconformance with contract documents excluding repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.12 INSURANCE

A. This Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.13 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the manufacturer for which a catalog number is given is the basis for job design and establishes the quality.

B. Equivalent equipment manufactured by the other listed manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meet all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor assumes all costs incurred as a result of using the offered material, article or equipment, on the Contractors part or on the part of other Contractors whose work is affected.

D. Voluntary add or deduct prices for alternate materials may be listed on the bid form. These items will not be used in determining the low bidder. This Contractor assumes all costs incurred as a result of using the offered material or equipment on the Contractors part or on the part of other Contractors whose work is affected.

E. All material substitutions requested after the final addendum must be listed as voluntary changes on the bid form.

PART 2 - PRODUCTS

2.1 GENERAL

A. All items of material having a similar function (e.g., safety switches, panelboards, switchboards, contactors, motor starters, dry type transformers) shall be of the same manufacturer unless specifically stated otherwise on drawings or elsewhere in specifications.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 EXCAVATION, FILL, BACKFILL, COMPACTION

A. General:

1. Prior to the commencement of any excavation or digging, the Contractor shall verify all underground utilities with the regional utility locator. Provide prior notice to the locator before excavations. Contact information for most regional utility locaters can be found by calling 811.
2. The Contractor shall do all excavating, filling, backfilling, compacting, and restoration in connection with the work.

B. Excavation:

1. Make all excavations to accurate, solid, undisturbed earth, and to proper dimensions.
2. If excavations are carried in error below indicated levels, concrete of same strength as specified for the foundations or thoroughly compacted sand-gravel fill, as determined by the Architect/Engineer shall be placed in such excess excavations under the foundation. Place thoroughly compacted, clean, stable fill in excess excavations under slabs on grade, at the Contractor's expense.
3. Trim bottom and sides of excavations to grades required for foundations.
4. Protect excavations against frost and freezing.
5. Take care in excavating not to damage surrounding structures, equipment or buried pipe. Do not undermine footing or foundation.
6. Perform all trenching in a manner to prevent cave-ins and risk to workmen.
7. Where original surface is pavement or concrete, the surface shall be saw cut to provide clean edges and assist in the surface restoration.
8. If satisfactory bearing soil is not found at the indicated levels, immediately notify the Architect/Engineer or their representative, and do no further work until the Architect/Engineer or their representative gives further instructions.

9. Excavation shall be performed in all ground conditions, including rock, if encountered. Bidders shall visit the premises and determine the soil conditions by actual observations, borings, or other means. The cost of all such inspections, borings, etc., shall be borne by the bidder.
10. If a trench is excavated in rock, a compacted bed with a depth of 3" (minimum) of sand and gravel shall be used to support the conduit unless masonry cradles or encasements are used.
11. Mechanical excavation of the trench to line and grade of the conduit or to the bottom level of masonry cradles or encasements is permitted, unless otherwise indicated on the electrical drawings.
12. Mechanical excavation of the trench to line and grade where direct burial cables are to be installed is permitted provided the excavation is made to a depth to permit installation of the cable on a fine sand bed at least 3 inches deep.

C. Dewatering:

1. Furnish, install, operate and remove all dewatering pumps and pipes needed to keep trenches and pits free of water.

D. Underground Obstructions:

1. Known underground piping, conduit, feeders, foundations, and other obstructions in the vicinity of construction are shown on the drawings. Review all Bid Documents for all trades on the project to determine obstructions indicated. Take great care in making installations near underground obstructions.
2. If objects not shown on the drawings are encountered, remove, relocate, or perform extra work as directed by the Architect/Engineer.

E. Fill and Backfilling:

1. No rubbish or waste material is permitted for fill or backfill.
2. Provide all necessary sand and/or CA6 for backfilling.
3. Native soil materials may be used as backfill if approved by the Geotechnical Engineer.
4. Dispose of the excess excavated earth as directed.
5. Backfill materials (native soil material, sand, and/or CA6) shall be suitable for required compaction, clean and free of perishable materials, frozen earth, debris, earth with a high void content, and stones greater than 4 inches in diameter. Water is not permitted to rise in unbackfilled trenches.
6. Backfill all trenches and excavations immediately after installing of conduit, or removing forms, unless other protection is directed.
7. Around piers and isolated foundations and structures, backfill and fill shall be placed and consolidated simultaneously on all sides to prevent wedge action and displacement. Spread fill and backfill materials in 6" uniform horizontal layers with each layer compacted separately to required density.
8. For conduits that are not concrete encased, lay all conduits on a compacted bed of sand at least 3" deep. Backfill around conduits with sand, in 6" layers and compact each layer.
9. Backfill with native soil material (if approved) or sand up to grade for all conduits under slabs or paved areas. All other conduits shall have sand backfill to 6" above the top of the conduit.
10. Place all backfill above the sand in uniform layers not exceeding 6" deep. Place then carefully and uniformly tamp each layer to eliminate lateral or vertical displacement.

11. Where the fill and backfill will ultimately be under a building, floor or paving, each layer of fill shall be compacted to 95% of the maximum density as determined by AASHTO Designation T-99 or ASTM Designation D-698. Moisture content of soil at time of compaction shall not exceed plus or minus 2% of optimum moisture content as determined by AASHTO T-99 or ASTM D-698 test.
12. After backfilling of trenches, no superficial loads shall be placed on the exposed surface of the backfill until a period of 48 hours has elapsed.

F. Surface Restoration:

1. Where trenches are cut through graded, planted or landscaped areas, the areas shall be restored to the original condition. Replace all planting and landscaping features removed or damaged to its original condition. At least 6" of topsoil shall be applied where disturbed areas are to be seeded or sodded. All lawn areas shall be sodded unless seeding is called out in the drawings or specifications.
2. Concrete or asphalt type pavement, seal coat, rock, gravel or earth surfaces removed or damaged shall be replaced with comparable materials and restored to original condition. Broken edges shall be saw cut and repaired as directed by Architect/Engineer.

3.3 ARCHITECT/ENGINEER OBSERVATION OF WORK

A. The contractor shall provide seven (7) calendar days' notice to the Architect/Engineer prior to:

1. Placing fill over underground and underslab utilities.
2. Covering exterior walls, interior partitions and chases.
3. Installing hard or suspended ceilings and soffits.

B. The Architect/Engineer will review the installation and provide a written report noting deficiencies requiring correction. The contractor's schedule shall account for these reviews and show them as line items in the approved schedule.

C. Above-Ceiling Final Observation:

1. All work above the ceilings must be complete prior to the Architect/Engineer's review. This includes, but is not limited to:

a. All junction boxes are closed and identified in accordance with Section 26 05 53 Electrical Identification.
b. Luminaires, including ceiling-mounted exit and emergency lights, are installed and operational.
c. Luminaire whips are supported above the ceiling.
d. Conduit identification is installed in accordance with Section 26 05 53 Electrical Identification.
e. Luminaires are suspended independently of the ceiling system when required by these contract documents.
f. All wall penetrations have been sealed.

2. It is understood that if the Architect/Engineer finds the ceilings have been installed prior to this review and prior to seven days elapsing, the Architect/Engineer may not recommend further payments to the contractor until full access has been provided.

3.4 PROJECT CLOSEOUT

A. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. To prevent the Final Jobsite Observation from occurring too early, the Contractor shall review the completion status of the project and certify that the job is ready for the final jobsite observation.
2. Attached to the end of this section is a typical list of items that represent the degree of job completeness expected prior to requesting a review. The Contractor shall sign the attached certification and return it to the Architect/Engineer so that the final observation can be scheduled.
3. It is understood that if the Architect/Engineer finds the job not ready for the final observation and additional trips and observations are required to bring the project to completion, the cost of the additional time and expenses incurred by the Architect/Engineer will be deducted from the Contractor's final payment.
4. Contractor shall notify Architect/Engineer 48 hours prior to installation of ceilings or lay-in ceiling tiles.

C. The following must be submitted before Architect/Engineer recommends final payment:

1. Operation and maintenance manuals with copies of approved shop drawings.
2. Record documents including marked-up drawings and specifications.
3. A report documenting the instructions given to the Owner's representatives complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of this Contractor and shall be signed by the Owner's representatives.
4. Inspection and testing report by the fire alarm system manufacturer.
5. Start-up reports on all equipment requiring a factory installation or start-up.

D. Circuit Directories:

1. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.

3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div26.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div26.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copies of all factory inspections and/or equipment startup reports.
5. Copies of warranties.
6. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
7. Dimensional drawings of equipment.
8. Detailed parts lists with lists of suppliers.
9. Operating procedures for each system.
10. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
11. Repair procedures for major components.
12. Replacement parts and service material requirements for each system and the frequency of service required.
13. Instruction books, cards, and manuals furnished with the equipment.
14. Include record drawings of the one-line diagrams for each major system. The graphic for each piece of equipment shown on the one-line diagram shall be an active link to its associated Operation & Maintenance data.
15. Copies of all panel schedules in electronic Microsoft Excel spreadsheet (.xlsx) file. Each panelboard shall be a separate tab in the workbook.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

A. Adequately instruct the Owner's designated representatives in the maintenance, care, and operation of the complete systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

D. The instructions shall include:

1. Maintenance of equipment.
2. Start-up procedures for all major equipment.

E. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.

F. Minimum hours of instruction time for each item and/or system shall be as indicated in each individual specification section.

G. Operating Instructions:

1. Contractor is responsible for all instructions to the Owner's representatives for the electrical and specialized systems.
2. If the Contractor does not have staff that can adequately provide the required instructions, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 RECORD DOCUMENTS

A. The following paragraphs supplement Division 1 requirements.

B. Maintain at the job site a separate and complete set of electrical drawings and specifications with all changes made to the systems clearly and permanently marked in complete detail.

C. Mark drawings and specifications to indicate approved substitutions; Change Orders, and actual equipment and materials used. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should this Contractor fail to complete Record Documents as required by this contract, this Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.

D. Record changes daily and keep the marked drawings available for the Architect/Engineer's examination at any normal work time.

E. Upon completing the job, and before final payment is made, give the marked-up drawings to the Architect/Engineer.

F. Record actual routing of conduits exceeding 2 inches.

3.8 PAINTING

A. Paint all equipment that is marred or damaged prior to the Owner's acceptance. Paint and color shall match original equipment paint and shall be obtained from the equipment supplier if available. All equipment shall have a finished coat of paint applied unless specifically allowed to be provided with a prime coat only.

B. Equipment in finished areas that will be painted to match the room decor will be painted by others. Should this Contractor install equipment in a finished area after the area has been painted, the Contractor shall have the equipment and all its supports, hangers, etc., painted to match the room decor. Painting shall be performed as described in project specifications.

C. After surfaces have been thoroughly cleaned and are free of oil, dirt or other foreign matter, paint all raceway and equipment with the following:

1. Bare Metal Surfaces - Apply one coat of metal primer suitable for the metal being painted. Finish with two coats of Alkyd base enamel paint.
2. Plastic Surfaces - Paint plastic surfaces with two coats of semi-gloss acrylic latex paint.

3.9 ADJUST AND CLEAN

A. Thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

B. Clean all foreign paint, grease, oil, dirt, labels, stickers, etc. from all equipment.

C. Remove all rubbish, debris, etc., accumulated during construction from the premises.

3.10 SPECIAL REQUIREMENTS

A. Coordinate the installation of all equipment, controls, devices, etc., with other trades to maintain clear access area for servicing.

B. Install all equipment to maximize access to parts needing service or maintenance. Review the final location, placement, and orientation of equipment with the Owner's representative prior to setting equipment.

C. Installation of equipment or devices without regard to coordination of access requirements and confirmation with the Owner's representative will result in removal and reinstallation of the equipment at the Contractor's expense.

D. Raceway and Cable Routing Restrictions: Raceways and cable are restricted from being routed in the following locations, unless serving the space or permitted by the authority having jurisdiction.

1. Elevator machine rooms and hoistways.
2. Exit enclosures.
3. Other areas restricted by code.
4. Technology, data, server rooms.
5. Normal power in emergency power equipment rooms: Limited to feeders and branch circuits serving the emergency power equipment located in the room.
6. Emergency power in normal power equipment rooms: Limited to feeders and branch circuits serving the normal power equipment located in the room.

3.11 INDOOR AIR QUALITY (IAQ) MAINTENANCE FOR OCCUPIED FACILITIES UNDER CONSTRUCTION

A. Within the Limits of Construction:

1. The Electrical Contractor shall coordinate all work with the contractor responsible for IAQ.
2. The means, methods and materials used by the Electrical Contractor shall be coordinated with the contractor responsible for IAQ and shall comply with the IAQ requirements set forth in Division 1 and Division 21/22/23 of these specifications.

B. Outside the Limits of Construction:

1. IAQ shall be the responsibility of the electrical contractor for work that is required outside the limits of construction.
2. The Electrical Contractor is responsible for the IAQ set forth in Division 1 and Division 21/22/23 of these specifications.
3. The Electrical Contractor shall review and coordinate all IAQ plans and procedures with the owner's IAQ representative.

3.12 SYSTEM STARTING AND ADJUSTING

A. The electrical systems shall be complete and operating. System startup, testing, adjusting, and balancing to obtain satisfactory system performance is the responsibility of the Contractor. This includes all calibration and adjustment of electrical controls, balancing of loads, troubleshooting and verification of software, and final adjustments that may be needed.

B. Complete all manufacturer-recommended startup procedures and checklists to verify proper equipment operation and does not pose a danger to personnel or property.

C. All operating conditions and control sequences shall be tested during the start-up period. Testing all interlocks, safety shut-downs, controls, and alarms.

D. The Contractor, subcontractors, and equipment suppliers shall have skilled technicians to ensure that all systems perform properly. If the Architect/Engineer is requested to visit the job site for trouble shooting, assisting in start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period, through no fault of the design; the Contractor shall reimburse the Owner on a time and materials basis for services rendered at the Architect/Engineer's standard hourly rates in effect when the services are requested. The Contractor shall pay the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.13 FIELD QUALITY CONTROL

A. General:

1. Conduct all tests required during and after construction. Submit test results in NETA format, or equivalent form, that shows the test equipment used, calibration date, tester's name, ambient test conditions, humidity, conductor length, and results corrected to 40°C.
2. Supply necessary instruments, meters, etc., for the tests. Supply competent technicians with training in the proper testing techniques.
3. All cables and wires shall be tested for shorts and grounds following installation and connection to devices. Replace shorted or grounded wires and cables.

4. Any wiring device, electrical apparatus or luminaire, if grounded or shorted on any integral "live" part, shall have all defective parts or materials replaced.
5. Test cable insulation of service and panel feeder conductors for proper insulation values. Tests shall include the cable, all splices, and all terminations. Each conductor shall be tested and shall test free of short circuits and grounds and have an insulation value not less than Electrical Code Standards. Take readings between conductors, and between conductors and ground.
6. If the results obtained in the tests are not satisfactory, make adjustments, replacements, and changes as needed. Then repeat the tests, and make additional tests, as the Architect/Engineer or authority having jurisdiction deems necessary.

B. Other Equipment:

1. Give other equipment furnished and installed by the Contractor all standard tests normally made to assure that the equipment is electrically sound, all connections properly made, phase rotation correct, fuses and thermal elements suitable for protection against overloads, voltage complies with equipment nameplate rating, and full load amperes are within equipment rating.

C. If any test results are not satisfactory, make adjustments, replacements and changes as needed and repeat the tests and make additional tests as the Architect/Engineer or authority having jurisdiction deem necessary.

END OF SECTION

SECTION 26 05 03 - THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 - Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. The Building Officials and Code Administrators National Building Code

J. 2015 International Building Code

K. NFPA 5000 - Building Construction Safety Code

1.4 SUBMITTALS

A. Submit under provisions of Section 26 05 00.

B. Submit Firestopping Installers Certification for all installers on the project.

C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Interek / Warnock Hersey Assembly number.

D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
4. F ratings for each firestop system.

E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.
2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 CFM/sq.ft. at both ambient temperature and 400F .

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.7 MEETINGS

A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.

1. Review foreseeable methods related to firestopping work.
2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.8 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk
4. Tremco; Sealant/Weatherproofing Division
5. Johns-Manville
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Wiremold/Legrand: FlameStopper
10. Dow Corning Corp.
11. Fire Trak Corp.
12. International Protective Coating Corp.
13. HoldRite

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

E. Provide firestopping systems allowing continuous insulation for all insulated pipes.

F. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

   a. F Rating = Floor/Wall Rating
   b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

   a. F Rating = Wall Rating
   b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

a. F Rating = Wall/Floor Rating
b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

G. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

H. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 INSPECTION

A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.

B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

D. The Contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the Contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The Contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the Contractor's expense.

END OF SECTION

SECTION 26 05 05 - ELECTRICAL DEMOLITION FOR REMODELING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work shall be as specified in individual Sections.

PART 3 - EXECUTION

3.1 EXAMINATION

A. The drawings are intended to indicate the scope of work required and do not indicate every box, conduit, or wire that must be removed. The contractor shall visit the site prior to submitting a bid and verify existing conditions.

B. Where walls, ceilings, structures, etc., are indicated as being removed on general or electrical drawings, the Contractor shall be responsible for the removal of all electrical equipment, devices, fixtures, raceways, wiring, systems, etc., from the removed area.

C. Where ceilings, walls, structures, etc., are temporarily removed and replaced by others, this Contractor shall be responsible for the removal, storage, and replacement of equipment, devices, fixtures, raceways, wiring, systems, etc.

D. Where mechanical or technology equipment is indicated as being removed on electrical, mechanical, or technology drawings, the Contractor shall be responsible for disconnecting the equipment and removing all starters, VFD, controllers, electrical equipment, raceways, wiring, etc. associated with the device.

E. Verify that abandoned wiring and equipment serve only abandoned equipment or facilities. Extend conduit and wire to facilities and equipment that will remain in operation following demolition. Extension of conduit and wire to equipment shall be compatible with the surrounding area. Extended conduit and conductors to match existing size and material.

F. Coordinate scope of work with all other Contractors and the Owner at the project site. Schedule removal of equipment and electrical service to avoid conflicts.

G. Bid submittal shall mean the Contractor has visited the project site and has verified existing conditions and scope of work.

3.2 PREPARATION

A. The Contractor shall obtain approval from the Owner before turning off power to circuits, feeders, panels, etc. Coordinate all outages with Owner.

B. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations. Assume all equipment and systems must remain operational unless specifically noted otherwise on drawings.

C. Disconnect electrical systems in walls, floors, structures, and ceilings scheduled for removal.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for connection. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.Provide a watchman to make required premise observations during all outages, requirements as dictated by codes and Owner's insurance carrier.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Demolish and extend existing electrical work under provisions of Division 1 of Specifications and this Section.

B. Remove, relocate, and extend existing installations to accommodate new construction.

C. Remove abandoned wiring and raceway to source of supply. Existing conduit in good condition may be reused in place by including an equipment ground conductor in reused conduit. Reused conduit and boxes shall have supports revised to meet current codes. Relocating conduit shall not be allowed.

D. Remove exposed abandoned raceway, including abandoned raceway above accessible ceiling finishes. Cut raceway flush with walls and floors, and patch surfaces. Remove all associated clamps, hangers, supports, etc. associated with raceway removal.

E. Disconnect and remove outlets and devices that are to be demolished. Remove conduit, supports, and conductors back to source. Devices' back box and conduit mounted in walls that are to remain can be abandoned in place. Provide appropriate cover plate for all abandoned back boxes. Cover plates shall match existing plates used in the adjacent areas.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories. Ballasts in light fixtures installed prior to 1980 shall be incinerated in EPA approved incinerator or disposed of in EPA certified containers and deposited in an EPA landfill certified for PCB disposal or recycled by permitted ballast recycler. Punctured or leaking ballasts must be disposed of according to Federal Regulations under the Toxic Substance Control Act. Provide Owner and Architect/Engineer with a Certificate of Destruction to verify proper disposal.

H. Repair adjacent construction and finishes damaged during demolition and extension work. Patch openings to match existing surrounding finishes.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide junction boxes and access panel as appropriate.

J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified. Extended conduit and conductors to match existing size and material.

K. HID and fluorescent lamps, determined by the Toxicity Characteristic Leachate procedure (TCLP), to be hazardous waste shall be disposed of in an EPA-permitted hazardous waste disposal facility or by a permitted lamp recycler.

L. Regulatory Requirements: Comply with governing EPA notification regulations before beginning demolition. Comply with hauling and disposal regulations of authorities having jurisdiction.

M. Floor slabs may contain conduit systems. This Contractor is responsible for taking any measures required to ensure no conduits or other services are damaged. This includes X-ray or similar non-destructive means. Where conduit is in concrete slab, cut conduit flush with floor, pull out conductors, and plug conduit ends.

N. This Contractor is responsible for all costs incurred in repair, relocations, or replacement of any cables, conduits, or other services if damaged without proper investigation.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

C. Electrical items (e.g., lighting fixtures, receptacles, switches, conduit, wire, etc.) removed and not relocated remain the property of the owner. Contractor shall place items retained by the owner in a location coordinated with the owner. The contractor shall be responsible for the disposal of material the owner does not want.

3.5 INSTALLATION

A. Install relocated materials and equipment under the provisions of Division 1 of Specifications.

END OF SECTION

SECTION 26 05 13 - WIRE AND CABLE

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Building wire

B. Cabling for remote control, signal, and power limited circuits

1.2 RELATED WORK

A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

A. NEMA WC 70 - Power Cables Rated 2,000V or Less for the Distribution of Electrical Energy

B. NFPA 70 - National Electrical Code (NEC)

C. UL 44 - Thermoset-Insulated Wires and Cables

D. UL 83 - Thermoplastic-Insulated Wires and Cables

E. UL 1581 - Standard for Electrical Wires, Cables, and Flexible Cords

F. UL 2196 - Fire Resistive, Fire Resistant and Circuit Integrity Cables

1.4 SUBMITTALS

A. Submit shop drawings and product data under the provisions of Section 26 05 00.

B. Submit manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 BUILDING WIRE

A. Feeders and Branch Circuits 8 AWG and larger: Copper, stranded conductor, 600-volt insulation, THHN/THWN or XHHW-2.

B. Feeders and Branch Circuits 8 AWG and larger in Underground Conduit: Copper, stranded conductor, 600-volt insulation, XHHW-2.

C. Feeders and Branch Circuits 10 AWG and Smaller: Copper, solid or stranded conductor, 600-volt insulation, THHN/THWN, unless otherwise noted on the drawings.

D. Control Circuits: Copper, stranded conductor 600-volt insulation, THHN/THWN.

E. Each 120 and 277-volt branch circuit shall have a dedicated neutral conductor. Neutral conductors shall be considered current-carrying conductors for wire derating.

2.2 CABLING FOR REMOTE CONTROL, SIGNAL, AND POWER LIMITED CIRCUITS

A. Wire for the following specialized systems shall be as designated on the drawings, or elsewhere in these specifications. If not designated on the drawings or specifications, the system manufacturer's recommendations shall be followed.

1. Fire alarm
2. Low voltage switching and lighting control
3. Electronic control`

B. Control Cable for Class 1 Remote Control and Signal Circuits: Copper conductor, 600-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket.

C. Control Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a PVC jacket; UL listed.

D. Plenum Cable for Class 2 or Class 3 Remote Control and Signal Circuits: Copper conductor, 300-volt insulation, rated 60°C, individual conductors twisted together, shielded, and covered with a nonmetallic jacket; UL listed for use in air handling ducts, hollow spaces used as ducts, and plenums.

PART 3 - EXECUTION

3.1 WIRE AND CABLE INSTALLATION SCHEDULE

A. Above Accessible Ceilings:

1. Building wire shall be installed in conduit.
2. Metal clad cable, Type MC, 1/2" size with minimum #12 conductors and ground, shall be allowed for flexible whips to individual luminaires only . The flexible whips shall be between 18" to 72" in length per Electrical Code.

B. All Other Locations: Building wire in conduit.

C. Above Grade: All conductors installed above grade shall be type "THHN".

D. Underground or In Slab: All conductors shall be type "XHHW-2".

E. Low Voltage Cable (less than 100 volts): Low voltage cables in ducts, plenums, and other air handling spaces shall be plenum listed. Low voltage cables in non-accessible areas shall be installed in conduit. Low voltage cable may be installed without conduit in accessible areas using the following types of cable supports. Cable support types/systems shall comply with the warranty requirements of the low voltage cable manufacturer.

1. J-hooks

3.2 CONTRACTOR CHANGES

A. The basis of design is copper conductors installed in raceway based on ambient temperature of 30°C, NEC Table 310.16 (2011 - 2017 edition 310.15(B)(16))

B. The Contractor shall be responsible for derating and sizing conductors and conduits to equal or exceed the ampacity of the basis of design circuits, if he/she chooses to use methods or materials other than the basis of design.

C. Conductor length(s) listed on plans and schedules. The drawings are diagrammatic with intent to convey the components of the electrical distribution system. Conductor length(s) when listed on plans and schedules are for engineering calculation purposes. Conductor length(s) shall NOT be used for bidding purposes.

D. Record drawing shall include the calculations and sketches.

3.3 GENERAL WIRING METHODS

A. Use no wire smaller than 12 AWG for power and lighting circuits, and no smaller than 14 AWG for control wiring.

B. Use no wire smaller than 18 AWG for low voltage control wiring below 100 volts.

C. Use 10 AWG conductor for 20 ampere, 120-volt branch circuit home runs longer than 75 feet, and for 20 ampere, 277-volt branch circuit home runs longer than 200 feet.

D. Use no wire smaller than 8 AWG for outdoor lighting circuits.

E. The ampacity of multiple conductors in one conduit shall be derated per the Electrical Code. In no case shall more than 4 conductors be installed in one conduit to such loads as motors larger than 1/4 HP, panelboards, motor control centers, etc.

F. Where installing parallel feeders, place an equal number of conductors for each phase of a circuit in same raceway or cable.

G. Splice only in junction or outlet boxes.

H. Neatly train and lace wiring inside boxes, equipment, and panelboards.

I. Make conductor lengths for parallel circuits equal.

J. All conductors shall be continuous in conduit from last outlet to their termination.

K. Terminate all spare conductors on terminal blocks, and label the spare conductors.

L. Cables or wires shall not be laid out on the ground before pulling.

M. Cables or wires shall not be dragged over earth or paving.

N. Care shall be taken so as not to subject the cable or wire to high mechanical stresses that would cause damage to the wire and cable.

O. At least six (6)-inch loops or ends shall be left at each outlet for installation connection of luminaires or other devices.

P. All wires in outlet boxes not connected to fixtures or other devices shall be rolled up, spliced if continuity of circuit is required, and insulated.

3.4 WIRING INSTALLATION IN RACEWAYS

A. Pull all conductors into a raceway at the same time. Use UL listed wire pulling lubricant for pulling 4 AWG and larger wires.

B. Install wire in raceway after interior of building has been physically protected from the weather and all mechanical work likely to injure conductors has been completed.

C. Pulling shall be continuous without unnecessary stops and starts with wire or cable only partially through raceway.

D. Where reels of cable or wire are used, they shall be set up on jacks close to the point where the wire or cable enters the conduit or duct so that the cable or wire may be unreeled and run into the conduit or duct with a minimum of change in the direction of the bend.

E. Conductors shall not be pulled through conduits until plastering or masonry work is completed and conduits are free from moisture. Care shall be taken so that long pulls of wire or pulls around several bends are not made where the wire may be permanently stretched and the insulation damaged.

F. Only nylon rope shall be permitted to pull cables into conduit and ducts.

G. Completely and thoroughly swab raceway system before installing conductors.

3.5 CABLE INSTALLATION

A. Provide protection for exposed cables where subject to damage.

B. Use suitable cable fittings and connectors.

C. Run all open cable parallel or perpendicular to walls, ceilings, and exposed structural members. Follow the routing as illustrated on the drawings as closely as possible. Cable routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatical, unless noted otherwise. The correct routing, when shown diagrammatically, shall be chosen by the Contractor based on information in the contract documents; in accordance with the manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", recognized industry standards; and coordinated with other contractors.

D. Open cable shall be supported by the appropriate size J-hooks or other means if called for on the drawings. Wire and cable from different systems shall not be installed in the same J-hook. J-hooks shall be sized with 20% spare capacity. J-hooks shall provide proper bend radius support for data cable and fiber cables.

E. Open cable installed above suspended ceilings shall not rest on the suspended ceiling construction, nor utilize the ceiling support system for wire and cable support.

F. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet. All J-hooks shall be installed where completely accessible and not blocked by piping, ductwork, inaccessible ceilings, etc. J-hooks shall be independently rigidly attached to a structural element. J-hooks shall be installed to provide 2" horizontal separation and 6" vertical separation between systems.

G. Open cable shall only be installed where specifically shown on the drawings, or permitted in these specifications.

3.6 WIRING CONNECTIONS AND TERMINATIONS

A. Splice and tap only in accessible junction boxes.

B. Use solderless, tin-plated copper, compression terminals (lugs) applied with circumferential crimp for conductor terminations, 8 AWG and larger.

C. Use solderless, tin-plated, compression terminals (lugs) applied with indenter crimp for copper conductor terminations, 10 AWG and smaller.

D. Use solderless pressure connectors with insulating covers for copper wire splices and taps, 8 AWG and smaller. For 10 AWG and smaller, use insulated spring wire connectors with plastic caps.

E. Use compression connectors applied with circumferential crimp for conductor splices and taps, 6 AWG and larger. Tape uninsulated conductors and connectors with electrical tape to 150 percent of the insulation value of conductor.

F. Thoroughly clean wires before installing lugs and connectors.

G. Make splices, taps and terminations to carry full ampacity of conductors without perceptible temperature rise.

H. Phase Sequence: All apparatus shall be connected to operate in the phase sequence A-B-C representing the time sequence in which the phase conductors so identified reach positive maximum voltage.

I. As a general rule, applicable to switches, circuit breakers, starters, panelboards, switchgear and the like, the connections to phase conductors are intended thus:

1. Facing the front and operating side of the equipment, the phase identification shall be:

a. Left to Right - A-B-C
b. Top to Bottom - A-B-C

J. Connection revisions as required to achieve correct rotation of motors shall be made at the load terminals of the starters or disconnect switches.

3.7 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 1.

B. Feeder (above 100A) Building Wire and Power Cable Testing: Perform an insulation-resistance test on each conductor with respect to ground and adjacent conductors. Test shall be made by means of a low-resistance ohmmeter, such as a "Megger". The applied potential shall be 500 volts dc for 300 volt rated cable and 1000 volts dc for 600 volt rated cable. The test duration shall be one minute. Insulation resistance must be greater than 100 mega-ohm for 600 volt and 25 mega-ohm for 300 volt rated cables per NETA Acceptance Testing Standard. Verify uniform resistance of parallel conductors.

C. Inspect wire and cable for physical damage and proper connection.

D. Torque test conductor connections and terminations to manufacturer's recommended values.

E. Perform continuity test on all power and equipment branch circuit conductors. Verify proper phasing connections.

F. Provide documentation of the manufacturer's recommended lug torque value for copper conductors, the date the lugs were torqued, and installed torque readings. Documentation indicating that the torque wrench has been calibrated not more than 30 days prior to tightening of lugs shall be provided.

G. Protection of wire and cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any wire or cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited to, overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid, or compound that could come in contact with the cable, cable jacket, or cable termination components.

H. Overspray of paint on any wire or cable will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed.

END OF SECTION

SECTION 26 05 27 - SUPPORTING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Conduit and Equipment Supports

B. Fastening Hardware

1.2 QUALITY ASSURANCE

A. Support systems shall be adequate for weight of equipment and conduit, including wiring, which they carry.

1.3 REFERENCES

A. UL 62275 - Cable Management Systems - Cables Ties for Electrical Installations

1.4 COORDINATION

A. Coordinate size, shape and location of concrete pads with section on Cast-in-Place Concrete or Concrete Topping.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Allied Support Systems

B. Cooper B-Line

C. Erico, Inc.

D. Hilti

E. Power Fasteners

F. Orbit Industries

2.2 MATERIAL

A. Support Channel: Hot-dip galvanized stainless steel for wet/damp locations; painted steel for interior/dry locations. All field cut ends shall be touched up with matching finish to inhibit rusting.

B. Hardware: Corrosion resistant.

C. Anchorage and Structural Attachment Components:

1. Strength: Defined in reports by ICBO Evaluation Service or another agency acceptable to Authorities Having Jurisdiction.

    a. Structural Safety Factor: Strength in tension and shear of components used shall be at least two times the maximum seismic forces to which they will be subjected.

2. Through Bolts: Structural type, hex head, high strength. Comply with ASTM F3125/F3125M Standard Specification for High Strength Structural Bolts and Assemblies.
3. Welding Lugs: Comply with MSS-SP-69, Type 57.
4. Beam clamps for Steel Beams and Joists: Double sided or concentric open web joist hangars. Single-sided type is not acceptable.
5. Bushings for Floor-Mounted Equipment Anchors: Neoprene units designed for seismically rated rigid equipment mountings, and matched to the type and size of anchor bolts and studs used.
6. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for seismically rated rigid equipment mountings, and matched to the type and size of attachment devices used.
7. Concrete Anchors: Fasten to concrete using cast-in or post-installed anchors designed per the requirements of Appendix D of ACI 318-14. Post-installed anchors shall be qualified for use in cracked concrete by ACI-355.2.
8. Masonry Anchors: Fasten to concrete masonry units with expansion anchors or self-tapping masonry screws. For expansion anchors into hollow concrete block, use sleeve-type anchors designed for the specific application. Do not fasten in masonry joints. Do not use powder actuated fasteners, wooden plugs, or plastic inserts.

D. Conduit Sleeves and Lintels:

1. Each Contractor shall provide, to the General Contractor for installation, lintels for all openings required for the Contractor's work in masonry walls and conduit sleeves for floors, unless specifically shown as being by others.
2. Refer to Structural General Notes for lintel requirements in masonry construction.

E. Rooftop Support System:

1. Provide pre-fabricated roof supports for all conduit and equipment installed above the roof. Support all conduit and equipment a minimum of 4" above roof.
2. Support system shall be compatible with single ply, bituminous, metal, and spray foam roof systems. The base shall be rounded to prevent damage to the roof, and drainage holes shall prevent ponding of water in the support.
3. All metal components shall be hot dipped galvanized. Mounting hardware shall be stainless steel or hot dipped galvanized. Support shall be UV, corrosion, and freeze/thaw resistant. Support shall include orange paint, reflective safety orange accents, or similar markings for increased visibility.
4. Products:

    a. Anvil International HBS-Base Series
    b. Cooper B-Line Dura-Blok
    c. Erico Caddy Pyramid 50, 150, 300, or 600 (to match load).

F. Truss and Joist Support System: Provided the installation complies with all loading requirements of truss and joist manufacturers, the following practices are acceptable:

1. Loads of 100 lbs. or less may be attached anywhere along the top or bottom chords of trusses or joists with a minimum 3' spacing between loads.
2. Loads greater than 100 lbs. must be hung concentrically and may be hung from top or bottom chord, provided one of the following conditions is met:

    a. The hanger is attached within 6" of a web/chord joint.
    b. Additional L2x2x1/4 web reinforcement is installed per manufacturer's requirements.

3. It is prohibited to cantilever a load using an angle or other structural component that is attached to a truss or joist in such a fashion that a torsional force is applied to that structural member.
4. If conditions cannot be met, coordinate installation with truss or joist manufacturer and contact Architect/Engineer.

G. Cable Ties for Cable Management Systems:

1. Cable ties, UL Listed, Type 21 or Type 21S, and tested to UL Standard 62275 for Cable Management Systems.
2. Acceptable Applications: Low-Voltage Wire and Cabling.

    a. Bundle wires and cables within cable trays, auxiliary gutters, and similar applications.
    b. Organize and support wiring and cables within equipment and distribution systems.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Fasten hanger rods, conduit clamps, and outlet and junction boxes to building structure using expansion anchors in concrete and beam clamps on structural steel.

B. Trapeze support installation: Cut hanger rods back at trapeze supports so they do not extend more than 3/4" below bottom face of lowest fastener and blunt any sharp edges.

C. Use toggle bolts or hollow wall fasteners in hollow masonry, plaster, or gypsum board partitions and walls; expansion anchors or preset inserts in solid masonry walls; self-drilling anchors or expansion anchors on concrete surfaces; sheet metal screws in sheet metal studs; and wood screws in wood construction.

D. Do not fasten support to ceiling systems, piping, ductwork, mechanical equipment, or conduit, unless otherwise noted.

E. Do not use powder-actuated anchors without specific permission.

F. Do not drill structural steel members.

G. Fabricate supports from structural steel or steel channels, rigidly welded or bolted to present a neat appearance. Use hexagon head bolts with spring lock washers under all nuts.

H. In wet locations and on all building floors below exterior earth grade install free-standing electrical equipment on concrete pads.

I. Install cabinets and panelboards with minimum of four anchors. Provide horizontal backing/support framing in stud walls for rigid mounting. Provide steel channel supports to stand surface-mounted panelboard or cabinet one inch off wall.

J. Bridge studs top and bottom with channels to support flush-mounted cabinets and panelboards in stud walls.

K. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

L. Refer to Section 26 05 33 for special conduit supporting requirements.

3.2 FINISH

A. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.

B. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

END OF SECTION

SECTION 26 05 33 - CONDUIT AND BOXES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Rigid metallic conduit and fittings (RMC)

B. Intermediate metallic conduit and fittings (IMC)

C. Electrical metallic tubing and fittings (EMT)

D. Flexible metallic conduit and fittings (FMC)

E. Liquidtight flexible metallic conduit and fittings (LFMC)

F. Rigid polyvinyl chloride conduit and fittings (PVC)

G. Wall and ceiling outlet boxes

H. Electrical connection

I. Pull and junction boxes

1.2 RELATED WORK

A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 REFERENCES

A. American National Standards Institute (ANSI):

1. ANSI C80.1 - Rigid Steel Conduit, Zinc-Coated
2. ANSI C80.3 - Electrical Metallic Tubing, Zinc-Coated and Fittings
3. ANSI C80.4 - Fittings for Rigid Metal Conduit and Electrical Metallic Tubing
4. ANSI C80.6 - Intermediate Metal Conduit, Zinc Coated
5. ANSI/NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers and Box Supports

B. NECA "Standards of Installation"

C. National Electrical Manufacturers Association (NEMA):

1. ANSI/NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing and Cable
2. RN 1 - Polyvinyl chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit, Rigid Aluminum Conduit, and Intermediate Metal Conduit
3. TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit
4. TC 9 - Fittings for PVC Plastic Utilities Duct for Underground Installation

D. NFPA 70 - National Electrical Code (NEC)

E. Underwriters Laboratories (UL): Applicable Listings

1. UL 1 - Flexible Metal Conduit
2. UL 6 - Rigid Metal Conduit
3. UL 360 - Liquid Tight Flexible Steel Conduit
4. UL514-B - Conduit Tubing and Cable Fittings
5. UL651-A - Type EB and a PVC Conduit and HDPE Conduit
6. UL797 - Electrical Metal Tubing
7. UL1242 - Intermediate Metal Conduit

F. Definitions:

1. Fittings: Conduit connection or coupling.
2. Body: Enlarged fittings with opening allowing access to the conductors for pulling purposes only.
3. Mechanical Spaces: Enclosed areas, usually kept separated from the general public, where the primary use is to house service equipment and to route services. These spaces generally have exposed structures, bare concrete and non-architecturally emphasized finishes.
4. Finished Spaces: Enclosed areas where the primary use is to house personnel and the general public. These spaces generally have architecturally emphasized finishes, ceilings and/or floors.
5. Concealed: Not visible by the general public. Often indicates a location either above the ceiling, in the walls, in or beneath the floor slab, in column coverings, or in the ceiling construction.
6. Above Grade: Not directly in contact with the earth. For example, an interior wall located at an elevation below the finished grade shall be considered above grade but a wall retaining earth shall be considered below grade.
7. Slab: Horizontal pour of concrete used for a floor or sub-floor.

1.4 SUBMITTALS

A. Include fittings and conduits 1.5" and larger in coordination files. Include all in--floor and underfloor conduit in coordination files. Refer to Section 26 05 00 for coordination drawing requirements.

PART 2 - PRODUCTS

2.1 RIGID METALLIC CONDUIT (RMC) AND FITTINGS

A. Manufacturers:

1. Atkore Allied Tube & Conduit
2. Nucor
3. Electroline
4. Western Tube
5. Wheatland Tube Co
6. or approved equal.

B. Manufacturers of RMC Conduit Fittings:

1. ABB/Thomas & Betts
2. Eaton/Crouse-Hinds

3. Electroline
4. Emerson Appleton & OZ Gedney
5. Hubbell Raco and Killark
6. NSI Bridgeport
7. Orbit Industries
8. Wesco Regal

C. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.

D. Fittings and Conduit Bodies:

1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.
2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

E. PVC Externally Coated Conduit: Compliant with UL 6, ANSI C80.1 and NEMA RN 1; rigid galvanized steel conduit with external 40 mil PVC coating and internal 2 mil urethane coating surface. All fittings and conduit bodies shall be complete with coating. Threads shall be hot galvanized and coated with a clear coat of urethane. The PVC coated system shall include necessary PVC coated fittings, boxes and covers to form a complete encapsulated system.

1. Acceptable Manufacturers:

a. Atkore Calbond Calpipe
b. Robroy Perma-cote and Plati-Bond
c. ABB Ocal

2.2 INTERMEDIATE METALLIC CONDUIT (IMC) AND FITTINGS

A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted.

B. Manufacturers:

1. Atkore Allied Tube & Conduit
2. Nucor
3. Electroline
4. Western Tube
5. Wheatland Tube Co

C. Fittings and Conduit Bodies:

1. End Bell Fittings: Malleable iron, hot dip galvanized, threaded flare type with provisions for mounting to form.

2. Expansion Joints: Malleable iron and hot dip galvanized providing a minimum of 4 inches of movement. Fitting shall be watertight with an insulating bushing and a bonding jumper.
3. Expansion Joint for Concrete Encased Conduit: Neoprene sleeve with bronze end coupling, stainless steel bands and tinned copper braid bonding jumper. Fittings shall be watertight and concrete-tight.
4. Conduit End Bushings: Malleable iron type with molded-on high impact phenolic thermosetting insulation. Where required elsewhere in the contract documents, bushing shall be complete with ground conductor saddle and clamp. High impact phenolic threaded type bushings are not acceptable.
5. All other fittings and conduit bodies shall be of malleable iron construction and hot dip galvanized.

D. Manufacturers of IMC Conduit Fittings:

1. ABB/Thomas & Betts
2. Easton/Crouse-Hinds
3. Electroline
4. Emerson Appleton & OZ Gedney
5. Hubbell Raco and Killark
6. NSI Bridgeport
7. Orbit Industries
8. Wesco Regal

2.3 ELECTRICAL METALLIC TUBING (EMT) AND FITTINGS

A. Minimum Size Electrical Metallic Tubing: 3/4 inch, unless otherwise noted.

B. Manufacturers of EMT Conduit:

1. Allied Tube & Conduit
2. Calbond Calpipe
3. Nucor
4. Electroline
5. Western Tube
6. Wheatland Tube Co

C. Fittings and Conduit Bodies:

1. 2" Diameter or Smaller: Compression or steel set screw type of steel designed for their specific application.
2. Larger than 2": Compression type of steel designed for their specific application.
3. Manufacturers of EMT Conduit Fittings:

a. ABB/Thomas & Betts
b. Eaton/Crouse-Hinds
c. Electroline
d. Emerson Appleton & OZ Gedney
e. Hubbell Raco and Killark
f. NSI Bridgeport
g. Orbit Industries
h. Wesco Regal

2.4 FLEXIBLE METALLIC CONDUIT (FMC) AND FITTINGS

A. Minimum Size Galvanized Steel: 3/4 inch, unless otherwise noted. Lighting branch circuit wiring to an individual luminaire may be a manufactured, UL listed 3/8" flexible metal conduit and fittings with #14 AWG THHN conductors and an insulated ground wire. Maximum length of 3/8" FMC shall be six (6) feet.

B. Manufacturers:

1. ABB/Thomas & Betts
2. Anamet Electrical
3. Atkore American Flex AFC and Flexicon
4. Electri-Flex Co
5. Electroline
6. Southwire Alflex

C. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel. Provide a separate equipment grounding conductor when used for equipment where flexibility is required.

D. Fittings and Conduit Bodies:

1. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
2. Manufacturers:

a. ABB/Thomas & Betts
b. Eaton/Crouse-Hinds
c. Electroline
d. Emerson Appleton & OZ Gedney
e. Hubbell Raco and Killark
f. NSI Bridgeport
g. Orbit Industries
h. Wesco Regal

2.5 LIQUIDTIGHT FLEXIBLE METALLIC CONDUIT (LFMC) AND FITTINGS

A. Manufacturers:

1. ABB/Thomas & Betts
2. Anamet Electrical
3. Atkore American Flex AFC and Flexicon
4. Electri-Flex Co
5. Electroline
6. Southwire Alflex

B. Construction: Flexible steel, approved for conduit ground, zinc coated, threadless type formed from a continuous length of spirally wound, interlocked zinc coated strip steel and an extruded PVC cover.

C. Fittings and Conduit Bodies:

1. Watertight, compression type, galvanized zinc coated cadmium plated malleable cast iron, UL listed.

2. Fittings and conduit bodies shall include plastic or cast metal inserts supplied by the manufacturer to protect conductors from sharp edges.
3. Manufacturers:

    a. ABB/Thomas & Betts
    b. Eaton/Crouse-Hinds
    c. Electroline
    d. Emerson Appleton & OZ Gedney
    e. Hubbell Raco and Killark
    f. NSI Bridgeport
    g. Orbit Industries
    h. Wesco Regal

2.6 RIGID NON-METALLIC CONDUIT (PVC) AND FITTINGS

A. Minimum Size Rigid Smooth-Wall Nonmetallic Conduit: 3/4 inch, unless otherwise noted.

B. Acceptable Manufacturers:

1. ABB/Carlon
2. Chevron Phillips Chemical Company
3. Cantex, J.M. Mfg.
4. Atkore Heritage Plastics

C. Construction: Schedule 40 and Schedule 80 rigid polyvinyl chloride (PVC), UL labeled for 90°C.

D. Fittings and Conduit Bodies: NEMA TC 3; sleeve type suitable for and manufactured especially for use with the conduit by the conduit manufacturer.

E. Plastic cement for joining conduit and fittings shall be provided as recommended by the manufacturer.

2.7 OUTLET BOXES

A. Sheet Metal Outlet Boxes: ANSI/NEMA OS 1; galvanized steel, 16 gauge (approximately 0.0625 inches), with 1/2-inch male fixture studs where required.

B. Nonmetallic Outlet Boxes: ANSI/NEMA OS 2.

C. Cast Boxes: Nema FB1, Type FD, Aluminum, cast feralloy, or stainless steel deep type, gasketed cover, threaded hubs.

D. Outlet boxes for luminaires to be not less than 1-1/2" deep, deeper if required by the number of wires or construction. The box shall be coordinated with surface luminaires to conceal the box from view or provide a finished trim plate.

E. Switch outlet boxes for local light control switches, dimmers and occupancy sensors shall be 4 inches square by 2-1/8 inches deep, with raised cover to fit flush with finish wall line. Multiple gang switch outlets shall consist of the required number of gang boxes appropriate to the quantity of switches comprising the gang. Where walls are plastered, provide a plaster raised cover. Where switch outlet boxes occur in exposed concrete block walls, boxes shall be installed in the block cavity with a raised square edge tile cover of sufficient depth to extend out to face of block or masonry boxes.

F. Wall or column receptacle outlet boxes shall be 4 inches square with raised cover to fit flush with finished wall line. Boxes in concrete block walls shall be installed the same as for switch boxes in block walls.

2.8 ECONN; ELECTRICAL CONNECTION

A. Electrical connection to equipment and motors, sized per Electrical Code. Coordinate requirements with contractor furnishing equipment or motor. Refer to specifications and general installation notes for terminations to motors.

2.9 JB; PULL AND JUNCTION BOXES

A. Sheet Metal Boxes: ANSI/NEMA OS 1; galvanized steel.

B. Sheet metal boxes larger than 12 inches in any dimension that contain terminations or components: Continuous hinged enclosure with 1/4 turn latch and white back panel for mounting terminal blocks and electrical components.

C. Cast Metal Boxes for Outdoor and Wet Location Installations: NEMA 250; Type 4 and Type 6, flat-flanged, surface-mounted junction box, UL listed as raintight. Galvanized cast iron box and cover with ground flange, neoprene gasket, and stainless steel cover screws.

D. Cast Metal Boxes for Underground Installations: NEMA 250; Type 4, inside flanged, recessed cover box for flush mounting, UL listed as raintight. Galvanized cast iron box and plain cover with neoprene gasket and stainless steel cover screws.

E. Flanged type boxes shall be used where installed flush in wall.

PART 3 - EXECUTION

3.1 CONDUIT INSTALLATION SCHEDULE AND SIZING

A. In the event the location of conduit installation represents conflicting installation requirements as specified in the following schedule, a clarification shall be obtained from the Architect/Engineer. If this Contractor is unable to obtain a clarification as outlined above, concealed rigid galvanized steel conduit installed per these specifications and the Electrical Code shall be required.

B. Installation Schedule: Refer to drawings.

C. Size conduit as shown on the drawings and specifications. Where not indicated in the contract documents, conduit size shall be according to the Electrical Code. Conduit and conductor sizing shall be coordinated to limit conductor fill to less than 40%, maintain conductor ampere capacity as required by the Electrical Code (to include enlarged conductors due to temperature and quantity derating values) and to prevent excessive voltage drop and pulling tension due to long conduit/conductor lengths.

D. Minimum Conduit Size (Unless Noted Otherwise):

1. Above Grade: 3/4 inch. (The use of 1/2 inch would be allowed for installation conduit to individual light switches, individual receptacles and individual fixture whips from junction box.)
2. Below Grade 5' or less from Building Foundation: 1 inch.

3. Below Grade More than 5' from Building Foundation: 1 inch.
4. Controls Conduit: 1/2 inch.

E. Conduit sizes shall change only at the entrance or exit to a junction box, unless specifically noted on the drawings.

3.2 CONDUIT ARRANGEMENT

A. In general, conduit shall be installed concealed in walls, in finished spaces and where possible or practical, or as noted otherwise. Conduit shall be installed parallel or perpendicular to walls, ceilings, and exposed structural members. In unfinished spaces, mechanical and utility areas, conduit may run either concealed or exposed as conditions dictate and as practical unless noted otherwise on drawings. Installation shall maintain headroom in exposed vicinities of pedestrian or vehicular traffic.

B. Exposed conduit on exterior walls or above roof will not be allowed without prior written approval of Architect/Engineer. A drawing of the proposed routing and a photo of the location shall be submitted 14 days prior to start of conduit rough-in. Routing shall be shown on coordination drawings.

C. Conduit arrangement in elevated slabs (restricted to applications specifically noted or shown on drawings):

1. Conduit size shall not exceed one-third of the structural slab thickness. Place conduit between the top and bottom reinforcing with a minimum of 3" concrete cover.
2. Parallel conduits shall be spaced at least 8 inches apart. Exception: Within 18 inches of commonly served floor boxes, junction boxes, or similar floor devices. Arrange conduits parallel or perpendicular to building lines and walls.

D. Conduit shall not share the same cell as structural reinforcement in masonry walls.

E. Conduit runs shall be routed as shown on large scale drawings. Conduit routing on drawings scaled 1/4"=1'-0" or less shall be considered diagrammatic, unless noted otherwise. The correct routing, when shown diagrammatically shall be chosen by the Contractor based on information in the contract documents, in accordance with manufacturer's written instructions, applicable codes, the NECA's "Standard of Installation", in accordance with recognized industry standards, and coordinated with other contractors.

F. Contractor shall adapt Contractor's work to the job conditions and make such changes as required and permitted by the Architect/Engineer, such as moving to clear beams and joists, adjusting at columns, avoiding interference with windows, etc., to permit the proper installation of other mechanical and/or electrical equipment.

G. Contractor shall cooperate with all contractors on the project. Contractor shall obtain details of other contractor's work to ensure fit and avoid conflict. Any expense due to the failure of This Contractor to do so shall be paid for in full by Contractor. The other trades involved as directed by the Architect/Engineer shall perform the repair of work damaged as a result of neglect or error by This Contractor. The resultant costs shall be borne by This Contractor.

3.3 CONDUIT SUPPORT

A. Conduit runs installed above a suspended ceiling shall be properly supported. In no case shall conduit rest on the suspended ceiling construction, nor utilize ceiling support system for conduit support.

1. Support wire used to independently support raceway and wiring systems above suspending ceilings shall be supported on both ends, minimum 12 gauge suspended ceiling support wire, and distinguishable from ceiling support systems by color (field paint), tagging, or equivalent means.

B. Conduit shall not be supported from ductwork, water, sprinkler piping, or other non-structural members, unless approved by the Architect/Engineer. All supports shall be from structural slabs, walls, structural members, and bar joists, and coordinated with all other applicable contractors, unless noted otherwise.

C. Conduit shall be held in place by the correct size of galvanized one-hole conduit clamps, two-hole conduit straps, patented support devices, clamp back conduit hangers, or by other means if called for on the drawings.

D. Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

E. Spring-steel conduit clips specifically designed for supporting single conduits or tubing may be used in lieu of malleable-iron hangers for 1-1/2" and smaller raceways serving lighting and receptacle branch circuits above accessible ceilings and for securing raceways to slotted channel and angle supports.

F. Group conduits in parallel runs where practical and use conduit racks or trapeze hangers constructed of steel channel, suspended with threaded solid rods or wall mounted from metal channels with conduit straps or clamps. Provide space in each rack or trapeze for 25% additional conduits.

G. Do not exceed 25 lbs. per hanger and a minimum spacing of 2'-0" on center when attaching to metal roof decking (excludes concrete on metal deck). This 25 lbs. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

H. Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

I. Supports for metallic conduit shall be no greater than 10 feet. A smaller interval may be used if necessitated by building construction, but in no event shall support spans exceed the Electrical Code requirements. Conduit shall be securely fastened within 3 feet of each outlet box, junction box, device box, cabinet, or fitting.

J. Supports of flexible conduit shall be within 12 inches of each outlet box, junction box, device box, cabinet, or fitting and at intervals not to exceed 4.5 feet.

K. Supports for non-metallic conduit shall be at sufficiently close intervals to eliminate any sag in the conduit. The manufacturer's recommendations shall be followed, but in no event shall support spans exceed the Electrical Code requirements.

L. Where conduit is to be installed in poured concrete floors or walls, provide concrete-tight conduit inserts securely fastened to forms to prevent conduit misplacement.

M. Finish:

1. Prime coat exposed steel hangers and supports. Hangers and supports in crawl spaces, pipe shafts, and above suspended ceiling spaces are not considered exposed.
2. Trim all ends of exposed field fabricated steel hangers, slotted channel and threaded rod to within 1" of support or fastener to eliminate potential injury to personnel unless shown otherwise on the drawings. Smooth ends and install elastomeric insulation with two coats of latex paint if exposed steel is within 6'-6" of finish floor and presents potential injury to personnel.

3.4 CONDUIT INSTALLATION

A. Conduit Connections:

1. Shorter than standard conduit lengths shall be cut square using industry standards. The ends of all conduits cut shall be reamed or otherwise finished to remove all rough edges.
2. Metallic conduit connections in slab on grade installation shall be sealed and one coat of rust inhibitor primer applied after the connection is made.
3. Where conduits with tapered threads cannot be coupled with standard couplings, then approved split or Erickson couplings shall be used. Running threads will not be permitted.
4. Install expansion/deflection joints where conduit crosses structure expansion/seismic joints.

B. Conduit terminations for all low voltage wiring shall have nylon bushings installed on each end of every conduit run.

C. Conduit Bends:

1. Use a hydraulic one-shot conduit bender or factory elbows for bends in conduit 2" in size or larger. All steel conduit bending shall be done cold; no heating of steel conduit shall be permitted.
2. All bends of rigid polyvinyl chloride conduit (PVC) shall be made with the manufacturer's approved bending equipment. The use of spot heating devices will not be permitted (i.e. blow torches).
3. A run of conduit shall not contain more than the equivalent of four (4) quarter bends (360°), including those bends located immediately at the outlet or body.
4. Rigid polyvinyl chloride conduit (PVC) runs longer than 100 feet or runs which have more than two 90° equivalent bends (regardless of length) shall use rigid metal or RTRC factory elbows for bends.
5. Use conduit bodies to make sharp changes in direction (i.e. around beams).

D. Conduit Placement:

1. Conduit shall be mechanically continuous from source of current to all outlets. Conduit shall be electrically continuous from source of current to all outlets, unless a properly sized grounding conductor is routed within the conduit. All metallic conduits shall be bonded per the Electrical Code.
2. Route exposed conduit and conduit above suspended ceilings (accessible or not) parallel/perpendicular to the building structural lines, and as close to building structure as possible. Wherever possible, route horizontal conduit runs above water and steam piping.
3. Route conduit through roof openings provided for piping and ductwork where possible. If not provided or routing through provided openings is not possible, route through roof jack with pitch pocket. Coordinate roof penetrations with other trades.
4. Conduits, raceway, and boxes shall not be installed in concealed locations in metal deck roofing or less than 1.5" below bottom of roof decking.

5. Avoid moisture traps where possible. Where unavoidable, provide a junction box with drain fitting at conduit low point.
6. All conduits through walls shall be grouted or sealed into openings. Where conduit penetrates firewalls and floors, seal with a UL listed sealant. Seal penetrations with intumescent caulk, putty, or sheet installed per manufacturer's recommendations. All materials used to seal penetrations of firewalls and floors shall be tested and certified as a system per ASTM E814 Standard for fire tests or through-penetration fire stops as manufactured by 3M or approved equal; refer to Section 26 05 03 for through penetration firestopping requirements.
7. Contractor shall be responsible for all openings required in masonry or exterior walls under this division. A qualified mason at the expense of this contractor shall repair all openings to match existing conditions.
8. Seal interior of conduit at exterior entries, air handling units, coolers/freezers, etc., and where the temperature differential can potentially be greater than 20°F, to prevent moisture penetration. Seal shall be placed where conduit enters warm space. Conduit seal fitting shall be a drain/seal, with sealing compound, identified for use with cable and raceway system.
9. Do not route conduits across each other in slabs on grade.
10. Rigid polyvinyl chloride conduit (PVC) shall be installed when material surface temperatures and ambient temperature are greater than 40°F.
11. Where rigid polyvinyl chloride conduit (PVC) is used below grade, in a slab, below a slab, etc., a transition to rigid galvanized steel conduit shall be installed before conduit exits earth. The conduit shall extend a minimum of 6" into the surface concealing the non-metallic conduit.
12. Contractor shall provide suitable mechanical protection around all conduits stubbed out from floors, walls or ceilings during construction to prevent bending or damaging of stubs due to carelessness with construction equipment.
13. Contractor shall provide a polypropylene pull cord with 2000 lbs. tensile strength in each empty conduit (indoor and outdoor), except in sleeves and nipples.

3.5 CONDUIT TERMINATIONS

A. Where conduit bonding is indicated or required in the contract documents, the bushings shall be a grounding type sized for the conduit and ground bonding conductor as manufactured by O-Z/Gedney, Appleton, Thomas & Betts, Burndy, Regal, Orbit Industries or approved equal.

B. Conduits with termination fittings shall be threaded for one (1) lock nut on the outside and one (1) lock nut and bushing on the inside of each box.

C. Where conduits terminate in boxes with knockouts, they shall be secured to the boxes with lock nuts and provided with approved screw type tinned iron bushings or fittings with plastic inserts.

D. Where conduits terminate in boxes, fittings, or bodies with threaded openings, they shall be tightly screwed against the shoulder portion of the threaded openings.

E. Conduit terminations to all motors shall be made with flexible metallic conduit (FMC), unless noted otherwise. Final connections to roof exhaust fans, or other exterior motors and motors in damp or wet locations shall be made with liquidtight flexible metallic conduit (LFMC). Motors in hazardous areas, as defined in the Electrical Code, shall be connected using flexible conduit rated for the environment. Flexible conduit shall not exceed 6' in length. Route equipment ground conductors from circuit ground to motor ground terminal through flexible conduit.

F. Rigid polyvinyl chloride conduit (PVC) shall be terminated using fittings and bodies produced by the manufacturer of the conduit, unless noted otherwise. Prepare conduit as per manufacturer's recommendations before joining. All joints shall be solvent welded by applying full even coat of plastic cement to the entire areas that will be joined. Turn the conduit at least a quarter to one half turn in the fitting and let the joint cure for 1-hour minimum or as per the manufacturer's recommendations.

G. All conduit ends shall be sealed with plastic immediately after installation to prevent the entrance of any foreign matter during construction. The seals shall be removed and the conduits blown clear of all foreign matter prior to any wires or pull cords being installed.

3.6 UNDERGROUND CONDUIT INSTALLATION

A. Conduit Connections:

1. Conduit joints in a multiple conduit run shall be staggered at least one foot apart.

B. Conduit Bends (Lateral):

1. Conduits shall have long sweep radius elbows instead of standard elbows wherever special bends are indicated and noted on the drawings, or as required by the manufacturer of the equipment or system being served.

C. Conduit Elbows (vertical):

1. Minimum metal or RTRC elbow radiuses shall be 30 inches for primary conduits (greater than 600V) and 18 inches for secondary conduits (less than 600V). Increase radius, as required, based on pulling tension calculation requirements.

D. Expansion Fittings at Finished Grade: Provide underground raceways with an expansion fitting after emerging from finished grade and exterior equipment pads. Field locate the expansion fitting above and within 24 inches of finished grade. Raceways extending less than 12 inches above finished grade, transitioning to LFMC within 12 inches of finished grade, and interior concrete building slabs do not require an expansion fitting unless required by code.

E. Conduit Placement:

1. Conduit runs shall be pitched a minimum of 4" per 100 feet to drain toward the terminations. Duct runs shall be installed deeper than the minimum wherever required to avoid any conflicts with existing or new piping, tunnels, etc.
2. For parallel runs, use suitable separators and chairs installed not greater than 4' on centers. Band conduit together with suitable banding devices. Securely anchor conduit to prevent movement during concrete placement or backfilling.
3. Where concrete is required, the materials for concreting shall be thoroughly mixed to a minimum f'c = 2500 and immediately placed in the trench around the conduits. No concrete that has been allowed to partially set shall be used.
4. Before the Contractor pulls any cables into the conduit, Contractor shall have a mandrel 1/4" smaller than the conduit inside diameter pulled through each conduit and if any concrete or obstructions are found, the Contractor shall remove them and clear the conduit. Spare conduit shall also be cleared of all obstructions.
5. Conduit terminations in manholes, masonry pull boxes, or masonry walls shall be with malleable iron end bell fittings.
6. All spare conduits not terminated in a covered enclosure shall have its terminations plugged as described above.

7. Ductbanks and conduit shall be installed a minimum of 24" below finished grade, unless otherwise noted on the drawings or elsewhere in these specifications.
8. All non-metallic conduit installed underground outside of a slab shall be rigid.

F. Horizontal Directional Drilling:

1. Entire drill path shall be accurately surveyed, with entry and exit stakes placed and coordinated with other contractors. If using a magnetic guidance system, entire drill path shall be surveyed for any surface geo-magnetic variations or anomalies.
2. Any utility locates within 20 feet of the bore path shall have the exact location physically verified by hand digging or vacuum excavation. Restore inspection holes to original condition after verification.

G. Raceway Seal (Exterior to Raceway):

1. All power, telecommunication, electrical conduits and innerducts shall be sealed between the raceway and the building foundation. The raceway penetration shall be sealed liquid-tight, water-tight, non-corrosive.
2. Below Grade Installation Options:

    a. Cast-in-place concrete installation.
    b. Hydraulic cement, hydraulic group, hydraulic epoxy.
    c. Foundation - Underground Sleeves and Seals; refer to Part 2-Products for product information.

3. Above Grade Installation Options:

    a. Masonry grout for masonry applications.
    b. Caulk Sealant, interior/exterior rated, color per architect. Approved Manufacturers include Sachco, Tremco Vulkem, Sika or approved equal when not specified by architectural scope.

3.7 BOX INSTALLATION SCHEDULE

A. Galvanized steel boxes may be used in:

1. Concealed interior locations above ceilings and in hollow studded partitions.
2. Exposed interior locations in mechanical rooms and in rooms without ceilings; higher than 8' above the highest platform level.
3. Direct contact with concrete except slab on grade.

B. Cast boxes shall be used in:

1. Exterior locations.
2. Direct contact with earth.
3. Direct contact with concrete in slab on grade.
4. Wet locations.

3.8 COORDINATION OF BOX LOCATIONS

A. Provide electrical boxes as shown on the drawings, and as required for splices, taps, wire pulling, equipment connections, and code compliance.

B. Electrical box locations shown on the Contract Drawings are approximate, unless dimensioned. Verify location of floor boxes and outlets in offices and work areas prior to rough-in.

C. Locate and install boxes to allow access. Avoid interferences with ductwork, piping, structure, equipment, etc. Recessed luminaires shall not be used as access to outlet, pull, and junction boxes. Where installation is inaccessible, provide access doors. Coordinate locations and sizes of required access doors with the Architect/Engineer and General Contractor.

D. Locate and install to maintain headroom and to present a neat appearance.

E. Coordinate locations with Heating Contractor to avoid baseboard radiation cabinets.

3.9 OUTLET BOX INSTALLATION

A. Do not install boxes back-to-back in walls.

1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.

B. The Contractor shall anchor switch and outlet box to wall construction so that it is flush with the finished masonry, paneling, drywall, plaster, etc. The Contractor shall check the boxes as the finish wall surface is being installed to assure that the box is flush. (Provide plaster rings as necessary.)

C. Mount at heights shown or noted on the drawings or as generally accepted if not specifically noted.

D. Locate boxes in masonry walls to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat openings for boxes.

E. Provide knockout closures for unused openings.

F. Support boxes independently of conduit.

G. Use multiple-gang boxes where more than one device is mounted together; do not use sectional boxes. Provide barriers to separate wiring of different voltage systems.

H. Install boxes in walls without damaging wall insulation.

I. Coordinate mounting heights and locations of outlets mounted above counters, benches, backsplashes, and below baseboard radiation.

J. Provide recessed outlet boxes in finished areas; secure boxes to interior wall and partition studs, accurately positioned to allow for surface finish thickness. Use stamped steel stud bridges for flush outlets in hollow stud wall, and adjustable steel channel fasteners for flush ceiling outlet boxes.

K. Align wall-mounted outlet boxes for switches, thermostats, and similar devices.

L. Provide cast outlet boxes in exterior locations and wet locations, and where exposed rigid or intermediate conduit is used.

3.10 PULL AND JUNCTION BOX INSTALLATION

A. Locate pull boxes and junction boxes above accessible ceilings or in unfinished areas.

B. Support pull and junction boxes independent of conduit.

C. Do not install boxes back-to-back in walls.

1. Provide a minimum horizontal separation of 6 inches between boxes installed on opposite sides of non-rated stud walls. When the minimum separation cannot be maintained, install sound insulation pads on all five sides of the back box in accordance with the manufacturer's instructions.
2. Provide a minimum horizontal separation of 24 inches between boxes installed on opposite sides of fire-rated walls. When the minimum separation cannot be maintained, the box is greater than 16 square inches or the total box area (all trades) per 100 square feet is greater than or equal to 100 square inches, install fire-rated moldable pads to all five sides of the back box to maintain the fire rating of the wall. Install moldable pads in accordance with UL listing for the specific product. Sound insulation pads are not acceptable for use in fire-rated wall applications unless the product carries the necessary fire rating.

3.11 EXPOSED BOX INSTALLATION

A. Boxes shall be secured to the building structure with proper size screws, bolts, hanger rods, or structural steel elements.

B. On brick, block and concrete walls or ceilings, exposed boxes shall be supported with no less than two (2) Ackerman-Johnson, Paine, Phillips, or approved equal screw anchors or expansion shields and round head machine screws. Cast boxes shall not be drilled.

C. On steel structures, exposed boxes shall be supported to the steel member by drilling and tapping the member and fastening the boxes by means of round head machine screws.

D. Boxes may be supported on steel members by APPROVED beam clamps if conduit is supported by beam clamps.

E. Boxes shall be fastened to wood structures by means of a minimum of two (2) wood screws adequately large and long to properly support. (Quantity depends on size of box.)

F. Wood, plastic, or fiber plugs shall not be used for fastenings.

G. Explosive devices shall not be used unless specifically allowed.

END OF SECTION

SECTION 26 05 53 - ELECTRICAL IDENTIFICATION

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Adhesive Markings and Field Labels

B. Nameplates and Signs

C. Product Colors

1.2 REFERENCES

A. NFPA 70E - National Electrical Safety Code

B. NFPA 70 - National Electrical Code (NEC)

C. ANSI A13.1 - Standard for Pipe Identification

D. ANSI Z535.4 - Standard for Product Safety Signs and Labels

1.3 QUALITY ASSURANCE

A. Electrical identification products shall be suitable for the environment installed. Identification labels damaged by the environment due to ultraviolet light fading, damp or wet conditions, physical damage, corrosion, or other conditions shall be replaced with labels suitable for the environment.

PART 2 - PRODUCTS

2.1 ADHESIVE MARKINGS AND FIELD LABELS

A. Colored Adhesive Marking Tape for banding Raceways, Wires, and Cables: Self-adhesive vinyl tape not less than 3 mils thick by 1 inch to 2 inches in width.

B. Pretensioned Flexible Wraparound Colored Plastic Sleeves for Cable Identification: flexible acrylic bands sized to suit the cable diameter and arranged to stay in place by pre-tensioned gripping action when coiled around the cable.

C. Wire/Cable Designation Tape Markers: Vinyl or vinyl-cloth, self-adhesive, wraparound, cable/conductor markers with preprinted numbers and letter.

D. Cable Ties: Fungus-inert, self-extinguishing, one-piece, self-locking nylon cable ties, 0.18-inch minimum width, 50-lb minimum tensile strength, and suitable for a temperature range from -40°F to 185°F (-40°C to 85°C), type 2/2S or type 21/21S based on application. Provide ties in specified colors when used for color coding. Cable ties shall be listed and identified for the application, securement, and support.

E. Underground Plastic Markers: Bright colored continuously printed plastic ribbon tape of not less than 6 inches wide by 4 mil thick, printed legend indicating type of underground line, manufactured for direct burial service. Tape shall contain a continuous metallic wire to allow location with a metal detector.

F. Aluminum, Wraparound Marker Bands: 1-inch width, 0.014 (5mm) inch thick aluminum bands with stamped or embossed legend, and fitted with slots or ears for permanently securing around wire or cable jacket or around groups of conductors.

G. Brass or Aluminum Tags: 2" (50mm) by 2" (50mm) by .05-inch metal tags with stamped legend, punched for fastener.

H. Indoor/Outdoor Number and Letters: Outdoor grade vinyl label with acrylic adhesive designed for permanent application in severe indoor and outdoor environments.

I. Text Sizes:

1. The following information shall be used for text heights, fonts, and size, unless otherwise noted.

a. Font: Normal 721 Swiss Bold
b. Adhesive Labels: 3/16 inch minimum text height
c. Vinyl / Plastic Laminate Labels: 3/4" inch minimum text height

2.2 NAMEPLATES AND SIGNS

A. Engraved, Plastic-Laminated Labels, Signs and Instruction Plates: Engraving stock melamine plastic laminate, 1/16-inch minimum thick for signs up to 20 square inches, or 8 inches in length; 1/8 inch thick for larger sizes. Labels shall be punched for mechanical fasteners.

B. Baked-Enamel Signs for interior Use: Preprinted aluminum signs, punched, or drilled for fasteners, with colors, legend, and size required for application. Mounting ¼" grommets in corners.

C. Exterior, Metal-Backed, Butyrate Signs: Weather-resistant, nonfading, preprinted, cellulose-acetate butyrate signs with 0.0396 inch galvanized-steel backing: and with colors, legend, and size required for application. Mounting 1/4" grommets in corners.

D. Safety Signs: Comply with 29 CFR, Chapter XVII, Part 1910.145.

E. Fasteners for Plastic-Laminated Signs; Self-tapping stainless steel screws or number 10/32 stainless steel machine screws with nuts and flat and lock washers.

2.3 PRODUCT COLORS

A. Adhesive Markings and Field Labels:

1. All Labels: Black letters on white face
2. Normal Power and General Labels: Black letters on white face
3. Control Labels: Black letters on white face
4. Fire Alarm: Red letters on white face
5. Emergency: Red letters on white face

B. Raceways and Conduit:

1. Provide color-coded conduit as indicated below. Conduit shall be colored by the manufacturer:

a. Normal Power and General Distribution: Silver
b. Emergency Power Distribution System:

1) Match existing conduit color coding.

c. Fire Alarm System: Red
d. Ground: Green

C. Box Covers:

1. Box cover colors shall match conduit colors listed above.

D. Conductor Color Identification: Refer to Part 3 for additional information.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lettering and Graphics: Coordinate names, abbreviations, colors, and other designations used in electrical identification work with corresponding designations specified or indicated. Install numbers, lettering, and colors as required by code.

B. Exposed Ceilings and Finished Spaces: The project includes exposed ceilings in finished spaces. The installation of colored raceways and labeling may not be aesthetically desirable in finished spaces. The contractor shall coordinate identification requirements in exposed ceilings of finished spaces with the Architect/Engineer prior to installation and ordering of materials.

C. Install identification devices in accordance with manufacturer's written instructions and requirements of Electrical Code.

D. Sequence of Work: Where identification is to be applied to surfaces that require finish, install identification after completion of finish work. All mounting surfaces shall be cleaned and degreased prior to identification installation.

E. Circuit Identification: Tag or label conductors as follows:

1. Multiple Power or Lighting Circuits in Same Enclosure: Where multiple branch circuits are terminated or spliced in a box or enclosure, label each conductor with source and circuit number.
2. Multiple Control Wiring and Communication/Signal Circuits in Same Enclosure: For control and communications/signal wiring, use wire/cable marking tape at terminations in wiring boxes, troughs, and control cabinets. Use consistent letter/number conductor designations throughout on wire/cable marking tape.
3. Match identification markings with designations used in panelboards, shop drawings, Contract Documents, and similar previously established identification schemes for the facility's electrical installations.

F. Apply Danger, Warning, Caution, and instruction signs as follows:

1. Install Danger, Warning, Caution or instruction signs where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions or explanations are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.
2. 'Danger' indicates a hazardous situation which, if not avoided, will result in death or serious injury. ANSI standard red background, white letters.
3. 'Warning' indicates a hazardous situation which, if not avoided, could result in death or serious injury. ANSI standard orange background, black letters.
4. 'Caution' indicates a hazardous situation which, if not avoided, may result in minor or moderate injury. ANSI standard yellow background, black letters.
5. Emergency Operating Signs: Install, where required by Electrical Code, where indicated, or where reasonably required to assure safe operation and maintenance of electrical systems and of the items to which they connect, engraved laminate signs with white legend on red background with minimum 3/8-inch high lettering for emergency instructions on power transfer, load shedding, or other emergency operations.

G. Apply circuit/control/item designation labels of engraved plastic laminate for pushbuttons, pilot lights, alarm/signal components, and similar items, except where labeling is specified elsewhere.

H. Install labels parallel to equipment lines at locations as required and at locations for best convenience of viewing without interference with operation and maintenance of equipment.

I. Install ARC FLASH WARNING signs on all switchboards, switchgear, distribution panels, branch panelboards, industrial control panels, and motor control centers.

1. Sample Label:

! WARNING
ARC FLASH AND SHOCK HAZARD
APPROPRIATE PPE REQUIRED
FAILURE TO COMPLY CAN RESULT IN DEATH OR INJURY
REFER TO NFPA 70E

J. Underground Electrical Lines: For exterior underground power, control, signal, and communication lines, install continuous underground plastic line marker located directly above line at 6 (150mm) to 8 (205mm) inches below grade. A single plastic line marker is permitted when the width of the common trench does not exceed 16 inches; provide a second plastic line marker to mark each edge of the trench when 16 inches of width is exceeded. Limit line markers to direct-buried cables.

3.2 LIGHTING CONTROL AND RECEPTACLE COVER PLATES

A. Product:

1. Adhesive labels and field markings
2. Nameplates and signs

B. Identification material to be a clear, 3/8-inch Kroy tape or Brother self-laminating vinyl label with black letters. Embossed Dymo-Tape labels are not acceptable. Permanently affix identification label to cover plates, centered above the receptacle openings.

C. Provide identification on all switch and receptacle cover plates. Identification shall indicate source and circuit number serving the device (e.g. "C1A #24"). Identification for switch cover plates shall be installed on the inside cover.

3.3 BOX LABELING

A. Products:

1. Adhesive labels and field markings

B. Identify Junction, Pull and Connection Boxes: Labeling shall be 3/8-inch Kroy tape OR Brother self-laminating vinyl label, letters/numbers. In rooms that are painted out, provide labeling on inside of cover.

C. All junction, pull, and connection boxes shall be identified as follows:

1. For power and lighting circuits, indicate system voltage and identity of contained circuits ("120V, 1LA1-3,5,7").

3.4 CONDUCTOR COLOR CODING

A. Products:

1. All wire and cables shall be color coded by the manufacturer.

B. Color coding shall be applied at all panels, switches, junction boxes, pull boxes, vaults, manholes etc., where the wires and cables are visible and terminations are made. The same color coding shall be used throughout the entire electrical system, therefore maintaining proper phasing throughout the entire project.

C. Colored cable ties shall be applied in groups of three ties of specified color to each conductor at each terminal or splice point starting 3 inches from the termination and spaced at 3- inches centers. Tighten to a snug fit, and cut off excess length.

D. Where more than one nominal voltage system exists in a building or facility, each ungrounded conductor of a multi-wire branch circuit, where accessible, shall be identified by phase and system.

E. Conductors shall be color coded as follows:

1. 208Y/120 Volt, 4-Wire:

a. A-Phase - Black
b. B-Phase - Red
c. C-Phase - Blue
d. Neutral - White
e. Ground Bond - Green

2. 480Y/277 Volt, 4-Wire:

a. A-Phase - Brown
b. B-Phase - Orange
c. C-Phase - Yellow
d. Neutral - Gray

e. Ground Bond - Green

3. Grounding Conductors:

a. Equipment grounding conductors, main/system/supply-side bonding jumpers: Green.

3.5 CONTROL EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all control equipment such as combination starters, starters, VFDs, contactors, motor control centers, etc.

C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner.

D. Labeling shall include:

1. Equipment type and contract documents designation of equipment being served.
2. Location of equipment being served if it is not located within sight.
3. Voltage and phase of circuit(s).
4. Panel and circuit number(s) serving the equipment.
5. Sample Label:

EXHAUST FAN EF-1 ("LOCATED ON ROOF")
480V, 3-PHASE
FED FROM "1HA1-1"
AUTO CONTROL BY FMCS

3.6 EQUIPMENT CONNECTION IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification for hard wired electrical connections to equipment such as disconnects switches, starters, etc. Plug and cord type connections do not require this specific label.

C. Identification shall be provided for all connections to equipment furnished by this Contractor, other contractors, or the Owner.

D. Labeling shall include:

1. Equipment type and contract documents designation of equipment being served
2. Location of equipment being served if it is not located within sight.
3. Voltage and rating of the equipment.
4. Panel and circuit numbers(s) serving the equipment
5. Available fault current; refer to one-line diagram or panel schedule of panel serving equipment.
6. Date of fault current study; refer to one-line diagram

7. Sample Label:

   UNIT HEATER UH-1 ("LOCATED IN STORAGE ROOM 200")
   480V: 3-PHASE
   FED FROM "1HA1-1"

3.7 POWER DISTRIBUTION EQUIPMENT IDENTIFICATION

A. Products:

1. Nameplates and signs

B. Provide identification on the front of all power distribution equipment such as panelboards, switchboards, switchgear, motor control centers, generators, UPS, storage battery disconnects, transfer switches, etc. Labels shall be visible on the exterior of the gear, correspond to the one-line diagram nomenclature, and identify each cubicle of multi-section gear.

1. Interior Equipment: The identification material shall be engraved plastic-laminated labels.
2. Labeling shall include:

   a. Equipment type and contract documents designation of equipment.
   b. Voltage of the equipment.
   c. Name of the upstream equipment and location of the upstream equipment if it is not located within sight.
   d. Rating and type of the overcurrent protection device serving the equipment if it is not located within sight ("FED BY 400A/3P BREAKER").
   e. Sample Label:

      DISTRIBUTION PANEL DP-H1
      480Y/277V
      FED FROM SWITCHBOARD "SB-1" (LOCATED IN MAIN ELEC ROOM)

C. Branch panelboards shall be provided with typed panel schedules upon completion of the project. Existing panelboards shall have their existing panel schedules typed, with all circuit changes, additions or deletions also typed on the panel schedules. A copy of all panel schedules for the project shall be turned over as part of the O&M Manuals. Refer to Section 26 05 00 for other requirements.

END OF SECTION

SECTION 26 09 33 - LIGHTING CONTROL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lighting Control Overview

B. Electrical Plan Symbols

C. Device Color and Coverplates

D. Standalone Line and Low Voltage Lighting Controls

1. Wall switches and wall dimmers
2. Sensors (occupancy, vacancy, daylighting, photocell, auxiliary power packs, etc.)

E. Room-Based Lighting Controls (specification grade, commonly distributed controllers, occasionally networked, 'intelligent' controls)

F. Time Clock Switches (Standalone)

G. Branch Circuit Emergency Lighting Transfer Switch (BCELTS)

1.2 RELATED SECTIONS

A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of directly comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:

1. Specification Section 26 51 19 LED Lighting
2. Electrical Drawings: Electrical Coversheet, plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

1.3 RELATED WORK

A. Section 23 09 23 - Direct Digital Control System for HVAC Interface of Lighting Controls with HVAC Controls

1.4 QUALITY ASSURANCE

A. Manufacturers shall be regularly engaged in the manufacture of lighting control equipment and ancillary equipment, of types and capacities required, whose products have been in satisfactory use in similar service for not less than five (5) years.

B. All components and assemblies are to be factory pre-tested prior to delivery and installation.

1.5 REFERENCES

A. FCC Rules and Regulations, Part 15, Subpart J - Radio Frequency Interference

B. FS W S 896 Switch, Toggle

C. NEMA WD 1 - General Color Requirements for Wiring Devices

D. NEMA WD 7 - Occupancy Motion Sensors

E. NFPA 70 - National Electrical Code (NEC)

F. UL Standard 916 Energy Management Equipment

G. UL 924 - Emergency Lighting and Power Equipment

H. UL 20 - Standards for General-Use Snap Switches

I. UL 98 - Enclosed and Dead-Front Switches

J. UL 917 - Clock Operated Switches

K. UL 1008 - Transfer Switch Equipment

L. UL 1472 - Solid-State Dimming Controls

1.6 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Submit a comprehensive package including devices, hardware, software, product specification, finishes, dimensions, installation instructions, component replacement instructions, warranty, system software requirements, and roles and responsibilities of all persons and groups involved in installation, execution, and commissioning.

C. Provide floor plan showing location, orientation, and coverage area of each control device, sensor, and controller/interface. For areas requiring multiple sensor devices for appropriate coverage, submit specific manufacturer-approved sensor layout as an overlay directly on the project drawings, either in print or approved electronic form. Sensor coverage patterns shall have a 20% overlap.

D. Submit a list of devices and equipment that will be installed for each sequence of operation.

E. Submit project specific control wiring diagrams showing all equipment, line voltage, and control wiring requirements for all components including, but not limited to, dimmers, relays, low voltage switches, occupancy sensors, control stations, and communication interfaces and programming instructions for each sequence of operation. Include network cable specification and end-of-line termination details, if required.

F. Programming Sequences: Provide a copy of the initial lighting control programming sequences in narrative and manufacturer/vendor format.

G. Lighting Control Stations: The manufacturer/vendor shall provide control station shop drawings showing arrangement of controls, dimensioned elevations, wiring diagram, and recommended backboxes. Label each applicable submittal with the applicable Sequence Of Operation SOO description. Submit data sheets on the switches, dimmers, sensors, buttons, etc. contained in the control station.

H. Nameplate Labels and Custom Engraving: Submit sample label/engraving text for review for each applicable Lighting Sequence Of Operation SOO. Include reference to applicable SOO description. Provide stencil templates for each device requiring stenciling.

1.7 PROJECT RECORD DOCUMENTS

A. Submit project record documents under provisions of Section 26 05 00.

B. Accurately record location of all controls and devices. Include description of switching sequences and circuiting arrangements.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit emergency, operation, and maintenance data under provisions of Section 26 05 00. Data shall also include the following:

1. Schedule for routine maintenance, inspection, and calibration of all lighting control devices and system components. Recommended schedule for inspection and recalibration of sensors.
2. Complete narrative describing intended operation and sequence for each control scenario and system component, updated to reflect all changes resulting from commissioning of systems. Narrative shall indicate recommended settings for devices where applicable.
3. Replacement part numbers for all system components.

B. Identify installed location and labeling for each luminaire controlled by automated lighting controls.

1.9 SYSTEM DESCRIPTION

A. Performance Statement: The specification section and lighting design documents describe the minimum material quality, required features, and operational performance requirements of the lighting control system. The documents do not convey every component, relay, wire, and equipment connection required. The Contractor and lighting control manufacturer/vendor are solely responsible for determining all system components, wiring, and programming required for a complete and operational system based on the performance based requirements of the documents.

B. Lighting Sequence Of Operation (SOO): The Sequence Of Operation (SOO) describes the required lighting control operation and performance in each space. The Sequence Of Operation descriptions are included on the drawings.

C. Drawings: The drawings include the Sequence Of Operation (SOO), luminaire schedule, location of control devices, sensors, and identification of control zones, and branch power circuiting. Control wiring and manufacturer/vendor specific components are NOT shown, but shall be submitted with the shop drawing submittals.

D. Extending the Existing Lighting Control System (LEVITON): Provide all items, components, devices, hardware, software, programming, expansion components, conduit, wiring etc. needed to extend Lighting Control system. This includes, but is not limited to, additional room controllers, , individual system components, power supplies, etc. The existing lighting control system shall be extended such that the existing system's functionality, integrity, control sequences, master control stations, etc shall be equivalent to pre-construction conditions, unless noted otherwise. The functionality and integrity shall be maintained during construction.

1.10 COMMISSIONING

A. The Contractor shall provide all services necessary for compliance with the IECC Section C408 Commissioning. The commissioning shall include, but not be limited to, a commissioning plan, preliminary commissioning report, construction documents, manuals, final commissioning report, and lighting system functional testing.

B. The system shall be functionally tested by a factory-authorized engineer and comply with the Sequence of Operation prior to system commissioning. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system.

1.11 WARRANTY

A. Manufacturer shall warrant products under normal use and service to be free from defects in materials and workmanship for a period of two (2) years from date of commissioning.

B. Occupancy, vacancy, daylight sensors and controls shall have a five (5) year warranty from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 LIGHTING CONTROL OVERVIEW

A. Lighting Control System: As defined in the System Description, the design documents describe the operational performance requirements of the lighting control system. The Lighting Control System has been categorized into the following groups. Refer to the Electrical Symbol Key, this specification section, and the drawings to determine the appropriate lighting control category when more than one is applicable to the project:

1. Standalone Lighting Control Devices: Independent (standalone) devices traditionally operating at line or low voltage, field configurable with other standalone devices to provide an overall lighting control system.
2. Room-Based Lighting Controls: Integrated system comprised of switch stations, sensors, room controllers, control panels, and accessories, operating at line and/or low voltage, configured as an integrated overall 'intelligent' lighting control system. Lighting control zones and power circuits commonly align.

B. All system components and materials of similar function (e.g., switches, dimmers, sensors, contactors, relays, etc.) shall be of the same manufacturer, unless specifically stated otherwise on drawings or elsewhere in the specifications. Lighting control switches, systems, and components shall be listed.

C. The functions described in the lighting sequence of operation shall dictate the actual lighting control device required to accomplish the functions described for the space, unless otherwise noted.

D. Emergency Lighting Override Control (UL924 and UL1008): Lighting Control Equipment coupled with remote emergency power sources (external to the luminaire) require ALCR (UL924) or BCELTS (UL1008) devices for emergency (life safety) compliance. An emergency lighting control bypass is required for every individual lighting control zone-circuit but NOT shown on the plans. Refer to this specification for ALCR and BCELTS descriptions. Refer to the sequence of operation lighting control descriptions on the plans for additional requirements. (For additional explanation purposes: Integral emergency power sources like battery drivers inside the luminaire are commonly provided with a switch and non-switched portion of the circuit allowing compliance without an ALCR nor BCELTS device to bypass the lighting controls).

2.2 ELECTRICAL PLAN SYMBOLS

A. Refer to Electrical Coversheet for Electrical Symbols list and device specification tag.

1. Standalone Lighting Control Devices: Control station commonly defined by an alpha character with subscripts.

    a. Example symbol "S", tagged "SW-1P", description "switch- single pole switch".
    b. Example Control Designation: a, b, c (when required to clarify design intent).

2. Room-Based Lighting Controls: Control station commonly defined by a rectangle symbol.

    a. Example Control Station: symbol "#B", tagged "SW-LV", description "Lighting Control Station".
    b. Example Panel/Rack/Cabinet: tagged "LCPR#", description Room-Based lighting control panel/rack/cabinet.
    c. Example Control Designations: a, b, c

3. Sensors, Relays, Accessories: Common plan symbols are used for occupancy, vacancy, and daylighting sensors. The control designations (a, b, c or z1, z2, z3) and identification of a standalone or #B type control station in the space defines the basis-of-design intent category of the lighting control sensors and accessories.

    a. Example, a standalone occupancy sensor SW-OC-## device is the basis of design when shown in the same room as a standalone S (SW-1P) single pole light switch with or without a, b, c control designations.
    b. Example, a Room-Based Lighting occupancy sensor SW-OC-## device is the basis of design when shown in the same room as a #B (SW-#B) lighting control station with or without a, b, c control designations.

2.3 DEVICE COLOR AND COVERPLATES

A. All switches and lighting controls shall be complete with coverplates that match material and color of the wiring device coverplates in the space. When the coverplate is proprietary to the device/manufacturer and do not match the wiring device coverplates, the architect shall select the coverplate color and materials from the standard coverplate options.

B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.

C. Install nameplate identification as indicated in Section 26 05 53.

D. Plate-securing screws shall be metal with head color matching the wall plate finish.

2.4 STANDALONE LINE AND LOW VOLTAGE LIGHTING CONTROLS

A. Overview:

1. Wall Switches and Wall Dimmers:

B. SW-V; Dual Technology Vacancy Sensor with Wall Switch (Standalone):

1. Wall switch with manual on/auto/off. 120/277 VAC load rating of 0-800 W for ballast, LED or tungsten. 5-, 15-, 20-minute adjustable OFF delay. Dual technology ultrasonic/acoustic and PIR coverage of minor motion in 12' x 15' pattern and occupancy detection in area based on half-step walking motion. Sensitivity adjustments separate for each sensing technology.
2. Manufacturers:

a. Watt Stopper DW-100 Series
b. Hubbell LHMTS
c. Leviton OSSMT Series
d. Sensor Switch WSX-PDT SA Series (acoustic approved when listed in above description)

2.5 ROOM-BASED LIGHTING CONTROL SYSTEM ('INTELLIGENT CONTROLS)

A. Manufacturers: Manufacturers as listed below meet the qualifications as outlined in this specification. Contractor is responsible for verifying that selected manufacturer is capable of furnishing the complete system as specified herein.

1. Acuity Controls nLight Series

B. Room-Based Lighting Control System Description: The room-based lighting control system is a distributed network of devices, components, and accessories for lighting controls and integrated control with other systems. The system includes system room controllers (network hubs), control stations, sensors (occupancy, vacancy, daylighting, etc.), switching/dimming modules, programming, 365/7 day scheduling, and associated wiring.

C. The lighting control system manufacturer shall be responsible to assure coordination and network compatibility between all system devices, components, and accessories.

D. Global System Typography: The system shall be provided with the following global system characteristics. When multiple exclusive options are listed the manufacturer/vendor may submit a system based on either criterion unless otherwise noted. When the drawings identify a specific option (typically identified with a subscript) provide the specific option as scheduled on the drawings. (Example, a control station (SW-#B) shown with a "W• • " subscript on the plans shall be provided in a wireless configuration regardless if the following specification descriptions allow both low voltage or wireless network.)

1. System Controllers (Room Controllers): Room-based controllers located above accessible ceilings.
2. Interior Lighting Control System Network Connectivity for System Devices, Components, and Accessories: Low voltage cabling.

E. Room-Based System Controllers (Room Controllers): Distributed room-based controller, integral switching relays and dimmers.

1. Installation: Provide a dedicated controller for each space; not shared with adjacent rooms. Locate the controller near the associated wall controller, near the entry door when applicable, and above the finished accessible ceiling. As an alternative, the controller may be mounted above the finished accessible ceiling of the adjacent space when the associated ceiling space is not accessible. Example, located in adjacent corridor.

F. Programming and Commissioning Dongle (Removable Style): Provide and permanently install a programming dongle for each room controller when a field removable dongle type device is required for programming and commissioning of the system. The programming dongle shall be permanently installed to allow for ease of programming the controller without above ceiling access.

G. Control Devices: All occupancy, vacancy sensors (ultrasonic, PIR, dual technology, daylighting, photocell, timers), control stations, and other system components shall be provided with the system and designed to operate on system network. Sensors shall be powered from power supplies, modules, packs, or Power Over Ethernet POE.

H. Power Supplies (Modules, Packs, etc.): Provide power supplies for control devices. Power supply shall provide physical separation of 120/277 volt line voltage wiring and low voltage control wiring. Provide supplementary power supplies when required for multiple control devices. Provide switch or dimmed control as required by the Sequence Of Operation SOO.

1. Installation: Install adjacent to wall room controller when applicable, near the entry door when applicable, and above the finished accessible ceiling. As an alternative, the controller may be mounted above the finished accessible ceiling of the adjacent space when the associated ceiling space is not accessible. Provide low voltage wiring to applicable control devices and control stations.

I. SW-#B; Lighting Control Station, Default Dimming Control Raise/Lower/Fade: The lighting control station shall comply with the performance requirements of the lighting sequence of operation. The control station may consist of switches, pushbuttons, sliders, dimming functions, etc. Provide a common coverplate for lighting control stations.

1. #B: The '#' indicates the minimum quantity of unique lighting control scenes when shown plus raise/lower and lights 'off' scene. Refer to the Lighting Sequence Of Operation (SOO) for the minimum quantity of scenes required (when a number is not designated) and a description of each control scene.
2. Subscripts:

    a. (BLANK) = Dimming Control (Default)
    b. S = Switch Control

3. Manufacturer: Room-Based Lighting Controller Manufacturer:

    a. Dimming (Blank) or Switch (S) Control Station: Modular, momentary pushbutton, with addressable capabilities to control the scene or luminaires assigned to the switch. The switch shall be able to actuate the functions based on the described sequence of operation and intended functions.

        1) Preset/fader stations shall operate using programmable buttons and/or faders as indicated on drawings.

2) Raise, Lower, Integral Fader Control: Provide control station with manual raise and lower fader control for each control zone of lighting control. Manual raise/lower shall be separate buttons from scene control; hold and dim scene control buttons not acceptable. Faders may be physical sliders or up/down buttons. Fader range shall provide continuous even dimming matching full range of dimmer specification.
3) Integral Pilot Light or LED: Indicate that controls are active or powered by being on continuously when powered or when pushbuttons are actuated.
4) Labeling of buttons and faders shall be engraved/screened by manufacturer, using approved text returned with shop drawing submittals.
5) Station control components shall be designed to operate standard default or custom system functions. Components shall operate default functions unless re-assigned via direct or network connection. Function options include: preset selection, manual mode, record mode, station lockout, raise/lower, macro, cue, and room join/separate.
6) Multiple stations (shown in same space): When multiple control stations are shown in the same space the sequence of operation shall be the same at all locations unless noted otherwise.
7) Multiple stations (movable partitions in same space): When multiple control stations are shown in the same space with movable partitions the sequence of operations shall be the same at all locations unless noted otherwise. A wall partition switch shall monitor the status of the movable partitions and automatically associated the control station(s) with the appropriate space based on the status of the wall partition.
8)

J. SW-LCD; LCD Lighting Control Station:

1. Refer to the Lighting Sequence Of Operation (SOO) for the minimum quantity of scenes required and a description of each control scene.
2. Manufacturer: Room Based Lighting Controller manufacturer.
3. Backlit color liquid crystal display (LCD) shall operate using buttons, faders, and other images on separate programmable control pages via touchscreen interface.
4. Raise, Lower, Integral Fader Control: Provide control station with manual raise and lower fader control for each control zone of lighting control. Faders may be physical sliders, up/down buttons, or graphical touch screen format. Fader range shall match full range of dimmer specification.
5. LCD station contrast and brightness shall be adjustable. It shall be possible to program the station to dim during periods of inactivity.
6. LCD stations shall support import of bitmap image files to customizable pages.
7. Permanently installed stations shall be either fully or semi-recessed in manufacturer-furnished backbox and trim assembly, with no visible fasteners or hardware.
8.

K. SW-OC- and SW-VC-; Occupancy / Vacancy Sensors :

1. Combination Devices: Subscripts identify combination type devices when applicable. The contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device. Manufacturer verified layouts shall include a 20% overlap of coverage patterns.
2. Subscripts: Subscripts are used to define the device type.

    a. Blank (or D) = Dual Technology

3. General Description: Wall- or ceiling-mounting, solid-state units with a separate power supply/relay unit.

    a. Operation - Occupancy: Occupancy sensors turn lights 'on' when covered area is occupied and turn lights 'off' with a time delay when unoccupied, unless otherwise indicated.
    b. Operation - Vacancy: Vacancy sensors require a manual switch operation to turn lights 'on' with a time delay when occupied to turn lights 'off'.
    c. Time Delay 'Off': Field adjustable with a minimum range of 1-20 minutes.
    d. Sensor Output: Contacts rated to operate the connected relay, complying with UL 773A. Sensor shall be powered from the relay unit.
    e. Relay Unit: Dry contacts rated for 20 A ballast load at 120 and 277 VAC, for 13-amp tungsten at 120 VAC, and for 1 hp at 120 VAC. Power supply to sensor shall be 24 V dc, 150-mA, Class 2 power source as defined by Electrical Code.
    f. Mounting:

        1) Sensor: Suitable for mounting in any position on a standard outlet box.
        2) Relay: Externally mounted through a 1/2-inch knockout in a standard electrical enclosure. Mount relay above accessible ceiling near entry door to room or area.

4. Indicator: LED to show when motion is being detected during testing and normal operation of the sensor.
5. Bypass Switch: Override the on function in case of sensor failure.
6. Power Supply and Child Packs: Provide as required for sensor quantity and switching scheme. Mount to standard 1/2" knockout on electrical box above accessible ceiling near entry door to room or area. Sensor power shall be from emergency circuit if emergency lighting is in the area.
7. Detection Coverage (Room): Detect occupancy anywhere in an area based on hand motion.
8. Detection Coverage (Corridor): Detect occupancy based on a half-step motion.

2.6 TIME CLOCK SWITCHES (STANDALONE)

A. SW-TC; Time Clock Switch, astronomical digital control, 7 day or 365/7 day schedule with holiday schedule, 2 channel, 120/277 Volt, 15 amp SPDT Contact, on/off override, indoor/outdoor enclosure, IECC / ASHRAE 90.1 battery backup compliance, UL Listed.

B. Manufacturers:

1. Paragon Timex Series
2. Tork DWZ Series
3. Intermatic ET 8000 Series

PART 3 - EXECUTION

3.1 PRE-CONSTRUCTION MEETING

A. Schedule a pre-construction meeting with the controls representative, installing contractor, Architect/Engineer, and Owner to explain the proposed lighting control system and integration with other systems as when applicable per the design documents.

3.2 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Beginning of installation means installer accepts existing conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions and approved shop drawings.

B. All wiring shall be installed in conduit. Class II low voltage control wiring may be open wiring and shall maintain 6 inch spacing from electronic ballast and other RFI/EMI sources.

C. Low Voltage Cabling (less than 100 volts): Low voltage lighting control cabling shall be plenum listed. Low voltage cables in non-accessible areas shall be installed in conduit. Low voltage lighting control cable may be installed without conduit in accessible areas using the following types of cable supports. Cable support types/systems shall comply with the warranty requirements of the low voltage cable manufacturer.

1. J-hooks; batwing type.
2. Bridle rings with saddle supports.
3. Low voltage cable batwings supported by independent luminaire support systems (luminaire support cabling); use of batwings on ceiling support systems not allowed.
4. Listed cable ties. Low voltage cabling secured to exterior of luminaire power raceway.

D. All branch load circuits shall be live tested before connecting the loads to the lighting control panel.

E. Lighting Control Station Wiring: Provide the grounded (neutral) conductor portion of the branch circuit with the line voltage phase conductors at each lighting control station.

F. Lighting Control Panel Directories: Provide a typewritten directory for each lighting control panel indicating relay/dimmer and description of load controlled.

3.4 INTEGRATION WITH OTHER SYSTEMS

A. The Room-Based lighting control system interacts, is controlled by, or controls the following other systems per the design documents and lighting sequence of operations descriptions. The contractor shall provide the necessary communication gateways, relays, cabling, and programming to interact with the following systems.

1. Fire Alarm and Automatic Detection System
2. Audio/Visual Systems

3.5 BRANCH CIRCUIT POWER WIRING FOR CONTROLLERS

1. Branch circuit power for the following lighting control system components shall be provided from the following branches. Lighting control power shall originate from the same branch circuits serving the controlled luminaires:

    a. Room controllers, lighting control power supplies, devices, components, and accessories when an associated (ALCR) device is applicable to the lighting control sequence of operation: Emergency (Electrical Code Article 700)
    b. Room controllers, lighting control power supplies, devices, components, and accessories when an associated (BCELTS) device is applicable to the lighting control sequence of operation: The load side of the BCELTS device normal and emergency/life safety pending the status of the BCELTS.
    c. The contractor shall coordinate the branch circuit power source required with the Engineer when required for unique lighting control system devices, components, and accessories.

3.6 LOW VOLTAGE LIGHTING CONTROL CABLING

A. Control Cable Raceway Routing: Class II low voltage control wiring may be open wiring, independently supported, and shall maintain 150 mm (6 inch) spacing from luminaire drivers and other RFI/EMI sources.

B. Control Cabling Installed with Line Voltage Wiring: When low voltage control cabling is installed with line-voltage wiring, the control wiring shall be, copper conductors, minimum 16 AWG or per manufacturer, with cable insulation equal to the line-voltage rating (voltage, temp rating, etc.) and comply with Specification Section 26 05 13 "Wire and Cable."

C. Network Cabling: As required by manufacturer.

D. Splices and Taps: Tapping or wire trap connectors shall be used to splice all Class 1 and Class 2 control wiring. Twist-on, wire-nut type connectors are not allowed.

3.7 SUPPORT SERVICES

A. System Startup:

1. Manufacturer shall provide factory authorized technician to confirm proper installation and operation of all system components.

B. Pre-Program, Testing, Training Coordination:

1. The construction documents and sequence of operations define the original design intent of the lighting controls as coordinated between the owner and the design team. The definition of the scope is intended to identify the hardware and programming flexibility required prior to programming, system testing, and owner training.
2. The final system programming, control station labels, scene presets, dimmer presets, dimmer range limits, fade times, etc. are subject to on site coordination between the design team, owner, contractor, and manufacturer. Contractor/manufacturer programming of the system prior to an onsite coordination with the owner and design team shall not be considered final programming nor commissioning.

3. The contractor and manufacturer shall provide on site representatives to provide final programming including preset, scene, switch labeling, and other programming adjustments based on owner and design team onsite observation and verbally requested adjustments as part of the based bid scope of work.
4. The contractor shall document onsite requested changes and update operation and maintenance manuals to match final programming.

C. Testing:

1. System shall be completely functional tested by a factory-authorized technician. All loads shall be tested live for continuity and freedom from defects, and all control wiring shall be tested for continuity and connections prior to energizing the system components.
2. Programming of initial zones, schedules, lighting levels, control station groups, and sensor settings shall be performed by a factory-authorized technician. Lighting Control Sequence of Operation shall serve as a basis for programming, However, all final decisions regarding groups and schedules shall be at the direction of the Owner. The following procedures shall be performed at a minimum:

    a. Confirm occupancy sensor placement, sensitivity, and time delay settings to meet specified performance criteria.
    b. Confirm daylight sensor placement, sensitivity, deadband, and delay settings to meet specified performance criteria.
    c. Confirm that schedules and time controls are configured to meet specified performance criteria and Owner's operating requirements.
    d. Confirm control station labeling, presets, switch labels, and scenes.

3. Verify occupancy/vacancy and daylight sensor operation is correct after furniture and equipment is installed in each area. Make adjustments to sensor settings and time delays to allow proper operation.
4. Verify occupancy/vacancy sensors are located to provide complete coverage for the area served with no nuisance switching.

    a. Relocate sensors or provide additional sensors as necessary to provide adequate coverage.
    b. Mask occupancy sensors where necessary to prevent nuisance switching from adjacent areas.

D. Training:

1. Manufacturer shall provide competent factory-authorized technician to train Owner personnel in the operation, maintenance and programming of the lighting control system. Submit training plan with notification seven (7) days prior to proposed training dates.
2. Training duration shall be no less than one (1) day being scheduled at least two (2) weeks after initial training.

E. Documentation:

1. Manufacturer shall provide system documentation including:

    a. System one-line showing all panels, number and type of control stations and sensors, communication line, and network or building automation system BAS interface unit.
    b. Drawings for each panel showing hardware configuration and numbering.
    c. Panel wiring schedules.
    d. Typical diagrams for each component.

3.8 SYSTEM COMMISSIONING

A. Mask sensors where necessary to prevent nuisance switching from adjacent areas.

B. System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Agent. Refer to Section 01 09 00, General Commissioning, for system verification tests and commissioning requirements.

C. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner's Representative. The instruction shall be scheduled in coordination with the Owner's Representative after submission and approval of formal training plans. Refer to Section 01 09 00, General Commissioning, for Contractor training requirements.

END OF SECTION

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lighting and appliance branch circuit panelboards: **Panel '###'**

1.2 RELATED SECTIONS AND WORK

A. Refer to the Electrical Distribution Diagram and Electrical Schedules for size, rating, and configuration.

B. Section 26 09 13 - Energy Metering and Management System

1.3 REFERENCES

A. NEMA AB 1 - Molded Case Circuit Breakers

B. NEMA PB 1 - Panelboards

C. NEMA PB 1.1 - Instructions for Safe Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less

D. NEMA PB 1.2 - Application Guide for Ground-fault Protective Devices for Equipment

E. UL 248 - Low-Voltage Fuses

F. UL 67 - Panelboards

1.4 SUBMITTALS

A. Submit shop drawings for equipment and component devices under provisions of Section 26 05 00.

B. Include outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker and fusible switch arrangement and sizes.

C. Submit manufacturer's instructions under provisions of Section 26 05 00.

PART 2 - PRODUCTS

2.1 RATINGS

A. Definitions:

1. Series rated equipment shall be defined as equipment that can achieve a required UL AIC rating with an upstream device such as a main breaker or a combination of devices to meet or exceed a required UL AIC rating. All series rated equipment shall have a permanently attached nameplate indicating that device rating must be maintained. See Section 26 05 53 for additional requirements.

2. Fully rated equipment shall be defined as equipment where all devices in that equipment shall carry a minimum of the AIC rating that is specified.

B. The panelboards for this project shall be fully rated unless otherwise specifically noted in the Drawings or Specifications.

2.2 BRANCH CIRCUIT PANELBOARDS

A. General

1. Manufacturers:

a. Square D NQ, NF
b. Siemens P1
c. Eaton PRL1, PRL2

B. Lighting and Appliance Branch Circuit Panelboards: NEMA PB 1; circuit breaker type.

C. Enclosure: NEMA PB 1; Type 1.

D. Provide cabinet front with door-in-door construction, concealed hinge, and flush lock all keyed alike. Door hardware shall provide swing clear operation (180-degree swing). Finish in manufacturer's standard gray enamel.

E. Provide panelboards with copper bus, ratings as scheduled on the drawings. Provide copper ground bus in all panelboards.

F. All unlabeled circuits shown on the panelboard schedule shall be fully prepared spaces for future breakers.

G. All multiple-section panelboards shall have the same dimensional back box and cabinet front size.

H. Minimum Integrated Short Circuit Rating: As shown on the drawings.

I. Molded Case Circuit Breakers: Bolt-on type thermal magnetic trip circuit breakers, with common trip handle for all poles. Provide circuit breakers UL listed as Type SWD for lighting circuits. Provide UL Class A ground fault interrupter circuit breakers where scheduled on the drawings. Do not use tandem circuit breakers.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install panelboards plumb as indicated on the drawings in conformance with NEMA PB 1.1.

B. Height: 6 feet to handle of highest device.

C. Provide filler plates for unused spaces in panelboards.

D. Provide custom typed circuit directory for each branch circuit panelboard. Provide updated custom typed circuit directory for each existing branch circuit panelboard with new or revised circuits per the scope of work. Label shall include equipment name or final approved room name, room number, and load type for each circuit (examples: SUMP SP-1 or ROOM 101 RECEPT). Revise directory to reflect circuit changes required to balance phase loads. Printed copies of the bid document panel schedules are not acceptable as circuit directories.

3.2 FIELD QUALITY CONTROL

A. Measure steady state load currents at each panelboard feeder. Should the difference at any panelboard between phases exceed 20 percent, rearrange circuits in the panelboard to balance the phase loads within 20 percent. Take care to maintain proper phasing for multi-wire branch circuits.

B. Visual and Mechanical Inspection: Inspect for physical damage, proper alignment, anchorage, and grounding. Check proper installation and tightness of connections for circuit breakers, fusible switches, and fuses.

END OF SECTION

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Device plates and box covers

B. Receptacles (REC-#)

C. Floor boxes and floor box with service fitting (FB-#)

D. Power Bollard (PB-1)

1.2 QUALITY ASSURANCE

A. Provide similar devices from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in the Electrical Code, by a testing agency to Authorities Having Jurisdiction and marked for intended use.

C. Comply with the Electrical Code.

1.3 REFERENCES

A. DSCC W-C-896F - General Specification for Electrical Power Connector

B. FS W-C-596 - Electrical Power Connector, Plug, Receptacle, and Cable Outlet

C. NEMA WD 1 - General Color Requirements for Wiring Devices

D. NEMA WD 6 - Wiring Devices - Dimensional Requirements

E. NFPA 70 - National Electrical Code (NEC)

F. UL 498 - Standard for Attachment Plugs and Receptacles

G. UL 943 - Standard for Ground Fault Circuit Interrupters

1.4 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Provide product data showing configurations, finishes, dimensions, and manufacturer's instructions.

1.5 COORDINATION

A. Receptacles for Owner Furnished Equipment: Match plug configurations.

B. Cord and Plug Sets: Match equipment requirements.

PART 2 - PRODUCTS

2.1 DEVICE COLOR

A. All switch, receptacle, and outlet colors shall be verified with Architect, unless indicated otherwise.

2.2 COVERPLATES

A. All switches, receptacles, and outlets shall be complete with the following:

1. Unbreakable thermoplastic/thermoset plastic and match device color coverplates in finished spaces where walls are finished.
2. #302 stainless steel coverplates in unfinished spaces for flush boxes.
3. Galvanized steel coverplates in unfinished spaces for surface mounted boxes.

B. Where several devices are ganged together, the coverplate shall be of the ganged style for the number of devices used.

C. Install nameplate identification as indicated in Section 26 05 53.

D. Plate securing screws shall be metal with head color matching the wall plate finish.

2.3 RECEPTACLES

A. Refer to Electrical Symbols List for device type.

B. REC-DUP-WP: NEMA 5-20R Weatherproof While-In-Use Ground Fault Duplex Receptacle:

1. 125-volt, 20 amp, 3-wire grounding type with test and reset buttons in impact resistant thermoplastic face, weather resistant WR listed. Provide extra-duty NEMA 3R rated while-in-use clear outlet box hood.
2. Device shall perform self-test of GFCI circuitry in accordance with UL 943.

a. Manufacturers:

1) Hubbell:

a) GFTWRST20 with clear housing RW57300

2) Leviton GFWT2 with clear housing 5977-CL
3) Pass & Seymour 2097TRWR with clear housing WIUC10-C
4) Cooper WRSGF20 with clear housing WIU-1

C. REC-USB: NEMA 5-20R Receptacle with USB Charger:

1. Standard Grade Type C USB: 125-volt, 20-amp, tamper resistant, 3-wire grounding type with impact resistant thermoplastic face.

a. One Type A USB charging rated at 5VDC 3.0A minimum and one Type C USB charging rated at 5VDC 5.0A. Mounted in double gang backbox.
b. Manufacturers:

1) Hubbell USB USB20C5

D. REC-DUP: NEMA 5-20R Tamper Resistant Duplex Receptacle:

1. Standard Grade: 125-volt, 20 amp, 3-wire grounding type with impact resistant thermoplastic face.

a. Manufacturers:

1) Hubbell BR20TR
2) Leviton TBR20
3) Pass & Seymour TR5362
4) Cooper TRBR20

E. REC-QUAD: NEMA 5-20R Double Duplex Receptacle:

1. Consists of two duplex receptacles, double gang box, plaster ring and faceplate.

a. Manufacturers:

1) Refer to Duplex Receptacle above.

F. REC-QUAD-WP: NEMA 5-20R Weatherproof Ground Fault Quad Receptacle:

1. Consists of two duplex, GFCI receptacles. Double gang box. Provide extra-duty NEMA 3R rated while-in-use cast aluminum outlet box hood.

a. Manufacturers:

1) Receptacle: Refer to GFCI Receptacle above.
2) Cover:

a) Intermatic WP1030MXD
b) Pass & Seymour WIUCAST2
c) Thomas & Betts Red Dot 2CKU

G. Back wired devices shall be complete with eight holes that are screw activated with metal clamps for connection to #12 or #10 copper conductors.

H. Side wired devices shall have four binding screws that are undercut for positive wire retention.

I. Ground fault circuit interrupter (GFCI) receptacles shall be listed and comply with UL 943 requiring increased surge immunity, improved corrosion resistance, improved resistance to false tripping and diagnostic indication for miswiring if the line and load conductors are reversed during installation.

2.4 FLOOR BOXES

A. Cover Color and Style: Verify with Architect from standard manufacturer options.

B. Refer to Technology drawings for voice/data, Audio/Video outlet, and coordination requirements.

C. Floor Boxes Housing Material Based on Cast-in-Place Floor Type:

1. Slab on Grade: Cast Iron or listed for slab on grade with special kit, coating, or equivalent, corrosion resistant.

D. FB-1: Square or Rectangular (Standard):

1. Floor Box, square or rectangular, square/rectangular flush-mounted hinged cover with flange, provide complete with appropriate outlet cover plates and hardware, rated for on grade installation, for use with 5-inch minimum concrete pour floors, fully adjustable.
2. Gang / Outlet Descriptions:

a. Single 125-Volt, 20-amp, NEMA 5-20R duplex receptacle with 3/4-inch conduit.
b. Three gangs for technology systems. Refer to Technology drawings for additional information related to voice/data and audio/visual outlet requirements and conduit size

3. Manufacturers:

a. Cast:

1) Hubbell RFB/RFBA Series
2) Legrand Wiremold
3) ABB Steel City

4. Installation: Group route raceway conduits under slab on grade to nearest wall. Route conduits to nearest wall or as shown on drawings. Provide hub reducers when applicable.

2.5 POWER BOLLARDS

A. PB-1: Power Bollard, 43-inch-tall, square aluminum bollard, coordinate finish with architect, two gangs with one weatherproof GFCI duplex receptacle and 1 USB charger (C and A type) and locking door, NEMA 3R rated, gasketed, L bolts for attaching into concrete.

1. Approved Manufacturers:

a. Wiremold Power Pedestal XCSALGRU-SV

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install convenience receptacles at elevations indicated in the General Installation Notes on the contract drawings.

B. Install specific-use receptacles at heights shown on the contract drawings. Install devices level, plumb, and square with building lines. Coordinate installation of adjacent devices of separate systems with common mounting heights, including lighting, power, systems, technology, and temperature control device rough-ins.

C. Install receptacles vertically with ground slot up or where indicated on the drawings, horizontally with ground slot to the left.

D. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface-mounted outlets.

E. Install devices and wall plates flush and level.

F. Install nameplate identification to receptacle cover plates indicated. Identification shall identify panel name and circuit number. Refer to Specification Section 26 05 53 - Electrical Identification.

G. Test receptacles for proper polarity, ground continuity and compliance with requirements.

H. Floor Box Installation:

1. Set boxes level and flush with finish flooring material.
2. Use cast iron floor boxes for installations in slab on grade. Trim shall match floor covering to be used.
3. Provide a minimum horizontal offset of 24 inches between boxes.

END OF SECTION

SECTION 26 28 21 - CONTACTORS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Lighting contactors

B. Enclosures

1.2 RELATED SECTIONS AND WORK

A. Refer to Lighting Contactor Schedule.

1.3 REFERENCES

A. ANSI/NEMA ICS 6 - Enclosures for Industrial Controls and Systems

B. NEMA ICS 2 - Industrial Control Devices, Controllers, and Assemblies

C. UL 508 - Industrial Control Equipment

1.4 SUBMITTALS

A. Submit shop drawings under provisions of Section 26 05 00.

B. Include outline drawings with dimensions, and equipment ratings for voltage, capacity, and poles.

C. Submit manufacturer's instructions under provisions of Section 26 05 00.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Schneider Electric 8903 Series

B. Eaton Corporation C30CN / CN35 Series

C. ABB

D. Siemens LC / CLM / CM Series

2.2 **LC-EC;** LIGHTING CONTACTORS

A. Contactors: NEMA ICS 2 and UL 508;electrically held, 2-wire control.

B. Coil Operating Voltage: 120 volts, 60 Hertz.

C. Contacts: 30 amp, 600 volts, 60 Hertz.

D. Poles: As shown on the schedule. Field convertible NO and NC configurations.

E. Enclosure: ANSI/NEMA ICS 6; Type 1.

F. Provide solderless pressure wire terminals.

G. Provide Hand-Off-Auto selector switch.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

C. Size conductors according to lighting control device manufacturer's written instructions, unless otherwise indicated.

D. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction boxes: and equipment enclosures.

E. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

END OF SECTION

SECTION 26 51 19 - LED LIGHTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires and accessories

B. Exterior luminaires and accessories

C. Emergency exit signs

1.2 RELATED SECTIONS

A. The lighting system design includes a combination of luminaire sources, lighting control components, programming sequences, and supplementary components for building and energy code compliance. The design uses performance-based specifications for portions of the lighting system to account for the limitation of comparable product solutions available by competitive manufacturers. The Contractor shall reference related specification sections, plans, schedules, and details prior to submitting pricing, submittals, and installation. The Contractor shall coordinate system component compatibility among various manufacturers and suppliers for a turnkey lighting system. Referenced sections include, but are not limited to, the following:

1. Electrical drawings: Plans, luminaire schedules, lighting control sequence of operations, diagrams, and details.

1.3 REFERENCES

A. ANSI C78.377 - Specifications for the Chromaticity of Solid State Lighting Products

B. ANSI C82.16 - Light-Emitting Diode Drivers - Method of Measurement

C. ANSI C82.77 - Standard for Harmonic Emission Limits and Related Power Quality Requirements for Lighting Equipment

D. NFPA 70E - National Electrical Safety Code

E. NEMA SSL1 - Electronic Drivers for LED Devices, Arrays or System

F. UL 8750 - Light Emitting Diode (LED) Equipment for use in Lighting Products

G. LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products

H. LM-80 - Measuring Luminous Flux and Color Maintenance of LED

I. FS W-L-305 - Light Set, General Illumination (Emergency or Auxiliary)

J. UL 924 - Standard for Emergency Lighting and Power Equipment

1.4 SUBMITTALS

A. Submit product data under provisions of Section 26 05 00.

B. Basic Requirements of Submittal:

1. Submit product data sheets for luminaires, LED light engines, drivers and poles. Include complete product model number with all options as specified. Submittal shall be arranged with luminaires listed in ascending order, and with each luminaire's LED light engine, driver, or pole information following luminaire's product data. Failure to organize submittal in this manner will result in the submittal being rejected.
2. Submit lens product data, dimensions and weights if not included in product data sheet submittal.
3. Include outline drawings, support points, weights, and accessory information for each luminaire.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site. Store and protect under provisions of Section 26 05 00.

B. Protect luminaire finishes, lenses, and trims from damage during storage and installation. Do not remove protective films until construction cleanup within each area is complete.

1.6 WARRANTY

A. The warranty period begins at the date of Substantial Completion.

B. LED Light Engines and Drivers:

1. LED Drivers and Dimming Drivers: Five (5) years
2. Light Emitting Diode (LED) Light Engines: Five (5) years

C. Emergency Lighting Units and Exit Signs:

1. Exit Signs: Three (3) year, non-prorated

1.7 REGULATORY REQUIREMENTS

A. Conform to NFPA 101 for installation requirements.

PART 2 - PRODUCTS

2.1 INTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

A. Lensed Troffers: Provide hinged frames with latches and 0.125-inch thick virgin acrylic lenses. Prismatic lenses shall have depth of no less than 0.080", KSH12 or equal. Other lenses as scheduled.

B. Recessed Luminaires: Confirm ceiling and wall type and furnish trim and accessories necessary to permit proper installation in each system. Where fire-rated ceiling or wall assemblies are specified, furnish and install listed enclosures around luminaires that maintain the system rating.

C. Luminaires: Louvers shall be anodized low iridescent specular aluminum with mitered corners and interlocking construction.

D. Suspended Luminaires: Coordinate power feed and suspension canopies with ceiling type and architectural RCP for proper fit and location. Ensure finished installations are plumb and level at elevations specified. Verify suspension length prior to submittal.

E. Painted reflector surfaces shall have a minimum reflectance of 90%.

F. All painted components shall be painted after fabrication.

2.2 EXTERIOR LUMINAIRES AND ACCESSORIES - GENERAL

A. Listed for wet or damp location as scheduled. Provide ingress protection (IP) rating when scheduled.

B. Provide low temperature LED drivers, with reliable starting to -20°F.

C. Exterior LED luminaires shall contain separate, easily accessible and replaceable Category C surge protection device.

2.3 LIGHT EMITTING DIODE (LED) LUMINAIRE SYSTEMS

A. Refer to the luminaire schedule for color temperature and minimum color rendering index CRI requirements. Provide light source color consistency by utilizing a binning tolerance within a maximum 3-step McAdam ellipse unless noted otherwise.

B. LED chip arrays specified as color changing shall have chip colors as noted on the luminaire schedule.

C. Rated life shall be minimum of 50,000 hours at L70.

D. LED chips shall be wired so that failure of one chip does not prohibit operation of the remainder of the chip array.

E. Luminaire delivered lumens is defined as the absolute lumens per the manufacturers LM-79-08 test report.

F. LED luminaires shall be designed for ease of component replacement including modular replaceable boards or Zhaga sockets. Luminaires that are factory sealed and do not have field replaceable parts shall provide a 10-year warranty.

G. LED light engine shall have a maximum LLD of 0.85 at 50,000 hours at 25°C ambient.

H. LED Driver:

1. Solid state driver with integral heat sink. Driver shall have over-heat, short-circuit and overload protection, power factor 0.90 or above and maximum total harmonic distortion of 10%. Driver shall have a voltage fluctuation tolerance of +/- 10%.
2. Drivers shall have dimming capabilities as outlined in the luminaire schedule for each luminaire type. Dimming shall control light output in a continuous curve from 100% to 10% unless noted otherwise.
3. Driver shall have a minimum of 50,000 hours rated life.

4. Driver shall be tested to ANSI C82-16 for input current inrush, total harmonic distortion (THD), and power factor. Driver start time shall be less than 0.5 seconds to 98% of initial light output. Flicker should be less than 30% throughout the operating range.
5. Driver shall be field replaceable without removal of the luminaire.
6. Class A sound rating; inaudible in a 27 dBA ambient.
7. Demonstrate no visible change in light output with a variation of plus or minus 10 percent change in line-voltage input.

2.4 EMERGENCY EXIT SIGNS

A. Exit Signs: Stencil face, 6-inch high letters, directional arrows as indicated, universal mounting type as indicated on the drawings.

B. Directional Indicators: The directional indicator for exit signage shall be of a chevron type meeting all requirements of NFPA 101.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Securely fasten luminaires to the listed and labeled ceiling framing member by mechanical means such as bolts, screws, rivets or listed clips identified for use with the type of ceiling framing members. The architectural ceiling framing system may be used in lieu of independent support with prior written approval by the ceiling system manufacturer and Authority Having Jurisdiction (AHJ). Luminaires and wiring installed in fire-rated ceiling assemblies shall be independently supported for all applications.

1. Install recessed flanged luminaires to permit removal from below. Use manufacturer-supplied plaster frames and swing gate supports. Provide independent support as follows:

a. Luminaires less than 56 lbs: Provide a minimum of two (2) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires.
b. Luminaires 56 lbs or greater: Provide a minimum of four (4) #12 gauge suspended ceiling support wires located on diagonal corners of the luminaires. Support luminaire independent of the ceiling system.
c. Luminaires larger than eight square feet (8 ft2): Support luminaire independent of the ceiling system.

B. Do not fasten luminaire supports to piping, ductwork, mechanical equipment, or conduit, unless otherwise noted. Support wires shall be tightly wrapped (minimum of three turns within 3 inches of the connection) and sharply bend to prevent vertical movement.

C. Support suspended or pendant mounted luminaires independent of ceiling grid with adjustable stainless steel aircraft cables or per luminaire schedule mounting requirements. Suspension assembly and anchors shall be capable of supporting 300 pounds dead load at each suspension point.

D. Support wire used to independently support luminaires, raceways, and wiring systems shall be distinguishable from ceiling support systems by color (field paint), tagging or equivalent means.

3.2 CONSTRUCTION USE OF PROJECT LUMINAIRES

A. The Contractor shall provide temporary construction lighting per the requirements of Division 1.

B. The project luminaires shown on the construction documents shall not be used for temporary construction purposes without providing a plan for Owner approval that addresses energy and luminaire operating hours.

3.3 RELAMPING

A. Replace failed LED light engine modules or arrays at completion of work.

3.4 ADJUSTING AND CLEANING

A. Align luminaires and clean lenses and diffusers at completion of work. Clean paint splatters, dirt, and debris from installed luminaires.

3.5 OWNER TRAINING

A. Provide electronic copy of periodic test log form to Owner's Representative. Explain and instruct Owner's Representative of requirements for testing and maintenance. Refer to latest adopted NFPA 101 for testing and logging requirements.

3.6 LUMINAIRE SCHEDULE

A. As shown on the drawings.

END OF SECTION

SECTION 27 05 00 - BASIC COMMUNICATIONS SYSTEMS REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic Communications Systems Requirements specifically applicable to Division 27 sections, in addition to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

A. This Specification and the associated drawings govern furnishing, installing, testing and placing into satisfactory operation the Communications Systems.

B. The Contractor shall furnish and install all new materials as indicated on the drawings, and/or in these specifications, and all items required to make the portion of the Communications Work a finished and working system.

C. Separate contracts will be awarded for the following work.

D. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

E. Separate contracts will be awarded for the following work. The division of work listed below is for the contractors' convenience and lists a normal breakdown of the work. Please refer to the Construction Manager's scope statements for complete scope of work description.

F. Description of Systems include, but are not limited to, the following:

1. Complete Structured Cabling System including, but not limited to:

    a. Horizontal cabling and terminations.
    b. Information outlets (IOes) including faceplates, jacks and labeling.
    c. Equipment racks, cable management, and equipment.
    d. Telecommunication Room equipment including patch panels, , and termination blocks.
    e. Cabling pathways.
    f. Testing

2. Complete Audio/Visual Systems.
3. Complete Paging Systems.
4. Mounting and patching of wireless access points provided by others.
5. Removal/demolition work and/or relocation and reuse of existing systems and equipment.
6. Low Voltage Communications Wiring (less than +120VAC) as specified and required for proper system control and communications.
7. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
8. Firestopping penetrations as described in Section 27 05 03.

9. Seismic requirements as described in Section 26 05 48 "Seismic Requirements for Equipment and Supports".

1.3 OWNER FURNISHED PRODUCTS

A. Existing telecommunication room

1.4 WORK SEQUENCE

A. All construction work that will produce excessive noise levels and interfere with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during non-occupied hours. The Owner shall reserve the right to set policy as to when restricted construction hours will be required.

1.5 DIVISION OF WORK BETWEEN ELECTRICAL AND COMMUNICATIONS CONTRACTORS

A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient to include said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the scope described. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.

B. Definitions:

1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
2. "Electrical Contractor" shall also refer to the Contractor listed in Division 27 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
3. "Technology Contractor" as referred to herein refers to the Contractors listed in Division 27 of this Specification.
4. Low Voltage Technology Wiring: The wiring (less than 120VAC) is associated with the Technology Systems, used for analog and/or digital signals between equipment.
5. Telecommunications/Technology Rough-in: Relates specifically to the backboxes, necessary plaster rings and other miscellaneous hardware required for the installation and mounting of the telecommunications/technology outlet. Rough-in shall include conduit from the information outlet backbox to above the lay-in ceiling. Where surface mounted backboxes are required, conduit shall be routed to above the lay-in ceiling.

C. General:

1. The purpose of these specifications is to outline typical Electrical and Technology Contractor's work responsibilities as related to technology systems including telecommunications rough-in, audio/visual systems rough-in, conduit, power wiring, and low voltage communications and technology wiring. The prime contractor is responsible for all divisions of work.

2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items, is shown on the technology drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the technology drawings but required for the successful operation of the systems shall be the responsibility of the Technology Contractor and included in the Contractor's bid.
3. Where the Electrical Contractor is required to install conduit, conduit sleeves and/or power connections in support of technology systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Technology Contractor has convened to determine the exact location and requirements of the installation.
4. Where the Electrical Contractor is required to install cable tray that will contain low voltage technology wiring, the installation shall not begin until the Technology Contractor has completed a coordination review of the cable tray shop drawing.
5. This Contractor shall establish electrical and technology utility elevations prior to fabrication and installation. The Technology Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:

    a. Lighting Fixtures
    b. Gravity Flow Piping, including Steam and Condensate
    c. Sheet Metal
    d. Electrical Busduct
    e. Cable Trays, including 12" access space
    f. Sprinkler Piping and other Piping
    g. Conduit and Wireway
    h. Open Cabling

D. Electrical Contractor's Responsibility:

1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
2. Assumes all responsibility for providing and installing cable tray.
3. Responsible for Communications Systems grounding and bonding.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Technology Contractor's Responsibility:

1. Assumes all responsibility for the low voltage technology wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of technology equipment which is required to be bonded to the technology bonding system.

5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

1.6 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

    a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
    b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
    d. Maintenance clearances and code-required dedicated space shall be included.
    e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

    a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

    a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1 '-0" (minimum).
        2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.
4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in his/her bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.

9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
    b. Potential layout changes shall be made to avoid additional access panels.
    c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
    d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
    e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain sign-off of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.7 QUALITY ASSURANCE

A. Telecommunications Structured Cabling System Standards:

1. All work and equipment shall conform to the most current ratified version of the following published standards, unless otherwise indicated that draft standards are to be followed:

    a. ANSI/NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling
    b. ANSI/TIA-568-0-D - Generic Telecommunications Cabling for Customer Premises

        1) 1-D - Commercial Building Telecommunications Standard
        2) 2-D - Balanced Twisted-Pair Telecommunications Cabling and Components Standard

    c. ANSI/TIA-569-E - Telecommunications Pathways and Spaces
    d. ANSI/TIA-606-C - Administration Standard for Commercial Telecommunications Infrastructure
    e. ANSI/TIA-862-A - Building Automation Systems Cabling Standard
    f. ANSI/TIA-942-A - Telecommunications Infrastructure Standard for Data Centers
    g. ANSI/TIA-1152 - Requirements for Field Test Instruments and Measurements for Balanced Twisted-Pair Cabling
    h. NFPA 70 (NEC) - National Electrical Code (Current Edition)
    i. UL 444 - Standard for Safety for Communications Cable

B. Refer to individual sections for additional Quality Assurance requirements.

C. Qualifications:

1. Only products of reputable manufacturers, as determined by the Architect/Engineer, will be acceptable.

2. The installing Contractor shall be certified by the manufacturer of the structured cabling system. Certification of Contractor shall have been in place for a minimum of one (1) year prior to bidding this project. Documentation of certification is required at the time of bid. Shop drawings will not be approved until proof of certification is submitted. Refer to the end of this specification section for certification documentation requirements.
3. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the termination of cabling shall be individually certified by the manufacturer.
4. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
5. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of optical and copper structured cabling systems and have personnel adequately trained in the use of such tools and equipment.
6. The Contractor must have a BICSI RCDD (Registered Communications Distribution Designer) or CNet CNIDP (Certified Network Infrastructure Design Professional) on-staff serving as a project manager. Project shop drawings and test reports shall be stamped by the RCDD or CNIDP.

    a. Review contractor's submittals and stamp the submittals stating the submittals compliance with the contract documents.
    b. Provide written and dated confirmation of an observation of the contractor's installation activities no less than every 2 weeks during the construction period.
    c. Provide a final written and dated confirmation of a final construction review prior to testing.
    d. Review final testing of system and indication that the documented results or transmittal of the results stating the test results compliance with the contract documents.

7. The Contractor shall have certified BICSI installation technicians or CNet CNIT (Certified Network Infrastructure Technician) on staff to perform the following tasks on the project:

    a. Act as the field superintendent or job foreman with the responsibility of monitoring the daily work of each technician.
    b. Oversee all testing and termination of cabling.

8. The Contractor shall have certified BICSI Installer 2 or CNet CNCI (Certified Network Cabling Installer) on staff to perform the following tasks:

    a. Installation and termination of copper cable.
    b. Installation and termination of optical fiber.

9. A resume of qualification shall be submitted with the Contractor's bid indicating the following:

    a. Documentation of certification of This Contractor by the proposed structured cabling system manufacturer as required at the end of this specification section.
    b. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.
    c. A list of test equipment proposed for use in verifying the installed integrity of copper and fiber optic systems on the project.
    d. A technical resume of experience for the Contractor's project manager and on-site installation supervisor assigned to this project.
    e. Resume and certification of the RCDD or CNIDP for the project as required by the form at the end of this specification section.

f. Resume and certification of the BICSI installation technician or CNet CNIT for the project.

D. Compliance with Codes, Laws, Ordinances:

1. Conform to all requirements of the City of Crystal Lake, IL Codes, Laws, Ordinances and other regulations having jurisdiction.
2. Conform to all published standards of McHenry County College.
3. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
4. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
5. If the Contractor notes, at the time of bidding, any parts of the drawings and specifications which are not in accordance with the applicable codes or regulations, he shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, he shall submit with the proposal, a separate price required to make the system shown on the drawings comply with the codes and regulations.
6. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
7. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.

E. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
3. Pay all applicable charges for such permits or licenses that may be required.
4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
7. Pay any charges by the service provider related to the service or change in service to the project.
8. All equipment and materials shall be as approved or listed by the following (unless approval or listing is not applicable to an item by all acceptable manufacturers):

    a. Factory Mutual
    b. Underwriters' Laboratories, Inc.

F. Service Provider Requirements:

1. Secure from the telecommunications service provider all applicable requirements.
2. Comply with all service provider requirements.
3. The Owner shall make application for and pay for new telecommunications service equipment and installation. The Contractor shall coordinate schedule and requirements with the Owner and service provider.

G. Examination of Drawings:

1. The drawings for the technology systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

H. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
4. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
5. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
6. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
7. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

I. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.
2. Field conditions that will result in telecommunications drops that exceed the length limitations identified in the contract documents shall be brought to the attention of the Architect/Engineer prior to installation. The cost of reworking cabling that is too long, that was not brought to the written attention of the Architect/Engineer will be borne entirely by the Contractor.

3. This Contractor shall provide the Architect/Engineer with written documentation of any cabling drops that will not be able to use the cable tray (where cable tray is available) due to the resulting cabling lengths. This documentation shall be submitted prior to installation and installation shall not commence until approved by the Architect/Engineer.

1.8 WEB-BASED PROJECT SOFTWARE

A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.

B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.

C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.

D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.9 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
27 05 03	Through Penetration Firestopping
27 05 28	Interior Communications Pathways
27 05 53	Identification and Administration
27 11 00	Communication Equipment Rooms
27 15 00	Horizontal Cabling Requirements
27 17 10	Testing
27 41 00	Professional Audio Video System
27 51 13	Paging Systems

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

a. Date
b. Project title and number
c. Contractor's name and address
d. Description of items submitted and relevant specification number
e. Notations of deviations from the contract documents
f. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

    a. Date
    b. Project title and number
    c. Architect/Engineer
    d. Contractor and subcontractors' names and addresses
    e. Supplier and manufacturer's names and addresses
    f. Description of item submitted (using project nomenclature) and relevant specification number
    g. Notations of deviations from the contract documents
    h. Other pertinent data
    i. Provide space for Contractor's review stamps

3. Composition:

    a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
    b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
    c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

    a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date, and sign each submittal certifying it has been reviewed.
    b. Unstamped submittals will be rejected.
    c. The Contractor shall provide proof of RCDD or CNIDP review on the submittal.
    d. The Contractor's review shall include, but not be limited to, verification of the following:

        1) Only approved manufacturers are used.
        2) Addenda items have been incorporated.
        3) Catalog numbers and options match those specified.
        4) Performance data matches that specified.
        5) Electrical characteristics and loads match those specified.
        6) Equipment connection locations, sizes, capacities, etc., have been coordinated with other affected trades.
        7) Dimensions and service clearances are suitable for the intended location.
        8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
        9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

e. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
f. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements**.**

6. Submittal Identification and Markings:

a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
b. The Contractor shall clearly indicate the size, finish, material, etc.
c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.

4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 27 XX XX.description.YYYYMMDD
    b. Transmittal file name: 27 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.10 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.11 EQUIPMENT SUPPLIERS' INSPECTION

A. The following equipment shall not be placed in operation until a representative of the manufacturer has inspected the installation and certified that the equipment is properly installed and that the equipment is ready for operation:

1. Firestopping, including mechanical firestop systems.

1.12 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.

B. Store materials on the site to prevent damage.

C. Keep fixtures, equipment and materials clean, dry and free from deleterious conditions.

1.13 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.14 WARRANTY

A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 27 may require additional warranty requirements for specific equipment or systems.

B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.

C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.15 INSURANCE

A. Contractor shall maintain insurance coverage as set forth in Division 1 of these specifications.

1.16 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.

B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.

D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

PART 2 - PRODUCTS

2.1 CABLE JACKET RATING

A. This project requires all cable jackets to carry a plenum rating.

2.2 Refer to individual sections.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or his or her employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and his or her personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 26 05 33. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.

B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.

C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.

D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

3.3 FIELD QUALITY CONTROL

A. General:

1. Refer to specific Division 27 sections for further requirements.
2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.
3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.

4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.
5. All communications cable tests that fail, including those due to excessive cabling lengths, shall be remedied by the Contractor without cost to the project.

B. Protection of cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

3.4 PROJECT CLOSEOUT

A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
2. Refer to the end of this specification section for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.

C. Before final payment will be authorized, this Contractor must have completed the following:

1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
2. Submitted bound copies of approved shop drawings.
3. Record documents including edited drawings and specifications accurately reflecting field conditions, **inclusive** of all project revisions, change orders, and modifications.
4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
5. Submitted testing reports for all systems requiring final testing as described herein.

6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; submit receipt to Architect/Engineer prior to final payment being approved.
8. Provide System Assurance Warranty certificate for the telecommunications system.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div27.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div27.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.

3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Detailed parts lists with lists of suppliers.
10. Operating procedures for each system.
11. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
12. Repair procedures for major components.
13. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

D. The Architect/Engineer shall be notified of the time and place for the verbal instructions to be given to the Owner's representative so that their representative can be present if desirable.

E. Refer to the individual specification sections for minimum hours of instruction time for each system.

F. Operating Instructions:

1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the Communications Systems.
2. If the Contractor does not have Engineers and/or Technicians on staff who can adequately provide the required instructions on system operation, performance, troubleshooting, care and maintenance, they shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM STARTING AND ADJUSTING

A. The Communications Systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.

B. All operating conditions and control sequences shall be simulated and tested during the start-up period.

C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.

C. This Contractor shall maintain at the job site, a separate and complete set of technology drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.

D. Record actual routing of all conduits sized 2" or larger.

E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.

F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.9 ADJUST AND CLEAN

A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.

C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION

To assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor's agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (cable tray, ladder rack, conduit sleeves, etc.) are installed, and all cabling has been pulled through them.
2. All mechanical firestop products are installed, and all other penetrations have been sealed.
3. All telecommunications jacks are installed on the faceplates.
4. All telecommunications cabling is pulled, and at least 90% of all jacks have been terminated at the jack and at the telecom room.
5. Telecommunications testing is in progress, and at least 50% of testing has been completed.
6. Telecommunications labeling has been provided with at least 50% of each type of component requiring a label.
7. All telecommunications-related grounding is complete.
8. All Audio/Visual components, cabling, and control systems are installed, programmed, and operational.
9. All overhead or integrated paging systems, including speakers, backboxes, cabling, and power supplies, and all headend equipment is installed, programmed and operational.
10. All CCTV cameras, mounts, cables, and all headend equipment are installed, programmed, and operational.
11. All access control system equipment, including card readers, conduits, cabling, electronic locks, controllers, and all headend equipment, is installed, programmed, and operational.

Prime Contractor: _____ By: _____

Requested Observation Date _____ Today's Date: _____

Contractor shall sign this readiness statement and transmit it to Architect/Engineer at least 10 days prior to the requested date of observation.

It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses, or the contractor's retainage may be deducted for the same amount.

TELECOMMUNICATIONS - PROOF OF CERTIFICATION

There are specific Contractor qualification requirements for this project as defined in Section 27 05 00, which may include Manufacturer Certification and RCDD or CNIDP credentials. This Proof of Certification document, and the supporting documentation require herein, is required to be submitted at the time of bid to show compliance with the requirements of 27 05 00.

Statement of Compliance:
The named Contractor's base bid is a structured cabling solution from the connectivity manufacturer: _Hubbell. Named Contractor is trained and certified, under the named manufacturer's formal certification program to provide and install all materials and work required by this project. Further, said Contractor is authorized, by the named manufacturer, to offer all product, labor and system assurance warranties required for this project by these contract documents.

The certification of this named manufacturer is valid, current and in effect as of the bid day of this project, the _____ day of _____, 20____.

The named Contractor is not employing any other sub-contractor on the telecommunications portion of this project that does not also meet this certification requirement.

Contractor Company Name: _____

Authorized Representative: (print) _____

Date: _____
Manufacturer Certification Number (if any): _____

If this project requires RCDD certification, complete the following:

RCDD or CNIDP Name: _____
RCDD #: _____ Expiration: _____

Submit the following with the bid:
This form.
Proof of Manufacturer Certification indicated above.
Proof of RCDD or CNIDP status.

END OF SECTION

SECTION 27 05 03 - THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 - Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. HCAI - Health Care Access and Information (California)

J. 2015 International Building Code

K. NFPA 5000 – Building Construction Safety Code

1.4 SUBMITTALS

A. Submit under provisions of Section 27 05 00.

B. Submit Firestopping Installers Certification for all installers on the project.

C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.

D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
4. F ratings for each firestop system.

E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store, protect, and handle products on site. Accept material on site in factory containers and packages. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls include fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies, including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 CFM/sq.ft. at both ambient temperature and 400F .

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.7 MEETINGS

A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.

1. Review foreseeable methods related to firestopping work.
2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.8 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk
4. Tremco; Sealant/Weatherproofing Division
5. Johns-Manville
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Wiremold/Legrand: FlameStopper
10. Dow Corning Corp.
11. Fire Trak Corp.
12. International Protective Coating Corp.
13. HoldRite

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.

E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

F. Provide firestopping systems allowing continuous insulation for all insulated pipes.

G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

   a. F Rating = Floor/Wall Rating
   b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

   a. F Rating = Wall Rating

   b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

a. F Rating = Wall/Floor Rating
b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 INSPECTION

A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.

B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

D. The Contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the Contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The Contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the Contractor's expense.

END OF SECTION

SECTION 27 05 28 - INTERIOR COMMUNICATION PATHWAYS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. The work covered under this section consists of the furnishing of all necessary labor, supervision, materials, equipment, tests and services to install complete support systems, conduits, sleeves, etc. for an interior cabling plant as shown on the drawings.

1.2 RELATED WORK

A. Section 26 05 33 - Conduit and Boxes

B. Section 27 05 00 - Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

A. Refer to Section 27 05 00 for requirements.

1.4 REFERENCES

A. ANSI/NFPA 70 - National Electrical Code

1.5 SUBMITTALS

A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:

1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.
2. Manufacturer's installation instructions.

B. Coordination Drawings:

1. Include conduit sleeve layout in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

1.6 DRAWINGS

A. The drawings, which constitute a part of these specifications, indicate the general route of the support systems, conduit, sleeves, etc. Data presented on these drawings is as accurate as preliminary surveys and planning can determine until final equipment selection is made. Accuracy is not guaranteed and field verification of all dimensions, routing, etc., is required.

PART 2 - PRODUCTS

2.1 CONDUIT

A. Refer to Section 26 05 33 for conduit requirements for this project.

2.2 CABLE HANGERS AND SUPPORTS

A. Provide a non-continuous cable support system suitable for use with open cable.

B. Cable Hooks:

1. Construction: Flat bottom design with a minimum cable bearing surface of 1-5/8". Hooks shall have 90-degree radius edges.
2. All cable hook mounting hardware shall be recessed to prevent damage to cable during installation. Installed cabling shall be secured using a cable latch retainer that shall be removable and reusable.
3. Finish: Pre-galvanized steel, ASTM A653 suitable for general duty use.

PART 3 - EXECUTION

3.1 CABLE HOOK SUPPORT SYSTEM

A. In areas where cabling is not supported by cable tray, ladder rack, enclosed wireway or installed in conduit, such cabling shall be supported by an approved cable hook support system.

B. Refer to manufacturer's requirements for allowable fill capacity for selected cable hook. In no case shall a 40% fill capacity be exceeded.

C. Cable hooks shall be securely mounted per manufacturer's instructions. In no case shall the side-to-side travel of any cable hook exceed 6".

D. Cable hooks shall be selected based on the contractor's cable routing. Hooks shall be capable of supporting a minimum of 30 pounds with a safety factor of 3.

E. J-hook support spans shall be based on the smaller of the manufacturer's load ratings and code requirements. In no case shall horizontal spans exceed 5 feet and vertical spans exceed 4 feet.

F. The resting and supporting of cabling on structural members shall not meet the requirements for cabling support specified herein.

G. The use of tie-wraps or hook and loop type fasteners is specifically prohibited as a substitute for cable hooks specified herein.

3.2 CONDUIT AND CABLE ROUTING

A. Refer to Section 26 05 33 for additional requirements.

B. All conduits shall be reamed and shall be installed with a nylon bushing.

C. Maintain appropriate conduit bend radius at all times. For conduits with an internal diameter of less than 2", maintain a bend radius of at least 6 times the internal diameter. For conduits with an internal diameter 2" or greater, maintain a bend radius of at least 10 times the internal diameter.

D. No conduit or sleeve containing more than two (2) cables shall exceed 40% fill ratio, regardless of length.

E. Any conduit exceeding 90' in length or containing more than two (2) 90-degree bends shall contain a pull box sized per ANSI/TIA/EIA 569 requirements.

1. A separate pull box is required for each 90' (or greater) length section.
2. A separate pull box is required after any two (2) consecutive 90-degree bends.
3. Pull box shall be located in an area that maintains accessibility of box, including the ability to remove box lid without removal or relocation of any other materials.

F. Any conduit with bends totaling 90 degrees or more shall have the fill capacity derated by 15% for each 90 degrees of cumulative bend.

G. Cables installed in any conduits that do not meet the above requirements shall be replaced at the Contractor's expense, after the conduit condition has been remedied.

3.3 ATTACHMENT TO METAL DECKING

A. Where supports for cable trays and cable hook systems attach to metal roof decking, excluding concrete on metal decking, do not exceed 25 lbs. per hangar and a minimum spacing of 2'-0" on center. This 25-lb. load and 2'-0" spacing include adjacent electrical and mechanical items hanging from deck. If the hanger restrictions cannot be achieved, supplemental framing off steel framing will need to be added.

END OF SECTION

SECTION 27 05 53 - IDENTIFICATION FOR COMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section describes the identification requirements relating to the structured cabling system and its termination components and related subsystems.

B. Identification and labeling.

1.2 RELATED WORK

A. Section 27 05 00 - Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

A. Refer to Section 27 05 00 for relevant standards.

1.4 SUBMITTALS

A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:

1. Documentation of labeling scheme.

PART 2 - PRODUCTS

2.1 LABELING

A. Adhesive labels shall meet the requirements of UL 969 (Ref D-16) for legibility, defacement and adhesion. Exposure requirements of UL 969 for indoor and outdoor (as applicable) use shall be met.

B. Insert labels shall meet the requirements of UL 969 for legibility, defacement and general exposure.

C. Labeling shall be consistent for all common elements in the project. This consistency shall include label size, color, typeface an attachment method.

D. Labels incorporating bar codes shall be either Code 39 conforming to USS-39 or Code 128 conforming to USS-128.

1. All Code 39 bar codes shall have a ratio between 2.5:1 and 3.0:1. Provide a minimum "quite zone" of 0.25" on each side of the bar code.
2. A descriptive label for reading by personnel shall be provided with any bar code. Bar codes by themselves are not acceptable.

E. Color Code: Observe the following requirements for color coding:

1. Labels on each end of a cable shall be the same color for each termination.

2. Labels for cross-connects shall be two different colors at each termination fields, representative of the color of that field.
3. Orange (Pantone 15C) shall be used for the demarcation point.
4. Green (Pantone 353C) shall be used for the termination point of network connection on the facility side of the demarc.
5. Purple (Pantone 264C) shall be used to identify the termination of cables from common equipment (PBX, computers, LANS, etc.)
6. White shall be used to identify the first-level backbone termination in the main cross-connect.
7. Gray (Pantone 422C) shall be used to identify the second-level backbone termination in the main cross-connect.
8. Blue (Pantone 291C) shall be used to identify the termination of station cabling at the telecommunications closet and/or equipment room end of the cable.
9. Brown (Pantone 465C) shall be used to identify the termination of the interbuilding backbone cable terminations.
10. Yellow (Pantone 101C) shall be used to identify the termination of auxiliary circuits, alarms, maintenance, security, etc.
11. Red (Pantone 184C) shall be used to identify the termination of key telephone systems.
12. In facilities that do not contain a main cross-connect, the color white may be used to identify second-level backbone terminations.

F. Tag all CAT 3, CAT 5E, CAT 6, and optical fiber cables at both the Communications Equipment Room and the information outlets using the following alphanumeric labeling system:

1. (Telecom Room Number) - (Patch Panel Letter) - (Patch Panel Port Number).
2. "Telecom Room Number" shall be as indicated on the drawings.
3. "Patch Panel Letter" shall start with 'A' for the top modular patch panel, increasing sequentially from top to bottom across the equipment rack.
4. "Patch Panel Port Number" shall start with '1' for the upper left port in each modular patch panel, increasing sequentially from left to right and top to bottom across the modular patch panel face.
5. Example #1: MC/1-A3 indicates the third modular patch panel port in modular patch panel 'A' in Main Equipment Room (MC/1).
6. Example #2: HC/2-C39 indicates the thirty-ninth modular patch panel port in modular patch panel C in Horizontal Cross-Connect room (HC/2).

2.2 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

1. Upon completion of the installation, the Contractor shall submit as-builts per the requirements of Section 27 05 00 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms shall become the property of the Owner.

B. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons and drawing conventions used shall be consistent throughout all documentation provided.

PART 3 - EXECUTION

3.1 IDENTIFICATION AND LABELING

A. Cable Labeling:

1. Horizontal cables shall be labeled at each end.

a. Cables that differ only by performance class shall have a suitable marking or label to indicate the higher performance class. For example, station cabling utilizing the blue color may include blue with a white stripe to indicate the higher performance class station cabling.

B. Information Outlet Labeling: Tag all voice and data jacks as defined herein.

END OF SECTION

SECTION 27 08 00 - COMMISSIONING OF COMMUNICATIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Description

B. Responsibilities

C. Related Work

D. Test Equipment

1.2 DESCRIPTION

A. The purpose of this section is to specify Division 27 responsibilities in the commissioning process.

B. The systems to be commissioned are listed in Section 01 91 00.

C. Commissioning requires the participation of the Division 27 Contractor to ensure that all systems are operating in a manner consistent with the Contract Documents. The general commissioning requirements and coordination are detailed in Section 01 91 00. Division 27 Contractor shall be familiar with all parts of Section 01 91 00 and shall execute all commissioning responsibilities assigned to them in the Contract Documents.

1.3 RESPONSIBILITIES

A. Refer to Section 01 91 00.

1.4 RELATED WORK

A. Specific commissioning requirements are given in the following sections of these specifications. All the following sections apply to the Work of this section.

1. Section 01 78 23 - Operations and Maintenance
2. Section 01 79 00 - Demonstration and Training
3. Section 01 91 00 - Commissioning
4. Section 21 08 00 - Commissioning of Fire Suppression
5. Section 22 08 00 - Commissioning of Plumbing
6. Section 23 08 00 - Commissioning of HVAC
7. Section 26 08 00 - Commissioning of Electrical
8. Section 28 08 00 - Commissioning of Electronic Safety and Security

PART 2 - PRODUCTS

2.1 TEST EQUIPMENT

A. The Contractor shall provide all test equipment necessary to fulfill the testing requirements of this Division. This equipment includes, but is not limited to, the following:

1. Digital multimeter capable of measuring voltage (AC/DC), current, and resistance.
2. Power quality and energy analyzer capable of capturing waveforms (3-phase) and data recording.

B. All testing equipment shall be of sufficient quality and accuracy to test and/or measure system performance with the tolerances specified in the related specifications. All equipment shall be calibrated according to the manufacturer's recommended intervals and when dropped or damaged. Calibration tags shall be affixed or certificates readily available.

C. Refer to Section 01 91 00 for additional Division 27 requirements.

PART 3 - EXECUTION

A. Refer to Section 01 91 00.

END OF SECTION

SECTION 27 15 00 - HORIZONTAL CABLING REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section describes the products and execution requirements relating to furnishing and installing horizontal communications cabling and termination components and related subsystems as part of a cabling plant. The cabling plant consists of copper cabling.

1.2 RELATED WORK

A. Section 27 05 00 - Basic Communications Systems Requirements

B. Section 27 17 20 - Structured Cabling System Warranty

1.3 QUALITY ASSURANCE

A. Refer to Section 27 05 00 for relevant standards and plenum or non-plenum cable requirements.

B. The channel shall be required to meet the performance requirements indicated herein. The manufacturer shall warranty the performance of their system to the required performance (and not just to the Standard, should the required performance exceed the Standard).

C. Specific components of the channel shall be required, at a minimum, to meet the Standard component requirements for that particular component.

D. The installing contractor must be certified by the manufacturer of the structured cabling system.

1.4 SUBMITTALS

A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work the Contractor shall submit:

1. Manufacturer's data covering all products proposed, including construction, materials, ratings and all other parameters identified in Part 2 - Products, below.

PART 2 - PRODUCTS

2.1 HORIZONTAL CABLE

A. CAT 6 Enhanced Cable:

1. The horizontal cable requirements must be met as well as the following channel requirements.
2. CAT 6 cable shall terminate on rack-mounted modular patch panels in their respective communication equipment room as indicated on the drawings.
3. Performance Tests shall be conducted using swept frequency testing through 250 MHz for the channel. All numbers given are for a 4-connection channel. Discrete frequency testing results at 250 MHz is not acceptable.

4. Performance data shall be characterized as "Guaranteed Headroom" and shall be guaranteed by the manufacturer to perform at guaranteed margins over ANSI/TIA/EIA-568-C.2. Performance data that is not warranted by the manufacturer will not be considered.
5. The structured cabling and connectivity must be provided by the same company. For the purpose of this specification that shall mean that the cabling and connectivity must be marketed, branded, supported, warranted, and distributed by the same company. Specifically, ally or partnerships between cabling manufacturers and connectivity manufacturers do not meet this requirement unless otherwise listed below. Specifically, products made by others through an OEM relationship are acceptable if the products are marketed, branded, supported, warranted, and distributed by the same company.
6. The 4-connector channel performance margins listed in the below criteria shall be guaranteed minimum margins above ANSI/TIA/EIA-568-C.2 with electrical parameters between 1-250 MHz.

    a. Insertion Loss: 14.0%
    b. NEXT: 7.0 dB
    c. PS NEXT: 8.0 dB
    d. ACR-F (ELFEXT): 8.0 dB
    e. PS ACR-F (PS ELFEXT): 8.0 dB
    f. Return Loss: 4.0 dB

7. The jacket color for CAT 6 cable shall be blue for all applications.
8. Basis of Design:

    a. Hubbell C6ESP Series
    b. Additional acceptable manufacturers:

        1) Panduit
        2) Commscope

2.2 FACEPLATES/JACKS

A. CAT 6 Jacks:

1. CAT 6 horizontal cable shall each be terminated at their designated work area location on RJ-45 modular jacks. These modular jack assemblies shall snap into a modular mounting frame. The combined modular jack assembly is referred to as an information outlet.
2. The same orientation and positioning of modular jacks shall be utilized throughout the installation. Prior to installation, the Contractor shall submit the proposed configuration for each information outlet type for review by the Architect/Engineer.
3. Information outlet faceplates shall incorporate recessed designation strips at the top and bottom of the frame for identifying labels. Designation strips shall be fitted with clear plastic covers.
4. Where standalone CAT 6 only modular jacks are identified, the information outlet faceplate shall be configured as to allow for the addition of one (1) additional modular jack (CAT 3, CAT 5E, or CAT 6) to be installed to supplement each such modular jack as defined by this project. The installation of these supplemental modular jacks is NOT part of this project.
5. Any unused modular jack positions on an information outlet faceplate shall be fitted with a removable blank inserted into the opening.

6. All modular jacks will be fitted with a dust cover. Modular jacks shall incorporate a dust cover that fits over and/or into the modular jack opening. The dust cover shall be designed to remain with the modular jack assembly when the modular jack is in use. No damage to the modular jack pinning shall result from insertion or removal of these covers. Dust covers that result in deformation of the modular jack pinning, will not be accepted.
7. The information outlet faceplate shall be constructed of high impact plastic (except where noted otherwise). The information outlet faceplate color shall:

    a. Match the receptacle color used for other utilities in the building, or
    b. When installed in surface raceway (if applicable), match the color of that raceway.

8. Different faceplate and frame designs for locations, which include optical fiber cabling relative to those, that terminate only copper cabling are acceptable. Information outlets that incorporate optical fiber shall be compliant with the above requirements plus:

    a. Be a low-profile assembly.
    b. Incorporate a mechanism for storage of cable and fiber slack needed for termination.
    c. Position the optical fiber couplings to face downward or at a downward angle to prevent contamination.
    d. Incorporate a shroud that protects the optical fiber couplings from impact damage.

9. All information outlets and the associated modular jacks shall be of the same manufacturer throughout the project.
10. The CAT 6 modular jacks shall be non-keyed 8-pin modular jacks.
11. The interface between the modular jack and the horizontal cable shall be a 110-type termination block or insulation displacement type contact. Termination components shall be designed to maintain the horizontal cable's pair twists as closely as possible to the point of mechanical termination.
12. CAT 6 modular jacks shall be pinned per TIA-568B.
13. CAT 6 termination hardware shall, as a minimum, meet all the mechanical and electrical performance requirements of the following standards:

    a. ANSI/TIA/EIA-568-A-5
    b. ANSI/TIA/EIA-568A
    c. ISO/IEC 11801
    d. IEC 603-7
    e. FCC PART 68 SUBPART F

14. The color for CAT 6 jacks shall be white for voice applications and blue for data applications. Alternately, a color-coded bezel or icon may be used to identify the CAT 6 modular jack.

2.3 COPPER WORK AREA CORDS

A. RJ-45:

1. Provide the same quantity of Category 6 copper work area cords as copper patch panel cords specified in Section 27 11 00. Copper work area cords shall be equipped with an 8-pin modular RJ-45 connector on each end.
2. Work area cords shall be 10' in length.
3. Manufacturer of copper patch cable shall be the same as the manufacturer of the horizontal copper cable.

PART 3 - EXECUTION

3.1 CABLE INSTALLATION REQUIREMENTS

A. Horizontal Cabling:

1. The maximum horizontal cable drop length for Data UTP shall not exceed 295 feet in order to meet data communications performance specifications. This length is measured from the termination panel in the wiring closet to the outlet and must include any slack required for the installation and termination. The Contractor is responsible for installing horizontal cabling in a fashion so as to avoid unnecessarily long runs. Any area that cannot be reached within the above constraints should be identified and reported to the Architect/Engineer prior to installation. Changes to the contract documents shall be approved by the Architect/Engineer.
2. All cable shall be free of tension at both ends. In cases where the cable must bear some stress, Kellum grips may be used to spread the strain over a longer length of cable.
3. Manufacturer's minimum bend radius specifications shall be observed in all instances.
4. Horizontal cabling installed as open cabling shall be supported at a maximum of 5' between supports. Refer to the specifications for required cable supports.
5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10' intervals with hook-and-loop tie wraps. The use of plastic cable ties is strictly prohibited.
6. The maximum conduit fill for horizontal cabling shall not exceed 40% regardless of conduit length.
7. Cable sheaths shall be protected from damage from sharp edges. Where a cable passes over a sharp edge, a bushing or grommet shall be used to protect the cable.

B. A coil of 3 feet in each cable shall be placed in the ceiling at the last support (e.g., J-hook, bridle ring, etc.) before the cables enter a fishable wall, conduit, surface raceway or box. At any location where cables are installed into movable partition walls or modular furniture via a service pole, approximately 15-feet of slack shall be left in each horizontal cable under 250 feet in length to allow for change in the office layout without re-cabling. These "service loops" shall be secured at the last cable support before the cable leaves the ceiling and shall be coiled from 100% to 200% of the cable recommended minimum bend radius.

1. To reduce or eliminate EMI, the following minimum separation distances from 480V power lines shall be adhered to:

   a. Twelve (12) inches from power lines of less than 5-kVa.
   b. Eighteen (18) inches from high-voltage lighting (including fluorescent).
   c. Thirty-nine (39) inches from power lines of 5-kVa or greater.
   d. Thirty-nine (39) inches from transformers and motors.

2. Information outlets shown on floor plans with the subscript "W" are intended to be used for wall mounted telephones. Back boxes for wall mounted telephones shall not be located within 12" vertically, or horizontally, from any light switches, power receptacles, nurse call devices, thermostats, or any other architectural element that would otherwise prevent the installation of a wall mounted telephone on the mating lugs.

3.2 CABLE TERMINATION REQUIREMENTS

A. Cable Terminations - Data UTP:

1. Modular patch panels shall be designed and installed in a fashion as to allow future horizontal cabling to be terminated on the panel without disruption to existing connections.
2. If the "last" patch (per rack) is greater than 90% utilized, one additional patch panel shall be provided for future use..
3. At information outlets and modular patch panels, the Contractor shall ensure that the twists in each cable pair are preserved to within 0.5-inch of the termination for data cables. The cable jacket shall be removed only to the extent required to make the termination.

END OF SECTION

SECTION 27 17 10 - TESTING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section describes the testing requirements relating to the structured cabling system and its termination components and related subsystems.

1.2 RELATED WORK

A. Section 27 05 00 - Basic Communications Systems Requirements

1.3 QUALITY ASSURANCE

A. Refer to Section 27 05 00 for relevant standards.

1.4 SUBMITTALS

A. Under the provisions of Section 27 05 00 and Division 1, prior to the start of work, the Contractor shall submit:

1. Complete information on testing procedure as described herein.
2. Test plan summary for each cable type to be tested including equipment to be used, setup, test frequencies or wavelengths, results format, etc.

PART 2 - PRODUCTS

2.1 TESTING COPPER

A. General Requirements:

1. Perform acceptance tests as indicated below for each sub-system (e.g., backbone, horizontal, etc.) as it is completed.
2. Supply all equipment and personnel necessary to conduct the acceptance tests. The method of testing shall be approved by the Architect/Engineer.
3. Visually inspect all cabling and termination points to ensure that they are complete and conform to the wiring pattern defined herein. Provide the Architect/Engineer with a written certification that this inspection has been made.
4. Conduct acceptance testing according to a schedule coordinated with the Owner/Architect/Engineer. Representatives of the Owner may be in attendance to witness the test procedures. Provide a minimum of one (1) week's advance notice to the Architect/Engineer to allow for such participation. The notification shall include a written description of the proposed conduct of the tests, including copies of blank test result sheets to be used.
5. Tests related to connected equipment of others shall only be done with the permission and presence of the Contractor involved. The Contractor shall ascertain that testing only is required to prove the wiring connections are correct.
6. Provide test results and describe the conduct of the tests including the date of the tests, the equipment used, and the procedures followed. At the request of the Architect/Engineer, provide copies of the original test results in their native format.

7. All cabling shall be 100% fault-free unless noted otherwise. If any cable is found to be outside the specification defined herein, that cable and the associated termination(s) shall be replaced at the expense of the Contractor. The applicable tests shall then be repeated.
8. Should it be found by the Architect/Engineer that the materials or any portion thereof furnished and installed under this Contract fail to comply with the specifications and drawings with respect or regard to the quality, amount, or value of materials, appliances, or labor used in the work, it shall be rejected and replaced by the Contractor and all work disturbed by changes necessitated in consequence of said defects or imperfections shall be made good at the Contractor's expense.

    a. CAT 6 Cable:

        1) Testing shall be from the modular jack at the information outlet to the modular patch panel in the communication equipment room.
        2) Horizontal cable shall be free of shorts within the pairs, and be verified for continuity, pair validity and polarity, and conductor position on the modular jack (e.g., wire map). Any defective, split, or mis-positioned pairs must be identified and corrected.
        3) CAT 6 horizontal cable shall be tested to 250 MHz as defined by TIA/EIA-568-C.2. Measurements shall be of the "Permanent Link", including cabling and modular jacks at the information outlet and modular patch panel. Parameters to be tested must include:

            a) Wire Map
            b) Length
            c) NEXT Loss (Pair-to-Pair)
            d) NEXT (Power Sum)
            e) ELFEXT (Pair-to-Pair)
            f) ELFEXT (Power Sum)
            g) Return Loss
            h) Attenuation
            i) Propagation Delay
            j) Delay Skew

        4) The maximum length of horizontal cable shall not exceed 295 feet, which allows 33 feet for technology equipment and modular patch cords.
        5) To establish testing baselines, cable samples of known length and of the cable type and lot installed shall be tested. The cable may be terminated with an eight-position CAT 6 modular connector (8-pin) to facilitate testing. Nominal Velocity of Propagation (NVP) and nominal attenuation values shall be calculated based on this test and be utilized during the testing of the installed cable plant. This requirement can be waived if NVP and nominal attenuation data is available from the cable manufacturer for the exact cable type under test.
        6) CAT 6 horizontal cable testing shall be performed using a test instrument designed for testing to 250 MHz or higher. Test records shall verify, "PASS" on each cable and display the specified parameters, comparing test values with standards based "templates" integral to the unit. Test records that report a PASS*, FAIL*, or FAIL result for any of the parameters will not be accepted.

7) In the event results of the tests are not satisfactory, the Contractor shall make adjustments, replacements, and changes as necessary and shall then repeat the test or tests that disclosed faulty or defective material, equipment, or installation methods, and shall make additional tests as the Architect/Engineer deems necessary at no additional expense to the project or user agency.

2.2 DOCUMENTATION/AS-BUILTS/RECORDS

A. General:

1. Upon completion of the installation, submit as-builts per the requirements of Section 27 05 00 and Division 1. Documentation shall include the items detailed in the subsections below.
2. All documentation, including hard copy and electronic forms, shall become the property of the Owner.
3. The Architect/Engineer may request that a 10% random field retest be conducted on the cable system at no additional cost to verify documented findings. Tests shall be a repeat of those defined above. If findings contradict the documentation submitted by the Contractor, additional testing can be requested to the extent determined necessary by the Architect/Engineer, including a 100% retest. This retest shall be at no additional cost to the Owner.

B. Copper Media Test Data:

1. Test results shall include a record of test frequencies, cable type, conductor pair and cable (or Outlet) I.D., measurement direction, test equipment type, model and serial number, date, reference setup, and crew member name(s).
2. Printouts generated for each cable by the wire test instrument shall be submitted as part of the documentation package. The Contractor shall furnish this information in electronic form (USB thumb drive). The thumb drive shall contain the electronic equivalent of the test results as defined by the bid specification and be in the tester's native format as well as summaries of each test in pdf format. Provide a licensed copy of the software required to view and print the data that is provided in a proprietary format. Furnish one (1) copy of the data and display (if applicable) software.

C. Record Drawings:

1. The drawings are to include cable routes and outlet locations. Outlet locations shall be identified by their sequential number as defined elsewhere in this document. Numbering, icons, and drawing conventions used shall be consistent throughout all documentation provided.

PART 3 - EXECUTION (Not Used)

END OF SECTION

SECTION 27 17 20 - STRUCTURED CABLING SYSTEM WARRANTY

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. This section describes support and warranty requirements relating to the structured cabling system and related subsystems.

1.2 RELATED WORK

A. Section 27 05 00 - Basic Technology Systems Requirements.

B. Section 27 11 00 - Communication Equipment Room (CER).

C. Section 27 13 00 - Backbone Cabling Requirements.

D. Section 27 15 00 Horizontal Cabling Requirements.

1.3 QUALITY ASSURANCE

A. Refer to Section 27 05 00 for relevant standards.

1.4 SUBMITTALS

A. Under the provisions of Section 27 05 00 and Division 1, prior to close of the project the Contractor shall submit:

1. A numbered certificate from the manufacturing company registering the installation.

PART 2 - PRODUCTS

2.1 WARRANTY

A. A twenty (20) year Product Installation Warranty shall be provided for the structured cabling system as described in the contract documents.

B. The Product Installation Warranty shall cover the replacement or repair of the defective product(s) and labor for the replacement or repair of such defective product(s).

C. Upon successful completion of the installation and subsequent inspection, the Owner shall be provided with a numbered certificate from the manufacturing company registering the installation.

PART 3 - EXECUTION

3.1 WARRANTY REQUIREMENTS

A. This Contractor shall be responsible for providing, installing and testing a structured cabling system that will meet the manufacturer's warranty requirements.

END OF SECTION

SECTION 27 41 00 - PROFESSIONAL AUDIO/VIDEO SYSTEM

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. System Components

B. Audio Connectors

C. Audio Cabling

D. Digital Video Cabling

E. Control Cabling

F. Horizontal Copper and Fiber Cabling and Connectors

1.2 RELATED WORK

A. Section 26 05 33 - Conduit

B. Section 26 05 13 - Wire and Cable

C. Section 27 05 00 - Basic Communications Requirements

D. Section 27 05 26 - Communications Bonding

E. Section 27 05 03 - Through Penetration Firestopping

F. Section 27 11 00 - Communication Equipment Rooms

G. Section 27 05 28 - Interior Communications Pathway

H. Section 27 15 00 - Horizontal Cabling Requirements

I. Section 27 42 00 - Electronic Digital Signage Systems

1.3 QUALITY ASSURANCE

A. Manufacturer: The manufacturer of equipment shall have a complete service organization for all products in the manufacturer's line.

B. Integrator/Dealer: The Contractor shall be a factory-authorized and certified integrator/dealer specializing in each selected manufacturer's products, with demonstrated prior experience with the selected manufacturer's system installation and programming.

C. The following qualifications have been endorsed by the AudioVisual and Integrated Experience Association (AVIXA), which is formerly known as InfoComm International.

1. The Contractor shall have the services of a Certified Technology Specialist with a specialized Installation endorsement (CTS-I) supervising the project. This service shall not be subcontracted. In addition to supervising the project, the CTS-I shall perform the following tasks on the project:

    a. Review submittals and provide a letter stating the submittals are in compliance with the contract documents.
    b. Provide written and dated confirmation of an observation of the contractor's installation activities no less than every 2 weeks month during the construction period.
    c. Provide a final written and dated confirmation of a final construction review prior to testing.
    d. Review final testing and calibration of the systems and provide a letter with the documented results or transmittal of the results stating the test results and calibration compliance with the contract documents.

D. A certification of CCNA or CCNP from CISCO.

E. This project uses a video over IP AV solution and will require that the Contractor be proficient in distribution of video over an IP network. QSC is the basis of design. The Contractor is required to have the following certification requirements to support the system:

1. Software Defined Video over Ethernet (SDVoE) Design Certification.

F. The Contractor(s) shall provide a resume of prior experience in similar types and scales of projects, and other projects that may have been completed with the client. The resume shall include the project name, square footage, budget, system descriptions, and references with email addresses and phone numbers.

G. Control System Dealer: The media control system shall be provided, terminated, installed, and programmed by a factory-authorized and certified dealer and integrator in good standing with the manufacturer. The dealer shall have direct purchasing and support authority. These services shall not be subcontracted.

H. Control System Programmer: The media control system shall be programmed by a factory-trained and certified programmer.

1. Should the installer of the system not employ a factory-trained and certified programmer, a representative from the equipment manufacturer or certified independent programmer shall be retained for programming services. The Contractor shall be responsible for payment of his/her services until the job is complete and signed off.
2. The Contractor shall have all certifications required by the manufacturer(s) for the installed system components on staff for the appropriate duties and responsibilities required by the manufacturer.

    a. The control system programmer shall have all refresher courses completed for the latest features of the control platform prior to bidding the project to ensure that the Contractor is up to date with the latest software features.
    b. The control system programmer shall have achieved the highest programmer level obtainable by the installed control manufacturer (e.g., master programmer).

I. Audio System Programmer: All digital sound processing equipment (DSP) used on the project shall be setup, programmed and calibrated by a factory-trained and certified technician. The audio system programmer shall have the following complementary certifications:

1. Associated manufacturer certifications
2. Dante Level III

J. Video System Programmer: All video distribution and processing used on the project shall be setup, programmed and calibrated by a factory-trained and certified technician.

K. The Contractor shall employ an ISF (Imaging Science Foundation) Level I certified video calibration specialist on staff to perform the calibration of the projectors and displays.

L. The Contractor shall have acquired and maintained all certifications for a minimum of one (1) month prior to the posted bid date of this project.

M. Servicing Contractor: The installer must be factory certified to provide service on the installed manufacturer's equipment and must have local service representatives within a 100 mile radius of the project site.

1.4 REFERENCES

A. ADA - Americans with Disabilities Act

B. ADAAG - Americans with Disability Accessibility Guidelines

C. ANSI - American National Standards Institute

D. AVIXA - Audiovisual and Integrated Experience Association (Formerly InfoComm)

E. ANSI/InfoComm A102.01:2017 - Audio Coverage Uniformity

F. ANSI/InfoComm 2M-2010 - Standard Guide for Audiovisual Systems Design and Coordination Processes

G. ANSI/InfoComm F501.01:2015 - Cable Labeling for Audiovisual Systems

H. ANSI/InfoComm 10:2013 - Audiovisual Systems Performance Verification

I. ANSI/AVIXA V202.01:2016 - Display Image Size for 2D Content in Audiovisual Systems

J. ANSI/InfoComm 4:2012 - Audio Visual Systems Energy Management

K. ANSI/InfoComm 3M-2011 - Projected Image System Contrast Ratio

L. IBC - International Building Code

M. IEC - International Electrotechnical Commission

N. NFPA 70 - National Electrical Code (NEC)

O. UL 813 - Commercial Audio Equipment

P. UL 1419 - Professional Video and Audio Equipment

Q. UL 1480 - Speakers for Fire Alarm, Emergency, and Commercial and Professional Use

R. UL 1492 - Audio/Video Products and Accessories

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 27 05 00.

B. General Requirements:

1. Submittals will be submitted in multiple passes over the course of construction. Each pass will be a dedicated single submission for review as outlined in the general submittal requirements outlined in section 27 05 00.
2. Upon acceptance of an item in the submittal, the Contractor shall remove them from future resubmittals of the same submittal "pass".
3. Should the Contractor not provide shop drawings in a timely fashion, not complete requirements, or extend the time of any resubmittals so as to jeopardize schedules, cause delay, or limit access for field work, the Contractor bears responsibility for impact and delay that may occur. This includes access or lift to overhead positions and associated protection of work already in place.

C. First Pass Submittals: To be submitted after the project is awarded but before equipment is submitted, purchased and installed.

1. Contractor(s) resume of qualifications.
2. All certifications shall be current and valid. Any certificate with expired dates will not be accepted.
3. All applicable AudioVisual and Integrated Experience Association (AVIXA) certifications. Qualifications from InfoComm that have not expired will be accepted.
4. All certifications outlined in the qualifications shall be included in this submittal. Refer to the qualifications section for additional information. Certifications include, but are not limited to:

    a. All installed manufacturer certifications required by the manufacturer.
    b. Control system authorized dealer certification.
    c. Control system certified programmer certification(s).
    d. Audio system DSP dealer certification.
    e. Audio system DSP programmer certification.
    f. Professional audio components dealer certification(s).
    g. Video system dealer certification(s).
    h. Video conferencing dealer certification(s).
    i. All other applicable dealer, installation and programming certifications.
    j. All applicable Microsoft certifications.
    k. All applicable networking certifications.

5. If an alternate manufacturer(s) is submitted, the equivalent certifications to the basis of design manufacturer(s) shall be required and submitted.
6. Audio and video calibration equipment certifications.
7. Audio and video testing and calibration equipment and software procedures and manufacturer-specific equipment calibration certificates.

D. Second Pass Submittals: To be submitted after all initial submittals have been approved but before equipment is purchased, installed, configured, and programmed. This can be submitted with the first pass submittal but will require it to be submitted as a separate document.

1. The submittal shall include a list of all equipment submitted, listing out each product manufacturer and model number cross-referenced with the equipment's Technology Equipment Schedule items, Equipment List Abbreviation.
2. Alternate System Drawings: If an approved alternate manufacturer is submitted, the Contractor shall provide project-specific system CAD drawings. These will be required to be submitted with the product data.

    a. Provide a system block diagram noting system components and interconnections between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical controllers), the diagram may show one device and refer to the others as "typical" of the device shown.

3. Product Data: Provide manufacturer's technical product specification sheet for each individual component type. Submitted data shall show the following:

    a. Compliance with each requirement of these documents.
    b. All component options and accessories are specific to this project.
    c. Electrical power consumption rating and voltage.
    d. Wiring requirements.
    e. Pre-terminated cable distances and requirements identified by each room where required.
    f. <u>Product manuals are not an acceptable format and will be rejected.</u>

4. Available wireless microphone frequencies within a 50 mile range based on the submitted system(s) and coordinated with the number of channels.

E. Final Pass Submittals: To be submitted after all initial submittals have been approved but before the equipment is installed, configured and programmed. These should not be submitted until after the pre-installation meeting outlined in Part 3.

1. System Drawings: Project-specific system drawings shall be provided as follows:

    a. Provide a system block diagram noting system components and interconnection between components. The interconnection of components shall clearly indicate all wiring required in the system. When multiple pieces of equipment are required in the exact same configuration (e.g., multiple identical controllers), the diagram may show one device and refer to the others as "typical" of the device shown.
    b. Submittals shall contain shop drawings indicating physical plan locations and placement of installed devices and accessories with associated scope or field conditions for review and coordination. Provide mounting details, suspensions, and rough-in notes with trade demarcations.

        1) Identify any non-standard back boxes or mounting assemblies required by product or specifications and elaborate on contractor means and methods for mounting.
        2) Provide rack drawing(s) showing the mounting of equipment in each rack or cabinet on the project.

3) All display mounts shall be coordinated with the Architect to verify the exact vertical and horizontal positioning of the display. Coordinate in-wall stud locations for installation of recessed display mounts to install in the exact location as coordinated with the architectural drawings.
4) Projector mounts shall be coordinated with other utilities on the ceiling and wall to minimize any potential obstructions for the visual beam of the projector prior to installation of the projector mount.
5) Projector mounts, projector screens, recessed ceiling speakers, in-ceiling microphones, and all other above ceiling devices shall be coordinated with other trades in the field (e.g., mechanical ductwork, lights, diffusers, etc.) to minimize changes that will impact the performance of the system design.

c. Submit wiring and cable path requirements, including field wiring, path verification, signal separation, and outside diameter of cables for conduit sizing and verification that can be used for field installation and electrical coordination.
d. Reproduction of contract documents is not acceptable for submittals. Wire CAD type drawings and cable tag lists or schedules, or typical manufacturer's abbreviated single lines alone, are not complete.

2. The Contractor shall submit graphic or emulated representations of the control system touch panels for each unique space and layout prior to purchase, installation and programming for review and comment by the Architect/Engineer and Owner. These shall show and describe the intended programming/macro control features and functions of each button/icon for all pages.
3. The Contractor shall submit graphic or emulated representations of the control system keypads for each unique space and layout prior to purchase, installation and programming for review and comment by the Architect/Engineer and Owner. These shall show and describe the intended programming/macro control features and functions of each button/knob.
4. The Contractor shall submit the actual DSP audio processor files or single line audio path file diagram prior to installation for review and comment by the Architect/Engineer. Provide preliminary settings with processor blocks identified and note resources allocated.
5. The Contractor shall submit the number of IP addresses, VLANS, and subnetworks that will be required from the Owner's Information Systems Department.
6. Provide system checkout and commissioning procedure to be performed at acceptance.

a. The A/E provides electro-acoustic and technical testing including punch list on behalf of the Owner for final performance verification and optimization of the systems. The AVC shall include a site test in his/her bid for A/E Commissioning and testing services.
b. AVC shall provide two (2) week written advance notice to the Prime Contractor for the A/E and schedule a minimum of one "quiet day" on the CM project schedule chart for A/E electro-acoustic testing, when project nears Substantial Completion and loudspeakers are properly aimed.

1) A "quiet day" means General Contractor activity may proceed in certain areas, but A/E shall retain the ability to call off any noise or intrusive construction activity in the main seat area for noise control measurements and main loudspeaker testing as required. This is at the will of the site acoustician and AV Commissioning Firm (A/E).
2) A test report and pre-commissioning check list shall be filed by AVC prior to scheduling A/E performance verification.

7. Submit meeting agenda for planning/programming meetings as required in Part 3 of this specification.
8. Submit detailed description of Owner training to be conducted at project end, including specific training times and typical attendees expected.
9. Provide rack drawing(s) showing the mounting of equipment in each rack or cabinet on the project. Rack drawings shall include the following:

    a. Equipment placement including mounting on the front or rear of the rack.
    b. Spacing separation as required by equipment for adequate airflow and heat dissipation.
    c. Signal separation based on AVIXA standards as required by the design.
    d. Heating/cooling load requirements for submitted equipment to verify the heating/cooling load of the rack. This shall include Owner-provided equipment coordinated with the Owner.
    e. Power requirements for each rack including plug type and loads based on the final approved products.

10. A console and equipment rack plan shall be provided showing console, countertop, rough-in, cable paths, and wall plates with dimensions in plan view and elevation. The plan shall include equipment layout within the console and rack.
11. Submit the detailed engineered and coordinated mounting solution(s) for wall-mounted and ceiling-mounted devices including the following items:

    a. Surface-mounted and/or flown loudspeakers.
    b. Ceiling-mounted and/or flown projectors, including distance from the screen, height to the lens, and the angle of the projector based on actual field conditions.
    c. Projection screens, including height from the finished floor and black screen masking from finished ceiling.
    d. Video displays including blocking or ceiling span requirements, height from finished floor, and back box location.
    e. Projector lifts, including height from the finished floor and decorative ceiling cover.

12. Submit engineered PE stamped rated rigging solution(s) for performance loudspeakers, including, but not limited to, the following items:

    a. Provide PE stamped shop drawings that detail suspension means and methods including rated loudspeaker rigging components, attachments, supplemental spans, and independent safety cables. Note load for each location.
    b. Clearly note and confirm the XYZ "reference" point being used on floor plans ("0" point) for determining proper aim, horn rotation, location, heights and clearance of main speakers. Refer to Loudspeaker Aim Schedule and confirm XYZ location and aim angle for each loudspeaker device. Verify clear sightline from speaker to aim point. Notify A/E of any anticipated conflicts.

13. If an alternate loudspeaker design is going to be utilized, the Contractor shall submit the following sets of calculations:

    a. EASE Calculations:

        1) All calculations shall be completed at a minimum patch size resolution of 1.00ft at 1/3 octave, 35ms split time, and shown with Summed Interference and Map with Shadow turned on. The calculations shall be submitted electronically as EASE OpenGL (*.egl) files. The Contractor shall also provide a copy of the latest version of the EASE GLL viewer to view the electronic EASE files.

2) Provide coverage maps (print or pdf) for each main loudspeaker and combined composite of all main loudspeakers as Direct SPL at 500 Hz, 1000 Hz, 2000 Hz, 4000 Hz, 8000 Hz, and three octave mid-band sum centered at 2000 Hz.
3) Articulation Loss of Consonants (ALCons).
4) Calculated Speech Transmissible Index (STI) using the Modulation Transfer Index (MTI) with noise levels.
5) The Contractor shall use the latest version of EASE.
6) The Contractor shall refer to the architectural drawings and specifications for room geometry, room dimensions and surface finishes.
7) The Contractor shall use a listener sitting height of four (4) feet for rooms where the primary function will be sitting. The Contractor shall utilize a listener standing height of five feet three inches (5.25') for rooms where the primary function will be standing.
8) The Contractor shall use a standard indoor temperature of 68°F, 60% humidity and a standard pressure of 29.8 Hg, unless more specific data is available.
9) The Contractor shall submit packed electronic EASE files or an EASE generated list of materials and room data for review and approval by the Architect/Engineer.

F. Discontinued Products and New Model Releases:

1. For each product, the Contractor shall submit (in addition to the specified product) a product cut sheet if the specified product has been replaced, improved upon, phased out or otherwise upgraded at the time of shop drawing submittal.

a. The intent of this requirement is for the Contractor to submit only direct replacements for the specified products. A direct replacement shall be defined as a product of newer release that has equal or greater capabilities. The Contractor shall submit a letter from the manufacturer with a direct replacement that includes both model numbers to clarify the replacement.
b. It is not the intent of this requirement for the Contractor to submit new products or other product options that significantly differ in capability and/or cost from the specified product.

G. Coordination Drawings:

1. Include all ceiling-mounted devices in composite electronic coordination files. Refer to Section 27 05 00 for coordination drawing requirements.

1.6 SYSTEM DESCRIPTION

A. This specification section describes the furnishing, installation, commissioning and programming of audio/video components and systems.

B. Performance Statement: This specification section and the accompanying Contract Documents are performance based, describing the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed, every equipment connection that must be made and every feature and function that must be programmed and configured. Based on the equipment constraints described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.

C. This document describes the major components of the system. All additional hardware, subassemblies, supporting equipment and other miscellaneous equipment required for proper system installation and operation shall be provided by the Contractor.

D. This document describes the major programming features and functions of the system. All additional programming, configuration and integration required for proper system installation and operation shall be provided by the Contractor.

E. When a specific manufacturer is not provided in this document for minor pieces of equipment, the Contractor shall provide only those materials considered to be of the same industry commercial and professional quality level as the major equipment manufacturers.

F. General System Description:

1. The purpose of this section is to define the overall AV system requirements for each space identified on the project drawings. This is to represent the end-user needs, applications, tasks and Functions and features for each space to assist with identifying programing requirements for each space.

G. Room Type Requirements:

1. Events Center:

a. Architectural and Infrastructure Requirements:

1) One 217” diagonal 4k LED video wall shall be provided as the main display for the audiovisual system.
2) The room video sources shall include:

a) Two floor boxes with network ethernet ports for Video over IP encoder connectivity.
b) Two Wall Mounted HDMI encoders.
c) Two Wall Mounted PTZ cameras.
d) One Rack HDMI input.
e) One Rack located Owner provided PC for presentations, Zoom videoconferencing, and software background music streaming service.
f) Owner provided digital signage source.

3) The audio system shall include:

a) Two main array speakers for the main floor program audio.
b) 70V distributed ceiling pendant speakers.
c) Four ceiling mounted subwoofers
d) 70V distributed outdoor ground mounted speakers.
e) Two XLR inputs at each of the two wall plate locations.
f) Two 3.5 mm audio inputs at each of the two wall plate locations.
g) Eight wireless mics, six handled and two headset.
h) Audio DSP with Acoustic echo cancelation for conferencing.
i) 3.5mm audio rack input.
j) WiFi based assisted listening system with bluetooth beacon locators.

4) The video conferencing system shall consist of:

a) One video conference software codec in PC located in the AV rack.

b) BYOM (Bring Your Own Meeting) capabilities with HDMI and USB inputs via AV over IP encoders utilized at floor box locations.
c) Two PTZ cameras routed to the Owner provided rack PC or for BYOM applications.
d) Wireless mics utilizing the audio DSP AEC.

5) The control system shall include:

a) Three wall-mounted touch panels:
- Two at Stage Location
- One on East Wall
- One is mounted in the rack.

b) Control functions shall include:
- Power on/off
- Source Selection
- Camera PTZ control
- Microphone levels
- Audio Routing
- Zone selection
- Program Volume
- Advanced setting page for matrix/window routing.

6) Equipment shall be installed on a floor rack located in AV Storage Room 103B.

1.7 LICENSING REQUIREMENTS

A. All user licenses required for system operation shall be included in the Contractor's bid. User licenses shall include, but not be limited to, server and workstation software and any other licensing that is required by the manufacturer for operation of any system component.

1. Licenses shall be provided on a one-to-one basis. One license shall be provided for each server, workstation, and device requiring a license. In the event the manufacturer requires the purchase of a block of licenses, the minimum standard licensing package to support all devices is required.

1.8 INTELLECTUAL PROPERTY OWNERSHIP

A. All supporting documentation, programming, uncompiled source code, graphic files, DSP code, and diagrams, written and electronic files, including all latest versions of the documentation and software necessary to edit and adapt the system(s), shall be provided to the Owner for all spaces and all systems. The integrator and/or programmer shall also maintain a current copy to be provided at the Owner's request.

1. The Owner shall have the right to modify the intellectual property directly, or to have the intellectual property modified by any party of the Owner's choosing.

1.9 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Section 27 05 00.

B. Provide all applicable certifications.

C. Provide statement that system checkout test, as outlined in the shop drawing submittal, is complete and satisfactory.

D. Provide schedules documenting all terminal block wiring, including cable numbers.

E. Warranty: Submit written warranty and complete all Owner registration forms.

F. Complete all operation and maintenance manuals as described below.

G. The Contractor shall include all factory-provided test results for equipment installed on the project.

H. The Contractor shall include all test results from system demonstration and performance testing specified in this document.

I. Record Drawings shall minimally include:

1. All revisions to, or deviations from the original drawings, as well as final dimensions, cable routes, connector panel drawings, cable numbering charts, and control system programming documentation. A complete as-installed equipment list, listed by room, and with manufacturers' names, model numbers, serial numbers, and quantities of each item.
2. A complete and correct system schematic, showing detailed connections for all parts of the system, including wire numbers, terminal block numbers and layouts, and other designations and programming code.
3. Complete equipment rack layouts showing locations of all rack-mounted equipment items.
4. Additional information, diagrams or explanations as designated under respective equipment or systems specification section.

J. Within each equipment room, the appropriate floor plan for which that equipment room serves shall be laminated and mounted for use by the Owner. Functional drawings shall be posted at each AV closet or included at every AV rack within a room.

K. Upon completion and final acceptance of the project, the Contractor shall provide the Owner a copy of the programming code for any and all AV systems and devices programmed by the Contractor.

1. For any subsequent modifications to the programming code, an updated copy of the code shall be provided to the Owner.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit documents under the provisions of Section 27 05 00.

B. Manuals: Final copies of the manuals shall be delivered after completing the installation. Each manual's contents shall be identified on the cover. The manual shall include names, addresses, and telephone numbers of the Contractor responsible for the installation and maintenance of the system and the factory representatives for each item of equipment for each system. The manuals shall have a table of contents and labeled sections. The final copies delivered after completion of the installation shall include all modifications made during installation, checkout, and acceptance. Manuals shall be submitted in electronic format. The manuals shall consist of the following:

1. Functional Design Manual: The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be included.
2. Hardware Manual: The manual shall describe all equipment furnished including:

    a. General description and specifications.
    b. Installation and checkout procedures.
    c. Equipment layout and electrical schematics to the component level.
    d. System layout drawings and schematics.
    e. Alignment and calibration procedures.
    f. Manufacturers repair parts list indicating sources of supply.

3. Software Manual: The software manual shall describe the functions of all software and shall include all other information necessary to enable proper loading, testing, and operation. The manual shall include:

    a. Definition of terms and functions.
    b. System use and application software.
    c. Initializations, startup, and shutdown.
    d. Reports generation.
    e. Details on forms customization and field parameters.

4. Operator's Manual: The operator's manual shall fully explain all procedures and instructions for the operation of the system including:

    a. Computers and peripherals.
    b. System startup and shutdown procedures.
    c. Use of system, command, and applications software.
    d. Recovery and restart procedures.
    e. Use of report generator and generation of reports.
    f. Data entry.
    g. Operator commands.
    h. Alarm messages and reprinting formats.
    i. System permissions functions and requirements.

5. Maintenance Manual: The maintenance manual shall include descriptions of maintenance for all equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.

C. Video Calibration Data: Provide documentation of all calibrated settings for each projector and display.

D. Audio Calibration Data: Provide documentation on all EQ settings, crossover points, limiter settings, gate settings and all other applicable settings.

E. Intellectual Property Ownership: Provide all uncompiled source code and DSP programming for all systems and spaces as described in Part 3 of this specification section.

1.11 WARRANTY

A. Unless otherwise noted, provide warranty for one (1) year after Date of Substantial Completion for all materials and labor.

B. Onsite Work During Warranty Period: This work shall be included in the Contractor's bid and performed during regular working hours, Monday through Friday.

1. Inspections: The Contractor shall perform two (2) minor inspections at even intervals (or more often if required by the manufacturer), and two (2) major inspections offset equally between the minor inspections.
2. Minor Inspections: These inspections shall include:

a. Visual checks and operational tests of all equipment, field hardware, and electrical and mechanical controls.
b. Mechanical adjustments if required on any mechanical or electromechanical devices.

3. Major Inspections: These inspections shall include all work described under paragraph Minor Inspections and the following work:

a. Clean all equipment, including filters, interior and exterior surfaces.
b. Perform diagnostics on all equipment.
c. Check, test, and calibrate (if required) any sensors or other equipment that contain settings.
d. Check zoom and focus of all projectors.
e. Run all system software diagnostics and correct all diagnosed problems.

C. Operation: Upon the performance of any scheduled adjustments or repairs, Contractor shall verify operation of the systems.

D. Emergency Service: The Owner will initiate service calls when the systems are not functioning properly. Qualified personnel shall be available to provide service within the distance defined within this specification section. The Owner shall be furnished with telephone number(s) where service personnel can be reached 24/7/365. Service personnel shall be at site within 24 hours after receiving a request for service.

E. Records and Logs: The Contractor shall keep records and logs of each task completed under warranty. The log shall contain all initial settings at substantial completion. Complete logs shall be kept and shall be available for review on site, demonstrating that planned and systematic adjustments and repairs have been accomplished for the systems.

F. Work Requests: The Contractor shall separately record each service call request on a service request form. The form shall include the model and serial number identifying the component involved, its location, date and time the call was received, specific nature of trouble, names of service personnel assigned to the task, instructions describing what must be done, the amount and nature of the materials used, the time and date work started, and the time and date of completion. The Contractor shall deliver a record of the work performed within five (5) business days after work is accomplished.

G. System Modifications: The Contractor shall make any recommendations for system modification in writing to the Owner. No system modifications shall be made without prior approval of the Owner. Any modifications made to the system shall be incorporated into the operations and maintenance manuals, and other documentation affected. To the fullest extent possible, the Owner shall be provided with electronic restorable versions of all configurations prior to the modifications being made.

H. Software: The Contractor shall provide all software and firmware updates during the period of the warranty and verify operation of the system upon installation. These updates shall be accomplished in a timely manner, fully coordinated with system operators, shall include training for the new changes/features, and shall be incorporated into the operations and maintenance manuals, and software documentation.

I. Refer to the individual product sections for further warranty requirements of individual system components.

1.12 ANNUAL SERVICE CONTRACT

A. Provide annual cost for extended service and maintenance warranty after the first year for the audio/video systems according to the following terms:

1. The term of the warranty shall begin on the system acceptance date and shall continue for one (1) year. The extended service and maintenance warranty may begin following this first year if accepted by the Owner. The term may be automatically renewed for successive one-year periods unless canceled by the Owner. The service and maintenance agreement shall include the following basic services to the Owner, including all necessary parts, labor and service equipment:

    a. Repair or replace any equipment item that fails to perform as initially installed, as specified, or as determined per the manufacturer's performance criteria.
    b. Perform semi-annual preventive maintenance on the equipment. This preventive maintenance shall include, but is not limited to, cleaning, realignment, bulb replacement, filter cleaning and replacement, inspection, re-calibration, and testing of devices. The Owner shall receive a written report of these inspections that identifies the device's status and, if required, a list of all necessary repairs or replacements.
    c. Provide software and firmware maintenance on the system. Contractor shall install and configure any software and firmware updates that the manufacturer provides at no cost. Any additional software or firmware options, updates, or enhancements purchased by the Owner shall be installed. The Contractor shall not be responsible for the purchase of additional software packages or the maintenance of Owner data.

2. The Contractor shall be compensated for any repairs or maintenance provided as a result of Owner abuse, misuse, intentional damage, accidental damage, or power fluctuations exceeding specified equipment tolerances.

3. System defects or failures shall be corrected within four (4) hours on the same business day if the Owner makes a service request before 11:00 am, or before 12:00 noon the next business day if the Owner makes the request after 11:00 am. If requested by the Owner, the Contractor shall respond or remain at the site after normal business hours, and the Owner shall reimburse the Contractor for the incremental cost difference between premium labor rates and standard labor rates. This reimbursement applies to premium labor rates that do not exceed time-and-one-half rates after normal business hours and double-time rates for Sundays and holidays. The Contractor's services shall be performed in a good and workmanlike manner and remain free from defects for a period of one (1) year.

B. Provide complete terms and conditions of warranty and service.

C. The Owner will enter into a contract directly with the vendor. This specification is not a contract between the Owner and the vendor to perform these services.

PART 2 - PRODUCTS

2.1 SYSTEM COMPONENTS

A. Refer to the project drawings for basis of design system components. Equivalent products shall meet or exceed all requirements defined on the project drawings. The following product information represents the minimum additional requirements for equivalent products:

B. Media Players:

1. All media players, including Blu-ray players that are capable of outputting protected content including HDCP and DPCP, shall have a minimum of 16 keys available.

C. Audio/Video GUI Control Systems:

1. Contractor shall furnish a programmable software-based audio/video control system. The system shall be field configurable and programmable by the factory and/or a factory-trained programmer.
2. The control system shall be TCP/IP based allowing direct connection of the system processors to a 10/100BaseT compatible Ethernet network.
3. The control system(s) shall connect to a centralized software-based management system for central control, monitoring and statistical information.
4. Virtual touch panel and keypad control shall be provided for remote trouble shooting and control.
5. Refer to project drawings for required central processors, touch panels, keypads and additional information.

D. Microphone Systems:

1. Wireless Microphones:

a. Wireless microphones shall not operate in the 614 to 806 MHz band (channels 38 to 69).
b. Features:

1) Dual antenna reception with true diversity reception.

c. Microphone systems that are common (shared) by multiple spaces or when the receivers are in a remote area shall include a compatible wireless antenna distribution system by the same manufacturer as the wireless microphone system.
d. Provide antenna cabling and connectors per manufacturer recommendations.

E. Audio Amplifiers:

1. Power Amplifier(s), 25, 70.7 and 100 Volt:

a. Power: The following calculation shall be used to determine the minimum required output of the amplifier(s):

1) Calculate the total power tap value of each transformer with insertion loss using the following equation:

a) Tap wattage x 10^(xdB/10) where x = the rated insertion loss at 1,000Hz.

2) Calculate the total wattage loss based on cable distance, cable gauge and cable resistance.
3) Add together all the speaker taps' total power values that will be on a single channel of the amplifier. Multiply that total by 1.2, which will allow for a 20% future expansion. Multiply that number by 1.25 to ensure the amplifier never exceeds 75% of its total output. Utilize the final number to determine the minimum amplifier power requirements.

F. Assisted Listening Systems (ALS):

1. All spaces with amplified audible communications require an ALS. The Contractor shall refer to the ADA and ADAAG guidelines, as well as IBC Section 1108.2.7 for ALS rules, regulations and guidelines. Refer to the table below for the required number of receivers to be provided for each space (Source: IBC, Table 1108.2.7.1). Alternatively, if the building is managed by a single entity and all systems are fully compatible and interoperable, the total number of seats for all areas can be used in accordance with the table below.

Capacity of Seating in Assemble Areas	Minimum Required Number of Receivers	Minimum Number of Receivers to be Hearing-aid (T-coil) Compatible
50 or less	2	2
51 to 200	2, plus 1 per 25 seats over 50 seats	2
201 to 500	2, plus 1 per 25 seats over 50 seats	1 per 4 receivers
501 to 1,000	20, plus 1 per 33 seats over 500 seats	1 per 4 receivers
1,101 to 2,000	35, plus 1 per 50 seats over 1,000 seats	1 per 4 receivers
Over 2,000	55, plus 1 per 100 seats over 2,000 seats	1 per 4 receivers

2. Receivers required to be hearing-aid compatible shall interface with telecoils in hearing aids through the provision of neckloops and shall be over-the-ear type headphones. Earbuds are not acceptable for this use.
3. Receivers shall include a 1/8" (3.2mm) standard mono output jack.
4. Refer to the Access Board Research "Large Area Assistive Listening Systems: Review and Recommendations" ALS report for additional recommendations.

G. Power Conditioning and Surge Protective Devices:

1. All equipment shall be plugged in through a power conditioning surge arrestor.
2. Provide a minimum of 50 dB noise attenuation.
3. Provide a minimum of 1,500 joules of surge protection.
4. UL 1449 – Standard for Safety for Surge Protective Devices listed to 330 volt clamping voltage.
5. Provide automatic voltage regulation from 97 VAC to 137 VAC at a minimum to maintain a stable 120 VAC where specified.
6. Power sequencers shall be equipped with contact closures or Ethernet control for remote turn on and off.
7. Refer to the project drawings for additional information.

H. Uninterruptible Power Supplies (UPS):

1. UPS shall be sized to accommodate the full startup VA load of all connected equipment for a minimum of fifteen (15) minutes. Adequate time shall be provided so all equipment can go through its normal shutdown sequence.
2. UPS shall be equipped with bi-directional RS-232 or Ethernet control for remote turn on/off control and status monitoring.
3. UPS shall provide automatic voltage regulation to maintain a stable 120VAC.
4. UPS shall provide power conditioning and surge protection to meet the UL 1449 – Standard for Safety for Surge Protective Devices listing to 330 volt clamping voltage.
5. UPS shall be UL 1778 – Uninterruptible Power Supply Equipment listed.

I. Digital Video Signal Equalizers and Regenerators:

1. For any cable run that exceeds the manufacturer-recommended distances or fails to transmit video or audio due to cable length, the Contractor shall provide and install a signal equalizer at the far end (sink) with the following minimum features:

    a. HDMI/DVI equalizers shall be HDCP compliant and support actively buffered DDC transmission.
    b. Display port equalizers shall be HDCP and DPCP compliant, support actively buffered DDC transmission, and be DP++ compatible.
    c. Provide automatic equalization.
    d. Pass all embedded audio and metadata.
    e. Have an auxiliary power input when adequate power is not available on the cable.
    f. Provide output reclocking and jitter reduction for multi-rate SDI signals.

2. For any cable run that that fails to transmit video or audio due to a weak source signal, the Contractor shall provide and install a signal regenerator at the near end (source) with the following minimum features:

    a. HDMI/DVI regenerators shall be HDCP compliant and support actively buffered DDC.
    b. Display port regenerators shall be HDCP and DPCP compliant, support DDC transmission, and be DP++ compatible.
    c. Provide automatic output reclocking and jitter reduction.
    d. Pass all embedded audio and metadata.
    e. Have an auxiliary power input when adequate power is not available on the cable.

J. Refer to project drawings for all other equipment not listed.

2.2 AUDIO CONNECTORS

A. This article includes minimum requirements for all connectors that are acceptable on this project. Should the Contractor request an alternative connector, it shall be submitted with the product submittals and clearly identified with which connector it will be replaced.

B. XLR Jack:

1. Manufacturers:

a. Switchcraft
b. Neutrik

C. XLR Plug:

1. Professional grade, 360° strain relief, nickel shell, silver pins. Provide colored boot.
2. Manufacturers:

a. Switchcraft
b. Neutrik

D. Loudspeaker Connector:

1. Panel Mount: Twist-lock type, 4-conductor.
2. Manufacturers:

a. Neutrik

2.3 AUDIO CABLING

A. Refer to Section 27 05 00 for cable rating requirements.

B. Microphone Level Audio Cabling:

1. For patch cables less than or equal to 25 feet:

a. 24 AWG 2-conductor, foil shield, twisted, stranded (19x36) tinned bare copper.

2. For cable runs greater than or equal to 25 feet:

a. 22 AWG 2-conductor, foil and braid shield, twisted, stranded (16x34) tinned bare copper.

C. Line Level Audio Cabling:

1. For patch cables less than or equal to 25 feet:

a. 22 AWG 2-conductor, foil shield, twisted, stranded (7x30) tinned bare copper.

2. For cable runs greater than or equal to 25 feet:

a. 18 AWG 2-conductor, foil shield, twisted, stranded (16x30) tinned bare copper.

D. Constant Voltage Speaker Cabling:

1. Class 2, stranded, twisted, 2-conductor, minimum of 16-gauge wire for all 25/70.7/100-volt applications unless noted otherwise.
2. The Contractor shall size cabling as required for distance power and shall provide larger gauge cable as required.

E. High Performance Constant Voltage Speaker Cabling:

1. Class 2, stranded, twisted, minimum of 12-gauge wire for all 25/70.7/100-volt high-wattage (50-watts per speaker or greater) applications unless noted otherwise.
2. The Contractor shall size cabling as required for distance power and shall provide larger gauge cable as required.

F. Low Capacitance Speaker/Subwoofer Cabling:

1. Class 2, high strand count (65x34), oxygen free copper, low capacitance (19.9 pF/Ft), twisted, 2-conductor, 16-gauge wire for all 2/4/8/16 ohm low impedance applications where amplifier output is 150 watts or less and/or the distance is less than 50', unless noted otherwise.
2. The Contractor shall size cabling as required for distance power and shall provide larger gauge cable as required.
3. Cables shall be installed in conduit within plenum areas.

G. High Performance Low Capacitance Speaker/Subwoofer Cabling:

1. Class 2, high strand count (259x34), oxygen free copper, low capacitance (23.2 pF/Ft), twisted, 2-conductor, 10-gauge wire for all 4/8-ohm low impedance applications where amplifier output is 150 watts or greater and/or the distance is greater than 50', unless noted otherwise.
2. The Contractor shall size cabling as required for distance power and shall provide larger gauge cable as required.
3. Cable shall be installed in conduit within plenum areas.

2.4 DIGITAL VIDEO CABLING

A. All digital video cabling shall be pre-assembled and tested in a factory and not field terminated. The contractor shall field verify the cable distance and provide the proper cable type and length.

B. High-Definition Multi-Media Interface (HDMI) Cable:

1. For cable runs less than or equal to 25 feet:

   a. The cable shall be a minimum of HDMI 2.0 certified.
   b. HDCP compliant.

2. For cable runs greater than 25 feet:

   a. HDMI optical cabling can be used as an alternative to copper cabling for distances over 25 feet.
   b. For any cable run that exceeds the manufacturer-recommended distances, the Contractor shall provide and install an HDCP-compliant signal equalizer approved by the cable manufacturer at the far end (sink).

c. The cable shall be a minimum of HDMI 2.0 certified.
d. HDCP compliant.

2.5 CONTROL CABLING

A. Control:

1. For Bidding Purposes: Two-pair, twisted, shielded, one (1) #18 AWG pair and one (1) #22 AWG pair. Provide with plenum-rated jacket where used in a plenum space without conduit.
2. Size conductors as required for distance and voltage drop.
3. Coordinate exact requirements with selected manufacturer and system prior to submitting bid.

B. Other Control Circuits:

1. #20 AWG, stranded, shielded cable, number of conductors as required for the applications. Provide with plenum-rated jacket where used in a plenum space without conduit. Provide PVC jacket where installed in conduit or non-plenum areas.
2. Coordinate exact requirements with selected manufacturers prior to submitting bid.

2.6 HORIZONTAL COPPER DATA AND FIBER CABLING AND CONNECTORS

A. Refer to Section 27 15 00 - Horizontal Cabling Requirements, for telecommunications cabling and connector requirements including fiber optics being utilized for A/V systems.

B. Refer to Section 27 17 10 - Testing, for telecommunications cabling testing requirements including fiber optics being utilized for A/V systems.

C. All category-rated copper data cabling and fiber optic cabling shall be installed, terminated, tested and certified by the Division 27 Telecommunications contractor certified by the selected manufacturers for the copper and fiber optic cabling plant. The Contractor shall submit all cabling and certifications to the Architect/Engineer for approval in the shop drawings.

D. The A/V contractor shall coordinate purchase, installation, testing and certification with the telecommunications contractor for all required category-rated copper data cabling and fiber optic cabling required for A/V system operation prior to bid.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work.

B. Verify field dimensions and coordinate physical size of all equipment with the architectural requirements of the spaces into which they are to be installed. Allow space for adequate ventilation and circulation of air.

C. Verify that required utilities are available, in proper location, and ready for use.

D. Beginning of installation means installer accepts existing conditions.

3.2 PRE-INSTALLATION

A. A pre-installation meeting shall be held after the project has been awarded but before any submittals or work has been conducted. The purpose of this meeting is to review the drawings and specifications to assist with the construction and installation process that will occur during construction. The meeting will include the Engineer, Architect, Owner's Representative, and all relevant installing contractors for this system. The meeting will be chaired by the project manager for the AV contract and will include the following topics:

B. The Contractor shall be responsible for submitting all requested submittals and holding the pre-installation meeting prior to any purchasing, installation, programming, and construction coordination. Any delays or changes to the project as a result of meeting this requirement will be at the Contractor's expense.

3.3 INSTALLATION

A. Comply with the manufacturer's instructions and recommendations for installation of all products.

B. Provide all system wiring between all components as directed by the manufacturer or required for proper system operation.

C. Mount all touch screen and keypad devices where shown on plans in accordance with Americans with Disabilities Act (ADA) requirements for both side reach and front reach.

D. Cabling Requirements:

1. Non-plenum rated cabling may be used instead of plenum when installed with-in conduit in plenum rated areas.
2. All cabling shall be routed according to function. Cabling shall be grouped and bundled by groups, such as: microphone and line level audio, control, video and speaker. In no case shall cabling from different functional groups be intermixed. No cabling shall be routed parallel to 120 VAC or higher power circuits unless separated by a minimum of 6" and the 120 VAC or higher power is installed in conduit.
3. When cabling is installed in conduit, a separate conduit shall be provided for each cabling functional type.
4. Cable bundles shall be loosely bundled to allow the visual following of individual cables within the bundle and to permit the easy removal and addition of cables as necessary.
5. Horizontal cabling installed as open cable or in cable tray shall be bundled at not less than 10' intervals with hook-and-loop tie wraps. The use of plastic cable zip ties is strictly prohibited in any situation.
6. Cabling shall not be spliced under any circumstances.
7. Each cable shall be appropriately identified (as defined on the record documents) at each end's termination point using pressure sensitive label strips.
8. Audio Cabling:

    a. All amplified audio cabling shall not be in the same enclosed pathway as any other type of cabling as required by the NEC. Refer to the NEC for definitions and additional requirements.
    b. The polarity of all cabling shall remain consistent throughout the project, on all equipment. Red conductors shall be used for the positive "+" side, and black used for the negative "-" side.
    c. Cable shield length shall be equal to the cable's conductor length.
    d. All shielded cables drain wire SHALL be grounded and continuous throughout the entire length of the system, including splices where speakers are installed.

e. Balanced audio connections shall be used whenever the mating equipment allows.
f. Do not run unbalanced cables longer than 3m. For interconnecting of unbalanced equipment in lengths longer than 3m, the Contractor shall provide a line driver located at the source.

9. Twisted Pair Cabling for All Applications:

a. The Contractor shall ensure that the twists in each cable pair are preserved to within 0.5 inch of the termination. The cable jacket shall be removed only to the extent required to make the termination.
b. The Contractor shall ensure that the cable shields are continuous throughout, terminated, and grounded according to the manufacturer's recommendations.

E. Grounding Requirements:

1. Provide a minimum of #6 AWG conductor from the nearest electrical service ground bus or nearest telecommunications room ground bus bar to the A/V equipment racks and cabinets regardless of location. Size cable as required by the NEC.
2. Cables containing shields shall not have the shields grounded at conduits, boxes, racks, etc. Ground the shield only at the equipment end.
3. Audio cable shields for line-level signals shall be connected to the metal equipment chassis at both ends of the cable.
4. Audio cables connected to transformers shall have the cable shield connected to the transformer shield and transformer case ground.
5. The Contractor shall not connect cable shields together from differing cables.
6. XLR cable shields shall be connected to chassis ground.
7. Signal-grounded balanced shields are not acceptable and shall not be installed. All balanced shields shall be chassis grounded.

F. Rack and Cabinet Requirements:

1. Ground equipment racks/cabinets as noted within this specification section and Section 27 05 26 - Communications Grounding.
2. Provide one (1) RU of space between adjacent pieces of equipment with top and/or bottom vents, above the topmost piece of equipment, and below the bottommost piece of equipment. Provide a vented cover panel covering each rack space.
3. Terminate all speaker cabling on individual barrier strips for positive "+", negative "-", and shield. The shield barrier strip shall be grounded.
4. Provide a power conditioning surge arrestor in the rack for distribution of AC power from the wall receptacles indicated on the plans. The quantity of plugs shall be adequate so that no equipment in the rack shall require plugging into an AC source outside the rack.
5. Power sequencing shall be provided in the racks where shown on the drawings. All amplifiers located in the racks shall be sequenced "last on – first off". Power sequencers shall provide power conditioning and surge protection.

G. Video System Installation Requirements:

1. The Contractor shall confirm calculations for the optimal distance from the screen to the projector lens based on actual field conditions and submit to the Architect/Engineer for review and approval.
2. If the projector and screen are in a fixed position, the Contractor shall provide the appropriate lens for the throw distance.
3. Video display image shall fill screen area with native aspect ratio

H. Audio System Installation Requirements:

1. The Contractor shall perform calculations for the optimal speaker tap settings to reach the desired SPL level and coverage without overloading the amplifier(s).

a. At a minimum, the following calculations shall be used:

1) Add together all speaker taps that will be on a single channel of the amplifier. Multiply that total by 1.2, which will allow for a 20% future expansion. Multiply that number by 1.25 to ensure the amplifier never exceeds 75% of its total output. Utilize the final number to determine the minimum amplifier power requirements.
2) For direct coupled systems (low impedance), allow a minimum of 10 dB headroom before any distortion occurs at the amplifier input indicator when beginning gain stage tests are set up. Increase headroom as appropriate for high impact and clarity needs, typically exceeding 12 to 15 dB during continuous operation.

2. Connections of balanced to unbalanced equipment shall only be done through an active converter at the unbalanced side.
3. Connections of unbalanced to balanced equipment shall only be done through an active converter at the unbalanced side.
4. Connections from stereo balanced or unbalanced equipment to mono equipment of the same signal type shall only be done through a passive combiner.
5. Connections from mono balanced or unbalanced equipment to stereo equipment of the same signal type shall only be done through a passive divider.
6. The Contractor shall provide an isolation transformer for any balanced or unbalanced audio line that exhibits a hum, noise from EMI or RFI, power line noise, or ground loops.
7. The Contractor shall provide an active audio line driver for all balanced and unbalanced signals that exceed the distance limitations of the cabling.

I. Control System Installation Requirements:

1. The Contractor shall perform calculations for the required wire AWG size based on distance for system power for touch panels, keypads and other devices being powered. A minimum of a 15% overhead is required.

3.4 VIDEO SYSTEM TESTING AND CALIBRATION

A. All video equipment shall receive proper testing and configuration.

B. Color Space Optimization:

1. The Contractor shall set the color space of each source and display device to a uniform color space to optimize the switching speed and compatibility of a digital video system. Each device shall be set to an RGB or YCbCr color space depending on the systems primary function and compatibility of the devices.
2. If the primary function of the space is video and other digital media, the color space of each device shall be set to a YCbCr color space. If the primary function of the space is computer-based graphics and presentations, the color space of each device shall be set to an RGB color space.
3. Chroma subsampling shall be set to a consistent 4:4:4 or 4:2:2 across all devices. Set to 4:4:4 when all equipment is capable.
4. If all devices are not capable of displaying a certain color space, all devices shall be set to a common shared color space.

C. Extended Display Identification Data (EDID) Management:

1. The Contractor shall set the EDID management tables in capable equipment so all sources output the highest common EDID table of the displays (sinks).
2. For systems with capable matrix switches, the matrix shall dynamically adjust its EDID tables so any source will output the highest common EDID table of the displays (sinks) being outputted to.
3. If any source or Owner-furnished equipment (OFE) is not outputting properly, the Contractor shall provide and install an EDID Emulator and set it to the highest common EDID table of the displays (sinks) being outputted to.

D. Projectors, and receivers shall be tested and adjusted for proper signal sync, convergence, brightness, contrast, and color level. The Contractor shall adjust all other parameters necessary to achieve a proper video image.

E. All video source selections shall be tested and verified.

F. All projectors and displays shall have a minimum burn-in time of 96 hours prior to any adjustments are made and the completion of the project

G. All projectors and displays shall have their hue/tint and color/saturation calibrated with a video signal test generator and blue lens filter after a minimum warmup time of 20 minutes. Provide all calibrated settings results for each projector and display in the final documentation.

H. All projectors and displays shall have their brightness, contrast and sharpness calibrated with a video signal test generator after a minimum warmup time of 20 minutes. Provide all calibrated settings results for each projector and display in the final documentation.

I. All dynamic contrast functions shall be turned off.

J. The Contractor shall utilize a portable oscilloscope to set video output gain and peaking levels on all line drivers and receivers for analog signals.

1. The Contractor shall submit screen shots of the fixed signal.
2. Calibration by eye is not acceptable.

K. Full video calibration for all projectors and displays shall be provided with the following minimum requirements:

1. The Contractor shall utilize non-contact professional video calibration tools such as Sencore OTC1000-CM ColorPro Optical Tri-stimulus Colorimeter or Klein K-10 Tri-stimulus CIE Colorimeter, Sencore or Extron Video Generator and the latest version of ColorPro by CalMan software or pre-approved equal.
2. The projector or display shall have a minimum burn-in time of 96 hours prior to calibration.
3. The projector or display shall have a minimum warmup time of 20 minutes before calibration begins. All efforts shall be taken to allow the display to warm up for a minimum of 60 minutes to allow the luminance to fully stabilize.
4. The space shall be as dark as possible. The colorimeter's ambient light sensor filter shall be recalibrated every 30 minutes when outside ambient light is present to account for the changes in daylight levels.
5. All inputs utilized on the projector or display shall be calibrated using the appropriate video signal, aspect ratio and resolution. Submit results for each input as a separate report.

6. The projector or display shall be calibrated to the Rec. 709 HDTV color standard. White balance shall be calibrated as close as possible to the D65 point for both high IRE and low IRE levels.
7. The projector or display shall have its 3D Color Management calibrated.
8. The projector or display shall have its brightness and contrast adjusted both before and after the gamma is calibrated.
9. Gamma shall be calibrated to an average of 2.2. Gamma shall be verified after the calibration is completed and readjusted as necessary.
10. The projector or display shall have its hue/tint and color/saturation calibrated with a blue lens filter.
11. For calibrating 3D projectors and displays, the matching 3D glasses shall be secured to the front of the Colorimeter "looking" through the glasses for the 3D mode calibration only.
12. Record the full on/full off contrast ratio both before and after calibration. Provide these results in the final documentation.
13. The Contractor shall submit the final calibration results to the Architect/Engineer for approval and include the approved results in final documentation submitted to the Owner.
14. Calibration by eye is not acceptable.
15. Any setting that cannot be calibrated because the projector or display lacks the functions shall be noted in the final documentation.
16. For video wall applications, or where multiple projectors or displays that will share content are being used within a single space, all displays after calibration shall be adjusted to match the lowest performing projector or display so all projectors or displays are uniform. If a projector or display differs greatly from the other displays, that projector or display shall be replaced at no cost to the Owner and recalibrated.

3.5 AUDIO SYSTEM TESTING AND CALIBRATION:

A. This Contractor shall field adjust any surface-mounted or flown loudspeaker orientation to achieve the necessary coverage pattern to the intended listening plane. Loudspeakers always face listeners and minimize coverage on walls. The contractor shall be familiar with the named and specified nominal coverage angle of all speakers above its crossover point or for speech range, (500-4,000 Hz).

B. All speakers shall be tested for polarity prior to high work and a table of test results shall be included for A/E inspection. All loudspeakers shall be connected with uniform polarity, where a positive pressure pulse at the input corresponds to a positive driver excursion, and all drivers are uniform always moving in the same direction. Main speakers shall not be lifted or hoisted into high access areas without polarity testing.

C. The Contractor shall make incremental adjustments on the equipment output and input tolerances to achieve matching signal levels while preserving +10 dB minimum headroom and also unity gain. Insert all broadband or high pass filters first for system protection after review of manufacturers specifications for power and bandpass.

D. The Contractor shall utilize a Real Time Audio (RTA) spectrum analyzer with AES2 Broadband pink noise at a minimum of 1/3 octave, capable of providing detailed plots and reports.

1. The Contractor shall have and own a calibrated Type 1 or Type 1.5 microphone for all measurements, that is recently calibrated within the last year.
2. Calibration by ear, tablets and portable phones with integrated microphones are never acceptable. All software analysis tools require a calibrated interface and calibrated microphone. No Android devices are used for metering or calibration. IOS devices with calibrated software and interfaces may be used.

E. Provide high quality media with full bandpass program material for critical listening. MP3 or streaming audio is not acceptable. Testing shall illustrate WAV file quality playback for impact and clarity.

F. The Contractor shall provide graphic plots of the reference ambient noise for each space at the time of the calibration and submit with the calibration results. Test signal shall be 10dB minimum above ambient noise levels during testing.

G. The Contractor shall use a listener sitting height of four (4) feet ± 1" for rooms where the primary function will be sitting. The Contractor shall use a listener standing height of five feet three inches (5.25') ± 1" for rooms where the primary function will be standing

3.6 AUDIO SYSTEM PERFORMANCE REQUIREMENTS

A. The Contractor shall test and provide documents verifying all the following performance criteria. The Architect/Engineer shall be informed when the testing will take place and have the option to witness the testing and ask for additional testing for any reason.

B. The Contractor shall develop an Audio Coverage Uniformity Measurement Location (ACUML) plan for each required space based on the project floor plans, and submit to the Architect/Engineer for review and approval prior to testing. The plan shall represent the majority of the listening area and perimeter seating in the direct field of main speakers.

C. The tests shall be performed at the multiple locations defined on the ACUML plan representing the majority of the listening area(s). The Contractor shall indicate on the floor plan drawings where each test was performed, with the corresponding graphic plot, and submit with the final documentation for review and approval by the Architect/Engineer.

D. The test shall be taken with AES2 Broadband pink noise at a minimum of 15 dB above the reference ambient noise level, taking caution to not overdrive and clip any component of the system beyond 0.5% Total Harmonic Distortion (THD), with a maximum system THD of 1.0%.

E. The audio system(s) shall meet the following minimum requirements:

1. Achieve a total average SPL of 95 dBA in the majority of seating area with additional headroom. Use dBC for levels above 95 dBA.
2. The system's total SPL frequency response shall be within ± 4 dB from 500 Hz to 8000 Hz. All efforts shall be made to equalize the system's frequency response possible throughout the system's entire 100 Hz to 16kHz spectrum.
3. All vocal microphones shall have high and low pass filters set to minimize rumble, pop and hiss. The high pass filter cutoff frequency shall be set between 125 and 160 Hz, with a 12 dB per octave slope, minimum. The low pass filter cutoff frequency shall be set at 12,000 Hz, with a 6 dB per octave slope. Adjust frequency and slope as required to maximize performance for both male and female voices.
4. The subwoofer/speaker low/high crossover points shall be a Butterworth (BW) filter set at 80 Hz with a 24 dB per octave slope. This crossover point shall be adjusted as needed to achieve a smooth frequency response. The subwoofer high-pass filter shall be set to manufacturer's recommended half-power point or 40 Hz, whichever is higher.
5. Achieve a minimum RaSTI value of 0.63.

3.7 ASSISTED LISTENING SYSTEM (ALS) PERFORMANCE REQUIREMENTS

A. The Contractor shall verify that the ALS system(s) meet the following minimum performance requirements at the earphone or headset:

1. Reach a minimum total SPL of 75 dBA and no greater than 95 dBA, with a minimum of a 50dB dynamic range volume control.
2. Achieve a minimum signal-to-noise (S/N) ratio of 18dB. It is recommended to achieve a minimum signal-to-noise (S/N) ratio of 25dB to accommodate children.
3. Ensure the peak clipping levels do not exceed 18dB down from the peak input signal level.

B. Infrared (IR)-based systems shall provide IR coverage throughout the entire listening area.

1. The IR system's RF sub-carrier frequency shall operate at 95kHz, 250kHz, or 2.3MHz.

3.8 DSP-BASED AUDIO PROCESSOR PROGRAMMING

A. Full system programming shall be provided for the system. Programming shall be performed by a factory-trained and certified programmer or an employee of the equipment manufacturer.

B. DSP pathfile with initial settings shall be provided by the Contractor for review by the Architect/Engineer before installation.

C. The IP-based audio (IEEE AVB, Dante, etc.) and components shall be on a dedicated Virtual LAN (VLAN) for the A/V systems. These components shall be on a dedicated subnetwork of the VLAN. The Contractor shall coordinate these requirements with the Owner prior to installation.

D. A parametric EQ shall be provided after each crossover point or as approved in the DSP pathfile during shop submittal review. These shall be utilized to set the speaker output as defined in the Audio System Calibration section within this specification. These equalizers should not be made available to the user to adjust.

E. Levelers, compressors/limiters, duckers, gates, and delays shall be preset during testing and commissioning and are not available for user adjustment following commissioning.

1. Adjust delays for time of flight plus 8 to 10 ms, typical.

F. Provide each microphone input with high-pass filter, 5-band parametric EQ, auto-leveler and volume module. Provide line level inputs with high-pass filter, 3-band parametric EQ, compressor/limiter, and volume module.

G. Acoustic Echo Cancelation (AEC) shall be provided for each conference microphone input.

H. A broadband pink noise generator shall be provided with a selectable on/off control button within the DSP pathfile. The noise shall be routable through all processing EQs and speaker outputs during testing.

I. Provide volume meters with labeling for each input and each output.

J. Provide user control software to be installed on the Owner-provided and installed computer.

K. The Contractor shall utilize the latest version of the programming software.

L. The Contractor shall ensure that all components are updated to the latest firmware at the completion of the project.

3.9 DSP-BASED AUDIO PROCESSOR CONTROL SOFTWARE PROGRAMMING

A. Full system software programming shall be provided for the system. Programming shall be performed by a factory-trained and certified programmer or an employee of the equipment manufacturer.

B. The Contractor shall schedule a series of meetings with the Owner and Architect/Engineer to define and determine the exact page layout requirements prior to the final configuration of the audio system. An Owner sign-off of the final layouts shall be required.

C. The Contractor shall use the latest version of the software.

D. At a minimum, there shall be password-protected pages for zone combining, input/output volume control with meters, speaker output volume control with meters, signal routing, signal processing (EQ's, feedback suppression, etc.), and supervision/maintenance for all spaces and combined zones.

3.10 MULTIMEDIA CONTROL SYSTEM INTEGRATION AND PROGRAMMING

A. Programming and Integration for Control Systems:

1. Full system programming shall be provided for the system. Programming shall be performed by a factory trained and certified programmer or an employee of the equipment manufacturer.
2. The Contractor shall schedule a series of meetings with the Owner and Architect/Engineer to define and determine the exact integration requirements of the control system prior to the installation of the control system and components. An Owner sign-off of the final configuration shall be required.
3. This section only defines the minimum requirements. The programmer shall provide complete programming for a fully functional system.
4. The Contractor shall utilize the latest version of the programming software.
5. The Contractor shall ensure that all components are updated to the latest firmware at the completion of the project.
6. The IP-based control system and controlled components shall be on a dedicated Virtual LAN (VLAN) for the A/V systems. These components shall be on a dedicated subnetwork of the VLAN. The Contractor shall coordinate these requirements with the Owner prior to installation.
7. Integration and programming of the following pieces of equipment shall be provided, with the following minimum features and functions:

    a. All equipment shall include on/off control, except for equipment that must remain active for system functionality.
    b. Integration of HDCP (High-bandwidth Digital Content Protection) and DPCP (Display Port Content Protection) protected content and sources:

        1) No protected sources or content shall be allowed to be selected to route through non-protected devices and displays. A warning shall be displayed stating this information to the user.

c. Matrix Switcher Integration:

1) The Contractor shall provide bi-directional RS-232 or Ethernet control system connections and programming with the following minimum functions:

a) On/off control of the matrix switcher.
b) Allow for independent video routing of individual video inputs to any audio number of audio outputs.
c) Allow for audio follow video switcher mode.
d) Allow for independent audio routing of individual audio inputs to any audio number of audio outputs.
e) Provide source detection of video inputs.
f) HDCP (High-bandwidth Digital Content Protection) and DPCP (Display Port Content Protection) Protection:
g) For HDCP/DPCP - compliant sources; switcher shall only allow for routing of signals to HDCP compliant devices.
h) For HDCP/DPCP - complaint switchers; room combining/uncombining features shall allow for complete audio and /or video devices to be connected to the system using a simplified interface.

d. DSP Audio Processor Integration:

1) The Contractor shall provide bi-directional RS-232 or Ethernet control system connections and programming with the following minimum functions:

a) On/off control of all microphones.
b) Volume and mute control of all microphones and input sources.
c) Volume and mute control of all outputs.
d) Independent volume and mute control of all assisted listening outputs.
e) On/off and reset control of feedback eliminators and suppressors.
f) Advanced routing of audio signals.
g) Audio conferencing dialer keypad with speed dials.
h) Audio conferencing CallerID display on touchpanel and/or workstation.
i) Acoustic Echo Cancelation (AEC) control.

e. Audio Conference Integration:

1) Refer to DSP Audio Processor Integration for requirements.

f. Projector Integration:

1) The projectors shall be integrated into the A/V control system via bi-directional RS-232 or Ethernet control. Provide with the following minimum functions:

a) On/off control.
b) Lamp status feedback.
c) Filter status feedback.
d) Source switching control.
e) Audio volume control with mute.
f) Video mute.
g) Auto image.

g. Motorized Projection Screen Integration:

1) Screens shall be integrated into the A/V control system via contact closures OR bi-directional RS-232 or Ethernet control.

a) Up/down and stop control shall be provided.

h. Video Conference/Telepresence Integration:

1) The Contractor shall provide bi-directional RS-232 or Ethernet control system connections and programming with the following minimum functions:

a) Refer to DSP Audio Processor Integration for audio requirements.
b) Video conferencing dialer keypad with speed dials.
c) PTZ near end camera control.
d) PTZ far-end camera control with lockout control at the far end.
e) Multi-window control with multiple presets the contractor shall coordinate with the Owner and users on designed layouts. All system inputs shall be selectable for each window.

i. Pan/Tilt/Zoom (PTZ) Camera Integration:

1) The Contractor shall provide bi-directional RS-232 or Ethernet control system connections and programming with the following minimum functions:

a) Provide full pan, tilt, and zoom control.
b) Provide presets for fixed camera positions; contractor shall coordinate with the Owner for desired preset positions.

j. DVD/Blu-ray Integration:

1) The Contractor shall provide bi-directional RS-232 or Ethernet control system connections and programming with the following minimum functions:

a) Typical DVD/Blu-ray functions shall be provided.
b) Real-time metadata (if available).
c) Player status feedback.
d) Provide standard Blu-ray menu navigation Red, Green, Blue, and Yellow buttons, in that order, for touch panel-based systems.

k. Digital Audio Mixing Board Integration:

1) The Contractor shall provide bi-directional RS-232 or Ethernet control system connections and programming with the following minimum functions:

a) On/off control of device.
b) Master volume control.
c) Scene or preset recall.
d) This defines only the basic integration requirements. Coordinate with Owner on additional required functions.

B. Programming and Configuration for Touch Panels:

1. This section only defines the minimum requirements. The programmer shall provide complete touch panel layouts and programming for a fully functional system.
2. The Contractor shall schedule a series of meetings with the Owner and Architect/Engineer to define and determine the exact touch panel layout requirements prior to the purchase and installation of the touch panels. An Owner sign-off of the final layouts shall be required.

    a. Some tabs, pages, buttons and functions may be required to have a password at the Owner's discretion. This shall be coordinated during the meetings.

3. Contractor logos are not allowed on the touch panels. The Contractor shall coordinate with the Owner on desired logos to be displayed.
4. All programming for interface and control of all devices shown on the drawings shall be provided. Programming shall be provided for the following minimum functionality:

    a. The main screen shall include graphical buttons for the primary room functions.

        1) Upon selection of the graphical button, all the required functions shall be displayed on the screen. All required equipment shall turn on.

    b. Master System On/Off Control:

        1) When the master system off button is selected, all capable components within the system shall be turned off or placed on standby, except for equipment that is required to remain on for the system to function like the control system processor.

    c. The main screen shall include graphical buttons for the selection of individual source selections.

        1) Upon selection of the graphical button for a source selection, all functional controls for the pieces of equipment, as well as all status indicators, shall be provided in graphical format on the screen.
        2) Rooms with multiple independent outputs and displays shall have a source routing matrix to allow any input to be routed to any output.

    d. The main screen shall include a button for advanced equipment status and monitoring.

        1) Upon selection of the graphical button, the page shall display the on/off status of all monitored equipment, projector lamp hours, projector filter status, and all other features listed within this section that require monitoring

    e. The main screen shall include a button for microphone volume control and muting.

        1) Upon selection of the graphical button, it shall display the individual volume level of each wired and wireless microphone, with a mute for each.
        2) Rooms with multiple independent audio outputs and zones shall have a source routing matrix to allow any input to be routed to any output or zone.

    f. At all times, on all screens, a button shall be provided to return to the main screen, except for modal pop-ups.

g. A master volume control and mute shall be provided at all times on all screens, except for modal pop-ups.
h. A master video mute shall be provided at all times on all screens, except for modal pop-ups and audio-only functions.
i. A modal countdown timer shall be displayed showing the warmup and cooldown time of the projector. All functions shall be locked out while the projector is in cooldown mode.
j. All unused hard buttons shall not be labeled. A blank touch panel bezel shall be provided if no hard buttons are used.

5. Room scheduling touch panels shall provide the following minimum functions:

a. The touch panel shall display the room name, room number, date, and time at all times in a clearly visible font.
b. Display Microsoft Outlook calendar day view with the ability to look up other available rooms and book a room directly from the touch panel.
c. The border of the touch panel and/or touch panel buttons shall be green when the room is available and red when the room is in use.
d. A door chime icon shall be provided to sound a tone through the room's interior touch panel.

1) The interior touch panel shall have an Enter or Do Not Enter button that displays the answer on the exterior to the room touch panel or scheduling panel.

e. The interior touch panel shall have a Do Not Disturb (DND) button that disables or replaces the exterior scheduling touch panel's chime button.
f. All unused hard buttons shall not be labeled. A blank touch panel bezel shall be provided if no hard buttons are used.

C. Touch Panel Layout Principles, Considerations and Guidelines:

1. Icons and Buttons:

a. Icons shall not be used solely as a button but can be embedded in a button.
b. Icons shall appear to be flat and unpressable.
c. Status bars or text windows for time, date, room number, and similar information shall appear to be slightly depressed into the screen and appear to be unpressable.
d. Buttons shall appear to be pressable by appearing to come off the screen with beveled edges, lighting gradients, and shadows. When pressed, the button shall appear to be depressed into the screen.

1) Buttons that are momentary shall change color when pressed, appear to depress, then pop back up and revert to the original button color and state.
2) Buttons that are not momentary shall change color when pressed, appear to depress, remain depressed, then pop back up, and revert to the original button color and state when pressed again.

e. Buttons and icons shall appear to be lit from the top left corner of the screen.
f. Buttons shall be grouped together according to general function.
g. Button size shall be based on the ratio of Phi (1:1.618) and be sized appropriately based on the screen area and dpi (pixel pitch).

h. Maintain a minimum of 5 to 10 pixels between buttons on small to medium touch panels, and a minimum of 10 to 15 pixels between buttons on medium to large touch panels.
i. Telephone dialer keypads shall be based on the ITU-T E.161/ANSI TI-703 standard telephone layout and include the a-z letters below each appropriate number.
j. TV and radio tuner keypads shall be based on the ITU-T E.161/ANSI TI-703 standard telephone layout, except for the asterisk (*) being replaced by a dot (.) and the pound (#) being replaced with Enter.
k. IP-address keypads shall be based on the standard computer keyboard 10-key numeric keypad typically found on the right side of the keyboard.
l. Buttons such as Power, Play, Stop, Record, Rewind, Previous, Forward, Eject, Return, Next, Up, Down, Left, Right, Plus, Minus, etc. shall use standard industry symbols. Record shall always be a solid red circle.

2. Text and Fonts:

a. The Contractor shall use a standard sans-serif bold Arial or Calibri font style unless the Owner dictates otherwise.
b. Words shall have the first letter capitalized and the rest of the word lower case. No words shall be all capitals or all lower case. Follow standard grammatically correct sentence structure where the first word is capitalized and the rest of the sentence is lower case, followed by the appropriate punctuation mark with accurate syntax and correct verbs.
c. All font size in a single group or cluster shall maintain the same font size. Headers to a group or cluster shall have a slightly enlarged font size. and footers shall have a slightly smaller font size in comparison to the group font size to maintain a visual hierarchy.

3. Color Considerations:

a. Colors shall be selected so that, when converted to monochrome, all text, buttons, icons, groups, clusters, borders, etc. are clearly visible to accommodate all color blind or color-impaired individuals and ADA requirements.
b. Background colors shall be cool low saturation colors such as grey, blue, or green and their analogous colors, and be a gradient from top down or top left to bottom right.
c. Base colors shall be analogous to the background color but be of a higher saturation to stand out more clearly.
d. Button colors shall be analogous to the background color, stand out clearly from the base colors, and be of a higher saturation cool color, gray, or a low saturation black.
e. Icon, symbols, and text color shall be a neutral white or black, or a low saturation grey, and shall clearly stand out from the background or button it is placed on.
f. Buttons for modal acknowledgement, exit or return, or other modal action shall be a warm color such as red or yellow and their analogous colors.
g. Buttons, icons, symbols or text for emergency or urgent notifications shall be bright red.

4. Pages and Background:

a. Groups and clusters shall have clearly defined borders, with spacing between adjacent groups.

b. Modal pop-up windows or pages shall be required when a command requires user input before it is executed or when a button has multiple nested elements to control, such as microphone volumes, zone control, lighting and environment control, advanced system controls, etc.

1) The modal pop-up pages shall dim and grey out the background and buttons, overlay the main page, and have a clear back or exit button to bring the user back into the active page the user was on before the modal pop-up.
2) A model pop-up timer page shall appear when a projector is being turned on or off for the appropriate warmup or cooldown time. No additional commands shall be allowed during this time.
3) Model pop-ups shall not replace or completely overlay the background.

c. Images or pictures shall never be used as backgrounds to any page other than a master start page, if appropriate.

5. Medium to Large Format Touch Panel Layout Guideline Template:

a. IMAGEClient Logo - Static Window
b. A/V Source Selection - Static Window
c. Display Power, Screen Controls, Light Controls, Shade Controls, and other Environmental Controls - Static Window
d. Controls for Selected Source and Status or Home Page - Dynamic Window
e. Master Volume and Mute, Video Mute, and Microphone Volume - Static Window
f. Home Button - Static Window
g. Date, Time, and Room Number - Static Window
h. Master System Off - Static Window

6. Small Format Touch Panel Layout Guideline Template:

a. A/V Source Selection and Source Control and Status After Selection - Dynamic Window
b. Home Button - Static Window
c. Date, Time, and Room Number - Static Window
d. Master System Off - Static Window

7. Small Format Room Scheduling Touch Layout Guideline Template

a. Room Schedule and Scheduling Control - Dynamic Window
b. Chime Button - Static Window
c. Date, Time, and Room Number - Static Window

D. Programming and Configuration for Keypads:

1. This section only defines the minimum requirements. The programmer shall provide complete keypad layouts and programming for a fully functional system.
2. Full system programming and configuration shall be provided for the system. Programming and configuration shall be performed by a factory-trained and certified programmer or an employee of the equipment manufacturer.
3. This section only defines the minimum requirements. The programmer shall provide complete programming and configuration for a fully functional system.
4. The Contractor shall utilize the latest version of the programming and configuration software.
5. The Contractor shall ensure that all components are updated to the latest firmware at the completion of the project.

6. All programming and configuration for interface and control of all devices shown on the drawings shall be provided. Programming and configuration shall be provided for the following minimum functionality:

    a. A master system on and off button.

        1) All capable components within the system shall be turned off or placed on standby when the system is selected to be off.

    b. A master volume control up/down buttons or knob and a mute
    c. Source select or source toggle button(s).
    d. DVD control including, but not limited to, play, pause, stop, fast forward, rewind and chapter forward and reverse.
    e. Screen up and down control.
    f. TV channel up and down control.
    g. All unused hard buttons shall not be labeled.

E. A

3.11 SYSTEM COMMISSIONING

A. The Contractor shall notify the Architect/Engineer and Owner prior to conducting final system commissioning.

B. Contractors' tests shall be scheduled and documented in accordance with the commissioning requirements. Refer to Section 01 09 00 - General Commissioning.

C. System verification testing is part of the commissioning process. Verification testing shall be performed by the Contractor and witnessed and documented by the Commissioning Agent. Refer to Section 01 09 00 - General Commissioning for system verification tests and commissioning requirements.

D. Contractor shall demonstrate system performance of all equipment and adjust settings as directed by the Architect/Engineer and/or Owner.

    1. All system settings, software options and other parameters shall be simulated and tested by the Contractor

3.12 FIELD QUALITY CONTROL

A. Where these specifications require a product or assembly without the use of a brand or trade name, provide a product that meets the requirements of the specifications, as supplied and warranted by the system vendor. If the product or assembly is not available from the system vendor, provide product or assembly as recommended by the system vendor.

B. Periodic observations will be performed during construction to verify compliance with the requirements of the specifications. These services do not relieve the Contractor of responsibility for compliance with the Contract Documents.

3.13 FIELD SERVICES

A. The installer shall conduct a planning meeting with the Owner. The purpose of this meeting shall be to determine all equipment settings that are considered preferences (where proper system operation does not depend on the setting).

B. The installer shall include labor for all planning and all programming activities required to implement the Owner's preferences for equipment settings.

C. It shall be the responsibility of the Contractor/installer to provide a complete, functional system as described by the design documents. These responsibilities include:

1. Complete hardware setup, installation and wiring and software configuration.
2. Complete programming of software in accordance with the Owner's desires determined by the planning meeting.
3. Complete system diagnostic verification.
4. Complete system commissioning.

3.14 SYSTEM ACCEPTANCE

A. The Contractor shall submit for review a formal acceptance and system checkout procedure. The system checkout procedures shall include all system components and software. The Contractor shall perform the tests and settings and document all results.

3.15 SYSTEM DOCUMENTATION

A. Complete documentation shall be provided for the system. The documentation shall describe:

1. All operational parameters of the system.
2. Complete documentation of programming and features.
3. Complete operating instructions for all hardware and software.

B. The following sections shall be provided in the system documentation:

1. User Manual: A step-by-step guide and instructions detailing all system user functions.
2. Technical Manual: A comprehensive document providing all system operations, troubleshooting flowcharts, functional system layout, wiring diagrams, block diagrams and schematic diagrams.
3. Maintenance Manual: A comprehensive document on all aspects of physical maintenance of the systems, including cleaning of the displays, bulb changes, filter cleaning, filter changing and UPS maintenance.

3.16 SYSTEM TRAINING

A. All labor and materials required for on-site system training shall be provided. Training shall be conducted at the project site using the project equipment.

1. Provide two week's advanced notice of training to the Owner and Architect/Engineer.
2. The Architect/Engineer shall be presented with the option to attend the training.
3. Provide a training outline agenda describing the subject matter and the recommended audience for each topic.

B. At a minimum, the following training shall be conducted:

1. User Manual: A course detailing the system functions and operations that a daily user will encounter.
2. Technical User: Provide configuration training on all aspects of the system(s), including equipment and software.

3. Maintenance User: Provide training on all aspects of physical maintenance of the systems, including cleaning of the displays, bulb changes, filter cleaning and filter changing.

C. Minimum on-site training times shall be:

1. User Manual: One (1) day.
2. Technical user: One (1) day.
3. Maintenance user: Four (4) hours.

END OF SECTION

SECTION 28 05 00 - BASIC ELECTRONIC SAFETY AND SECURITY SYSTEM REQUIREMENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Basic Safety and Security System Requirements (herein referred to Security) specifically applicable to Division 28 sections, in addition to Division 1 - General Requirements.

B. All materials and installation methods shall conform to the applicable standards, guidelines and codes referenced herein and within each specification section.

1.2 SCOPE OF WORK

A. This Specification and the accompanying drawings govern the work involved in furnishing, installing, testing and placing into satisfactory operation the security systems as shown on the drawings and specified herein.

B. Each Contractor shall provide all new materials as indicated in the schedules on the drawings, and/or in these specifications, and all items required to make the portion of the security systems a finished and working system.

C. All work will be awarded under a single General Contract. The division of work listed below is for the Contractor's convenience and lists normal breakdown of the work.

D. Description of systems include but are not limited to the following:

1. Fire detection and alarm.
2. Low voltage security wiring (less than +120VAC) as specified and required for proper system control and communications.
3. All associated electrical backboxes, conduit, miscellaneous cabling, and power supplies required for proper system installation and operation as defined in the "Suggested Matrix of Scope Responsibility".
4. Firestopping of penetrations of fire-rated construction as described in Section 28 05 03.

1.3 OWNER FURNISHED PRODUCTS

A. Access control system

B. Existing Video Surveillance System.

1.4 WORK SEQUENCE

A. All construction work that will produce excessive noise levels and interference with normal building operations, as determined by the Owner, shall be scheduled with the Owner. It may be necessary to schedule such work during non-occupied hours. The Owner shall reserve the right to set policy as to when restricted construction hours will be required.

1.5 DIVISION OF WORK BETWEEN ELECTRICAL AND SECURITY CONTRACTORS

A. Division of work is the responsibility of the Prime Contractor. Any scope of work described in the contract document shall be sufficient to include said requirement in the project. The Prime Contractor shall be solely responsible for determining the appropriate subcontractor for the scope described. In no case shall the project be assessed an additional cost for scope that is described in the contract documents. The following division of responsibility is a guideline based on typical industry practice.

B. Definitions:

1. "Electrical Contractor" as referred to herein refers to the Contractors listed in Division 26 of this Specification.
2. "Electrical Contractor" shall also refer to the Contractor listed in Division 28 of this specification when the "Suggested Matrix of Scope Responsibility" indicates the work shall be provided by the EC. Refer to the Contract Documents for the "Suggested Matrix of Scope Responsibility".
3. "Security Contractor" as referred to herein refers to the Contractors listed in Division 28 of this Specification.
4. Low Voltage Security Wiring: The wiring (less than 120VAC) associated with the Security Systems, used for analog and/or digital signals between equipment.

C. General:

1. The purpose of these Specifications is to outline typical Electrical and Security Contractor's work responsibilities as related to security systems including back boxes, conduit, power wiring and low voltage security wiring. The prime contractor is responsible for all divisions of work.
2. The exact wiring requirements for much of the equipment cannot be determined until the systems have been purchased and submittals are approved. Therefore, only known wiring, conduits, raceways, and electrical power as related to such items are shown on the Security Drawings. Other wiring, conduits, raceways, junction boxes, and electrical power not shown on the Security Drawings but required for the successful operation of the systems shall be the responsibility of the Security Contractor and included in the Contractor's bid.
3. Where the Electrical Contractor is required to install conduit, conduit sleeves, and/or power connections in support of Security systems, the final installation shall not begin until a coordination meeting between the Electrical Contractor and the Security Contractor has been convened to determine the exact location and requirements of the installation.
4. Where the Electrical Contractor is required to install cable tray that will contain Low Voltage Security Wiring, the installation shall not begin until the Security Contractor has completed a coordination review of the cable tray shop drawing.
5. This Contractor shall establish Electrical and Security utility elevations prior to fabrication and installation. The Security Contractor shall cooperate with the Electrical Contractor and the determined elevations in accordance with the guidelines below. This Contractor shall coordinate utility elevations with other trades. When a conflict arises, priority shall be as follows:

    a. Lighting Fixtures
    b. Gravity Flow Piping, including Steam and Condensate
    c. Sheet Metal
    d. Electrical Busduct
    e. Cable Trays, including 12" access space

f. Sprinkler Piping and other Piping
g. Conduit and Wireway
h. Open Cabling

D. Electrical Contractor's Responsibility:

1. Assumes all responsibility for all required conduit and power connections when shown on the "Suggested Matrix of Scope Responsibility" to be provided by the Electrical Contractor.
2. Assumes all responsibility for providing and installing cable tray.
3. Responsible for Security Systems grounding and bonding.
4. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other Contractors to determine a viable layout.

E. Security Contractor's Responsibility:

1. Assumes all responsibility for the low voltage security wiring of all systems, including cable support where open cable is specified.
2. Assumes all responsibility for all required backboxes, conduit and power connections not specifically shown as being provided by the Electrical Contractor on the "Suggested Matrix of Scope Responsibility."
3. Assumes all responsibility for providing and installing all ladder rack and other cable management hardware (as defined herein).
4. Responsible for providing the Electrical Contractor with the required grounding lugs or other hardware for each piece of security equipment which is required to be bonded to the telecommunications bonding system.
5. This Contractor is responsible for coordination of utilities with all other Contractors. If any field coordination conflicts are found, the Contractor shall coordinate with other contractors to determine a viable layout.

1.6 COORDINATION DRAWINGS

A. Definitions:

1. Coordination Drawings: A compilation of the pertinent layout and system drawings that show the sizes and locations, including elevations, of system components and required access areas to ensure that no two objects will occupy the same space.

a. Mechanical trades shall include, but are not limited to, mechanical equipment, ductwork, fire protection systems, plumbing piping, medical gas systems, hydronic piping, steam and steam condensate piping, and any item that may impact coordination with other disciplines.
b. Electrical trades shall include, but are not limited to, electrical equipment, conduit 1.5" and larger, conduit racks, cable trays, pull boxes, transformers, raceway, busway, lighting, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
c. Technology trades shall include, but are not limited to, technology equipment, racks, conduit 1.5" and larger, conduit racks, cable trays, ladder rack, pull boxes, raceway, ceiling-mounted devices, and any item that may impact coordination with other disciplines.
d. Maintenance clearances and code-required dedicated space shall be included.
e. The coordination drawings shall include all underground, underfloor, in-floor, in chase, and vertical trade items.

2. Spaces with open/cloud ceiling architecture shall indicate the overhead utilities and locate equipment as required to maintain clearance above lights. The intent for the installation is to maintain a maximum allowable vertical clearance and an organized/clean manner in the horizontal. Notify Architect/Engineer of the maximum clearance which can be maintained. Failure to comply will result in modifications with no cost to Owner.

    a. In cloud ceiling architecture, when open cabling/wire and/or cable tray crosses gaps between ceiling clouds and/or walls, cabling is to transition to conduits to span the gaps in order to conceal cabling from below.

3. The contractors shall use the coordination process to identify the proper sequence of installation of all utilities above ceilings and in other congested areas, to ensure an orderly and coordinated end result, and to provide adequate access for service and maintenance.

B. Participation:

1. The contractors and subcontractors responsible for work defined above shall participate in the coordination drawing process.
2. One contractor shall be designated as the Coordinating Contractor for purposes of preparing a complete set of composite electronic CAD coordination drawings that include all applicable trades, and for coordinating the activities related to this process. The Coordinating Contractor for this project shall be the Mechanical Contractor.

    a. The Coordinating Contractor shall utilize personnel familiar with requirements of this project and skilled as draftspersons/CAD operators, competent to prepare the required coordination drawings.

3. Electronic CAD drawings shall be submitted to the Coordinating Contractor for addition of work by other trades. IMEG will provide electronic file copies of applicable drawings for contractor's use if the contractor signs and returns an "Electronic File Transfer" waiver provided by IMEG. IMEG will not consider blatant reproductions of original file copies an acceptable alternative for coordination drawings.

C. Drawing Requirements:

1. The file format and file naming convention shall be coordinated with and agreed to by all contractors participating in the coordination process and the Owner.

    a. Scale of drawings:

        1) General plans: 1/4 Inch = 1 '-0" (minimum).
        2) Mechanical, electrical, communication rooms, and including the surrounding areas within 10 feet: 1/2 Inch = 1'-0" (minimum).
        3) Shafts and risers: 1/2 Inch = 1'-0" (minimum).
        4) Sections of shafts and mechanical and electrical equipment rooms: 1/4 Inch = 1 '-0" (minimum).
        5) Sections of congested areas: 1/2 Inch = 1'-0" (minimum).

2. Ductwork layout drawings shall be the baseline system for other components. Ductwork layout drawings shall be modified to accommodate other components as the coordination process progresses.
3. There may be more drawings required for risers, top and bottom levels of mechanical rooms, and shafts.

4. The minimum quantity of drawings will be established at the first coordination meeting and sent to the Architect/Engineer for review. Additional drawings may be required if other areas of congestion are discovered during the coordination process.

D. General:

1. Coordination drawing files shall be made available to the Architect/Engineer and Owner's Representative. The Architect/Engineer will only review identified conflicts and give an opinion, but will not perform as a coordinator.
2. A plotted set of coordination drawings shall be available at the project site.
3. Coordination drawings are not shop drawings and shall not be submitted as such.
4. The contract drawings are schematic in nature and do not show every fitting and appurtenance for each utility. Each contractor is expected to have included in the bid sufficient fittings, material, and labor to allow for adjustments in routing of utilities made necessary by the coordination process and to provide a complete and functional system.
5. The contractors will not be allowed additional costs or time extensions due to participation in the coordination process.
6. The contractors will not be allowed additional costs or time extensions for additional fittings, reroutings or changes of duct size, that are essentially equivalent sizes to those shown on the drawings and determined necessary through the coordination process.
7. The Architect/Engineer reserves the right to determine space priority of equipment in the event of spatial conflicts or interference between equipment, piping, conduit, ducts, and equipment provided by the trades.
8. Changes to the contract documents that are necessary for systems installation and coordination shall be brought to the attention of the Architect/Engineer.
9. Access panels shall preferably occur only in gypsum board walls or plaster ceilings where indicated on the drawings.

    a. Access to mechanical, electrical, technology, and other items located above the ceiling shall be through accessible lay-in ceiling tile areas.
    b. Potential layout changes shall be made to avoid additional access panels.
    c. Additional access panels shall not be allowed without written approval from the Architect/Engineer at the coordination drawing stage.
    d. Providing additional access panels shall be considered after other alternatives are reviewed and discarded by the Architect/Engineer and the Owner's Representative.
    e. When additional access panels are required, they shall be provided without additional cost to the Owner.

10. Complete the coordination drawing process and obtain signoff of the drawings by all contractors prior to installing any of the components.
11. Conflicts that result after the coordination drawings are signed off shall be the responsibility of the contractor or subcontractor who did not properly identify their work requirements, or installed their work without proper coordination.
12. Updated coordination drawings that reflect as-built conditions may be used as record documents.

1.7 QUALITY ASSURANCE

A. Qualifications:

1. Only products of reputable manufacturers as determined by the Architect/Engineer will be acceptable.

2. Each Contractor and their subcontractors shall employ only workers who are skilled in their respective trades and fully trained. All workers involved in the installation, termination, testing, and placing into operation electronic security devices shall be individually trained by the manufacturer.
3. The Contractor shall be experienced in all aspects of this work and shall be required to demonstrate direct experience on recent systems of similar type and size.
4. The Contractor shall own and maintain tools and equipment necessary for successful installation and testing of electronic security devices and have personnel adequately trained in the use of such tools and equipment.
5. A resume of qualification shall be submitted with the Contractor's bid indicating the following:

    a. A list of recently completed projects of similar type and size with contact names and telephone numbers for each.

6. Conform to all requirements of the City of Crystal Lake, IL Codes, Laws, Ordinances and other regulations having jurisdiction.
7. Conform to all published standards of McHenry County College .
8. In the event there are no local codes having jurisdiction over this job, the current issue of the National Electrical Code shall be followed.
9. If there is a discrepancy between the codes and regulations having jurisdiction over this installation, and these specifications, Architect/Engineer shall determine the method or equipment used.
10. If the Contractor notes, at the time of bidding, that any parts of the drawings or specifications do not comply with the codes or regulations, Contractor shall inform the Architect/Engineer in writing, requesting a clarification. If there is insufficient time to follow this procedure, Contractor shall submit with the proposal a separate price to make the system comply with the codes and regulations.
11. Verify the installation environment prior to purchasing or installing any cable. Cable installed in a plenum environment shall be appropriately rated. Bring all discrepancies between the contract documents and installation conditions to the attention of the Architect/Engineer prior to purchase or installation.
12. All changes to the system made after the letting of the contract, in order to comply with the applicable codes or the requirements of the Inspector, shall be made by the Contractor without cost to the Owner.

B. Permits, Fees, Taxes, Inspections:

1. Procure all applicable permits and licenses.
2. Abide by all applicable laws, regulations, ordinances, and other rules of the State or Political Subdivision wherein the work is done, or as required by any duly constituted public authority.
3. Pay all applicable charges for such permits or licenses that may be required.
4. Pay all applicable fees and taxes imposed by the State, Municipal and/or other regulatory bodies.
5. Pay all charges arising out of required inspections due to codes, permits, licenses or as otherwise may be required by an authorized body.
6. Pay all charges arising out of required contract document reviews associated with the project and as initiated by the Owner or authorized independent agency/consultant.
7. All equipment, and materials shall be as approved or listed by the following: (Unless approval or listing is not applicable to an item by all acceptable manufacturers.)

    a. Factory Mutual
    b. Underwriters' Laboratories, Inc.

C. Examination of Drawings:

1. The drawings for the Security Systems work are diagrammatic, intended to convey the scope of the work and to indicate the general arrangements and locations of equipment etc., and the approximate sizes of equipment.
2. Contractor shall determine the exact locations of equipment and the exact routing of cabling to best fit the layout of the job. Scaling of the drawings will not be sufficient or accurate for determining this layout. Where a specific route is required, such route will be indicated on the drawings.
3. Where job conditions require reasonable changes in indicated arrangements and locations, such changes shall be made by the Contractor at no additional cost to the Owner.
4. If an item is either shown on the drawings, called for in the specifications or required for proper operation of the system, it shall be considered sufficient for including same in this contract.
5. The determination of quantities of material and equipment required shall be made by the Contractor from the drawings. Schedules on the drawings and in the specifications are completed as an aid to the Contractor but where discrepancies arise, the greater number shall govern.
6. Where words "provide", "install", or "furnish" are used on the drawings or in the specifications, it shall be taken to mean, to furnish, install and terminate completely ready for operation, the items mentioned.

D. Electronic Media/Files:

1. Construction drawings for this project have been prepared utilizing Revit.
2. Contractors and Subcontractors may request electronic media files of the contract drawings and/or copies of the specifications. Specifications will be provided in PDF format.
3. Upon request for electronic media, the Contractor shall complete and return a signed "Electronic File Transmittal" form provided by IMEG. If the information requested includes floor plans prepared by others, the Contractor will be responsible for obtaining approval from the appropriate Design Professional for use of that part of the document.
4. The electronic contract documents can be used for preparation of shop drawings and as-built drawings only. The information may not be used in whole or in part for any other project.
5. The drawings prepared by IMEG for bidding purposes may not be used directly for ductwork layout drawings or coordination drawings.
6. The use of these CAD documents by the Contractor does not relieve them from their responsibility for coordination of work with other trades and verification of space available for the installation.
7. The information is provided to expedite the project and assist the Contractor with no guarantee by IMEG as to the accuracy or correctness of the information provided. IMEG accepts no responsibility or liability for the Contractor's use of these documents.

E. Field Measurements:

1. Before ordering any materials, this Contractor shall verify all pertinent dimensions at the job site and be responsible for their accuracy.

1.8 WEB-BASED PROJECT SOFTWARE

A. The General Contractor shall provide a web-based project software site for the purpose of hosting and managing project communication and documentation until completion of the warranty phase.

B. The web-based project software shall include, at a minimum, the following features: construction schedule, submittals, RFIs, ASIs, construction change directives, change orders, drawing management, specification management, payment applications, contract modifications, meeting minutes, construction progress photos.

C. Provide web-based project software user licenses for use by the Architect/Engineer. Access will be provided from the start of the project through the completion of the warranty phase.

D. At project completion, provide digital archive of entire project in format that is readable by common desktop software applications in format acceptable to Architect/Engineer. Provide data in locked format to prevent further changes.

1.9 SUBMITTALS

A. Submittals shall be required for the following items, and for additional items where required elsewhere in the specifications or on the drawings.

1. Submittals list:

Referenced Specification Section	Submittal Item
28 05 03	Through-Penetration Firestopping

B. General Submittal Procedures: In addition to the provisions of Division 1, the following are required:

1. Transmittal: Each transmittal shall include the following:

a. Date
b. Project title and number
c. Contractor's name and address
d. Division of work (e.g., plumbing, heating, ventilating, etc.)
e. Description of items submitted and relevant specification number
f. Notations of deviations from the contract documents
g. Other pertinent data

2. Submittal Cover Sheet: Each submittal shall include a cover sheet containing:

a. Date
b. Project title and number
c. Architect/Engineer
d. Contractor and subcontractors' names and addresses
e. Supplier and manufacturer's names and addresses
f. Division of work (e.g., plumbing, heating, ventilating, etc.)
g. Description of item submitted (using project nomenclature) and relevant specification number
h. Notations of deviations from the contract documents

i. Other pertinent data
j. Provide space for Contractor's review stamps

3. Composition:

   a. Submittals shall be submitted using specification sections and the project nomenclature for each item.
   b. Individual submittal packages shall be prepared for items in each specification section. All items within a single specification section shall be packaged together where possible. An individual submittal may contain items from multiple specifications sections if the items are intimately linked (e.g., pumps and motors).
   c. All sets shall contain an index of the items enclosed with a general topic description on the cover.

4. Content: Submittals shall include all fabrication, erection, layout, and setting drawings; manufacturers' standard drawings; schedules; descriptive literature, catalogs and brochures; performance and test data; wiring and control diagrams; dimensions; shipping and operating weights; shipping splits; service clearances; and all other drawings and descriptive data of materials of construction as may be required to show that the materials, equipment or systems and the location thereof conform to the requirements of the contract documents.
5. Contractor's Approval Stamp:

   a. The Contractor shall thoroughly review and approve all shop drawings before submitting them to the Architect/Engineer. The Contractor shall stamp, date and sign each submittal certifying it has been reviewed.
   b. Unstamped submittals will be rejected.
   c. The Contractor's review shall include, but not be limited to, verification of the following:

      1) Only approved manufacturers are used.
      2) Addenda items have been incorporated.
      3) Catalog numbers and options match those specified.
      4) Performance data matches that specified.
      5) Electrical characteristics and loads match those specified.
      6) Equipment connection locations, sizes, capacities, etc. have been coordinated with other affected trades.
      7) Dimensions and service clearances are suitable for the intended location.
      8) Equipment dimensions are coordinated with support steel, housekeeping pads, openings, etc.
      9) Constructability issues are resolved (e.g., weights and dimensions are suitable for getting the item into the building and into place, sinks fit into countertops, etc.).

   d. The Contractor shall review, stamp and approve all subcontractors' submittals as described above.
   e. The Contractor's approval stamp is required on all submittals. Approval will indicate the Contractor's review of all material and a complete understanding of exactly what is to be furnished. Contractor shall clearly mark all deviations from the contract documents on all submittals. If deviations are not marked by the Contractor, then the item shall be required to meet all drawing and specification requirements.

6. Submittal Identification and Markings:

    a. The Contractor shall clearly mark each item with the same nomenclature applied on the drawings or in the specifications.
    b. The Contractor shall clearly indicate the size, finish, material, etc.
    c. Where more than one model is shown on a manufacturer's sheet, the Contractor shall clearly indicate exactly which item and which data is intended.
    d. All marks and identifications on the submittals shall be unambiguous.

7. Schedule submittals to expedite the project. Coordinate submission of related items.
8. Identify variations from the contract documents and product or system limitations that may be detrimental to the successful performance of the completed work.
9. Reproduction of contract documents alone is not acceptable for submittals.
10. Incomplete submittals will be rejected without review. Partial submittals will only be reviewed with prior approval from the Architect/Engineer.
11. Submittals not required by the contract documents may be returned without review.
12. The Architect/Engineer's responsibility shall be to review one set of shop drawing submittals for each product. If the first submittal is incomplete or does not comply with the drawings and/or specifications, the Contractor shall be responsible to bear the cost for the Architect/Engineer to recheck and handle the additional shop drawing submittals.
13. Submittals shall be reviewed and approved by the Architect/Engineer **before** releasing any equipment for manufacture or shipment.
14. Contractor's responsibility for errors, omissions or deviation from the contract documents in submittals is not relieved by the Architect/Engineer's approval.
15. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required, and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.

    a. Allow at least two weeks for Architect's/Engineer's review and processing of each submittal.

16. Architect/Engineer reserves the right to withhold action on a submittal which, in the Architect/Engineer's opinion, requires coordination with other submittals until related submittals are received. The Architect/Engineer will notify the Contractor, in writing, when they exercise this right.

C. Electronic Submittal Procedures:

1. Distribution: Email submittals as attachments to all parties designated by the Architect/Engineer, unless a web-based submittal program is used.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. Submittal file name: 28 XX XX.description.YYYYMMDD
    b. Transmittal file name: 28 XX XX.description.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.

1.10 CHANGE ORDERS

A. A detailed material and labor takeoff shall be prepared for each change order, along with labor rates and markup percentages. Change orders shall be broken down by sheet or associated individual line item indicated in the change associated narrative, whichever provides the most detailed breakdown. Change orders with inadequate breakdown will be rejected.

B. Itemized pricing with unit cost shall be provided from all distributors and associated subcontractors.

C. Change order work shall not proceed until authorized.

1.11 EQUIPMENT SUPPLIERS' INSPECTION

A. The following equipment shall not be placed in operation until a representative of the manufacturer has inspected the installation and certified that the equipment is properly installed and that the equipment is ready for operation:

1. Firestopping, including mechanical firestop systems.

1.12 PRODUCT DELIVERY, STORAGE, HANDLING & MAINTENANCE

A. Exercise care in transporting and handling to prevent damage to fixtures, equipment and materials.

B. Store materials on the site to prevent damage.

C. Keep fixtures, equipment and materials clean, dry and free from harmful conditions.

1.13 NETWORK / INTERNET CONNECTED EQUIPMENT

A. These specifications may require certain equipment or systems to have network, Internet and/or remote access capability ("Network Capability"). Any requirement for Network Capability shall be interpreted only as a functional capability and is not to be construed as authority to connect or enable any Network Capability. Network Capability may only be connected or enabled with the express written consent of the Owner.

1.14 WARRANTY

A. At a minimum, provide a one (1) year warranty for all equipment, materials, and workmanship. Individual specifications sections within Division 28 may require additional warranty requirements for specific equipment or systems.

B. The warranty period for the entire installation described in this Division of the specifications shall commence on the date of substantial completion unless a whole or partial system or any separate piece of equipment or component is put into use for the benefit of any party other than the installing contractor with prior written authorization. In this instance, the warranty period shall commence on the date when such whole system, partial system or separate piece of equipment or component is placed in operation and accepted in writing by the Owner or their representative.

C. Warranty requirements shall extend to correction, without cost to the final user, of all work and/or equipment found to be defective or nonconforming to the contract documents. The Contractor shall bear the cost of correcting all damage resulting from such defects or nonconformance with contract documents exclusive of repairs required as a result of improper maintenance or operation, or of normal wear as determined by the Architect/Engineer.

1.15 INSURANCE

A. Contractor shall maintain insurance coverage as set forth in Division 0 of these specifications.

1.16 MATERIAL SUBSTITUTION

A. Where several manufacturers' names are given, the first named manufacturer constitutes the basis for job design and establishes the equipment quality required.

B. Equivalent equipment manufactured by the other named manufacturers may be used. Contractor shall ensure that all items submitted by these other manufacturers meets all requirements of the drawings and specifications and fits in the allocated space. When using other listed manufacturers, the Contractor shall assume responsibility for any and all modifications necessary (including, but not limited to structural supports, electrical connections and rough-in, and regulatory agency approval, etc.) and coordinate such with other contractors. The Architect/Engineer shall make the final determination of whether a product is equivalent.

C. Any material, article or equipment of other unnamed manufacturers which will adequately perform the services and duties imposed by the design and is of a quality equal to or better than the material, article or equipment identified by the drawings and specifications may be used if approval is secured in writing from the Architect/Engineer via addendum. The Contractor bears full responsibility for the unnamed manufacturers' equipment adequately meeting the intent of design. The Architect/Engineer may reject manufacturer at time of shop drawing submittal. The Contractor assumes all costs incurred by other trades on the project as a result of changes necessary to accommodate the offered material, equipment or installation method.

D. Should this Contractor be unable to secure approval from the Architect/Engineer for other unnamed manufacturers as outlined above, this Contractor may list voluntary add or deduct prices for alternate materials on the bid form. These items will not be used in determining the low bidder. Should a voluntary alternate material be accepted, This Contractor shall assume all costs that may be incurred as a result of using the offered material, article or equipment necessitating extra expense on This Contractor or on the part of other Contractors whose work is affected.

PART 2 - PRODUCTS

2.1 Refer to individual sections.

PART 3 - EXECUTION

3.1 JOBSITE SAFETY

A. Neither the professional activities of the Architect/Engineer, nor the presence of the Architect/Engineer or the employees and subconsultants at a construction site, shall relieve the Contractor and any other entity of their obligations, duties and responsibilities including, but not limited to, construction means, methods, sequence, techniques or procedures necessary for performing, superintending or coordinating all portions of the work of construction in accordance with the contract documents and any health or safety precautions required by any regulatory agencies. The Architect/Engineer and personnel have no authority to exercise any control over any construction contractor or other entity or their employees in connection with their work or any health or safety precautions. The Contractor is solely responsible for jobsite safety. The Architect/Engineer and the Architect/Engineer's consultants shall be indemnified and shall be made additional insureds under the Contractor's general liability insurance policy.

3.2 GENERAL INSTALLATION REQUIREMENTS

A. Installation of all conduit and cabling shall comply with Sections 26 05 33 and 26 05 13. Additional conduit requirements described within this Division shall be supplemental to the requirement described in Section 26 05 33. Should conflicts exist between the two Divisions the more stringent (more expensive material and labor) condition shall prevail until bidding addendum or construction clarification or RFI can be submitted and responded to. In no case shall the Contractor carry the least stringent condition in the pricing.

B. It is the Contractor's responsibility to survey the site and include all necessary costs to perform the installation as specified.

C. The Contractor shall be responsible for identifying and reporting to the Architect/Engineer any existing conditions including but not limited to damage to walls, flooring, ceiling and furnishings prior to start of work. All damage to interior spaces caused by this Contractor shall be repaired at this Contractor's expense to pre-existing conditions, including final colors and finishes.

D. All cables and devices installed in damp or wet locations, including any underground or underslab location, shall be listed as suitable for use in such environments. Follow manufacturer's recommended installation practices for installing cables and devices in damp or wet locations. Any cable or device that fails as a result of being installed in a damp or wet location shall be replaced at the Contractor's expense.

3.3 FIELD QUALITY CONTROL

A. General:

1. Refer to specific Division 28 sections for further requirements.
2. The Contractor shall conduct all tests required and applicable to the work both during and after construction of the work.

3. The necessary instruments and materials required to conduct or make the tests shall be supplied by the Contractor who shall also supply competent personnel for making the tests who has been schooled in the proper testing techniques.
4. In the event the results obtained in the tests are not satisfactory, This Contractor shall make such adjustments, replacements and changes as are necessary and shall then repeat the test or tests which disclose faulty or defective work or equipment, and shall make such additional tests as the Architect/Engineer or code enforcing agency deems necessary.

B. Protection of cable from foreign materials:

1. It is the Contractor's responsibility to provide adequate physical protection to prevent foreign material application or contact with any cable type. Foreign material is defined as any material that would negatively impact the validity of the manufacturer's performance warranty. This includes, but is not limited, to overspray of paint (accidental or otherwise), drywall compound, or any other surface chemical, liquid or compound that could come in contact with the cable, cable jacket or cable termination components.
2. Application of foreign materials of any kind on any cable, cable jacket or cable termination component will not be accepted. It shall be the Contractor's responsibility to replace any component containing overspray, in its entirety, at no additional cost to the project. Cleaning of the cables with harsh chemicals is not allowed. This requirement is regardless of the PASS/FAIL test results of the cable containing overspray. Should the manufacturer and warrantor of the structured cabling system desire to physically inspect the installed condition and certify the validity of the structured cabling system (via a signed and dated statement by an authorized representative of the structured cabling manufacturer), the Owner may, at their sole discretion, agree to accept said warranty in lieu of having the affected cables replaced. In the case of plenum cabling, in addition to the statement from the manufacturer, the Contractor shall also present to the Owner a letter from the local Authority Having Jurisdiction stating that they consider the plenum rating of the cable to be intact and acceptable.

3.4 PROJECT CLOSEOUT

A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Final Jobsite Observation:

1. The Architect/Engineer will not perform a final jobsite observation until the project is ready. This is not dictated by schedule, but rather by completeness of the project.
2. Refer to the end of Section 27 05 00 for a "STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION."
3. The Contractor shall sign this form and return it to the Architect/Engineer so that the final observation can commence.

C. Before final payment will be authorized, this Contractor must have completed the following:

1. Submitted operation and maintenance manuals to the Architect/Engineer for review.
2. Submitted bound copies of approved shop drawings.
3. Record documents including edited drawings and specifications accurately reflecting field conditions, **inclusive** of all project revisions, change orders, and modifications.

4. Submitted a report stating the instructions given to the Owner's representative complete with the number of hours spent in the instruction. The report shall bear the signature of an authorized agent of This Contractor and shall be signed by the Owner's representative as having received the instructions.
5. Submitted testing reports for all systems requiring final testing as described herein.
6. Submitted start-up reports on all equipment requiring a factory installation inspection and/or start.
7. Provide spare parts, maintenance, and extra materials in quantities specified in individual specification sections. Deliver to project site; submit receipt to Architect/Engineer prior to final payment being approved.

3.5 OPERATION AND MAINTENANCE MANUALS

A. General:

1. Provide an electronic copy of the O&M manuals as described below for Architect/Engineer's review and approval. The electronic copy shall be corrected as required to address the Architect/Engineer's comments. Once corrected, electronic copies and paper copies shall be distributed as directed by the Architect/Engineer.
2. Approved O&M manuals shall be completed and in the Owner's possession prior to Owner's acceptance and at least 10 days prior to instruction of operating personnel.

B. Electronic Submittal Procedures:

1. Distribution: Email the O&M manual as attachments to all parties designated by the Architect/Engineer.
2. Transmittals: Each submittal shall include an individual electronic letter of transmittal.
3. Format: Electronic submittals shall be in PDF format only. Scanned copies, in PDF format, of paper originals are acceptable. Submittals that are not legible will be rejected. Do not set any permission restrictions on files; protected, locked, or secured documents will be rejected.
4. File Names: Electronic submittal file names shall include the relevant specification section number followed by a description of the item submitted, as follows. Where possible, include the transmittal as the first page of the PDF instead of using multiple electronic files.

    a. O&M file name: O&M.div28.contractor.YYYYMMDD
    b. Transmittal file name: O&Mtransmittal.div28.contractor.YYYYMMDD

5. File Size: Files shall be transmitted via a pre-approved method. Larger files may require an alternative transfer method, which shall also be pre-approved.
6. Provide the Owner with an approved copy of the O&M manual on compact discs (CD), digital video discs (DVD), or flash drives with a permanently affixed label, printed with the title "Operation and Maintenance Instructions", title of the project and subject matter of disc/flash drive when multiple disc/flash drives are required.
7. All text shall be searchable.
8. Bookmarks shall be used, dividing information first by specification section, then systems, major equipment and finally individual items. All bookmark titles shall include the nomenclature used in the construction documents and shall be an active link to the first page of the section being referenced.

C. Operation and Maintenance Instructions shall include:

1. Title Page: Include title page with project title, Architect, Engineer, Contractor, all subcontractors, and major equipment suppliers, with addresses, telephone numbers, website addresses, email addresses, and point of contacts. Website URLs and email addresses shall be active links in the electronic submittal.
2. Table of Contents: Include a table of contents describing specification section, systems, major equipment, and individual items.
3. Copies of all final approved shop drawings and submittals. Include Architect's/Engineer's shop drawing review comments. Insert the individual shop drawing directly after the Operation and Maintenance information for the item(s) in the review form.
4. Copy of final approved test and balance reports.
5. Copies of all factory inspections and/or equipment startup reports.
6. Copies of warranties.
7. Schematic wiring diagrams of the equipment that have been updated for field conditions. Field wiring shall have label numbers to match drawings.
8. Dimensional drawings of equipment.
9. Capacities and utility consumption of equipment.
10. Detailed parts lists with lists of suppliers.
11. Operating procedures for each system.
12. Maintenance schedule and procedures. Include a chart listing maintenance requirements and frequency.
13. Repair procedures for major components.
14. List of lubricants in all equipment and recommended frequency of lubrication.
15. Instruction books, cards, and manuals furnished with the equipment.

3.6 INSTRUCTING THE OWNER'S REPRESENTATIVE

A. Adequately instruct the Owner's designated representative or representatives in the maintenance, care, and operation of the complete systems installed under this contract.

B. Provide verbal and written instructions to the Owner's representative or representatives by FACTORY PERSONNEL in the care, maintenance, and operation of the equipment and systems.

C. The Owner has the option to make a video recording of all instructions. Coordinate schedule of instructions to facilitate this recording.

D. Notify the Architect/Engineer of the time and place for the verbal instructions to be given to the Owner's representative so a representative can be present if desired.

E. Refer to the individual specification sections for minimum hours of instruction time for each system.

F. Operating Instructions:

1. The Contractor is responsible for all instructions to the Owner and/or Owner's operating staff on the security systems.
2. If the Contractor does not have Engineers and/or Technicians on staff who can adequately provide the required instructions on system operation, performance, troubleshooting, care, and maintenance, the Contractor shall include in the bid an adequate amount to reimburse the Owner for the Architect/Engineer to perform these services.

3.7 SYSTEM STARTING AND ADJUSTING

A. The security systems included in the construction documents are to be complete and operating systems. The Architect/Engineer will make periodic job site observations during the construction period. The system start-up, testing, configuration, and satisfactory system performance is the responsibility of the Contractor. This shall include all calibration and adjustments of electrical equipment controls, equipment settings, software configuration, troubleshooting and verification of software, and final adjustments that may be required.

B. All operating conditions and control sequences shall be simulated and tested during the start-up period.

C. The Contractor, subcontractors, and equipment suppliers are expected to have skilled technicians to ensure that the system performs as designed. If the Architect/Engineer is requested to visit the job site for the purpose of trouble shooting, assisting in the satisfactory start-up, obtaining satisfactory equipment operation, resolving installation and/or workmanship problems, equipment substitution issues or unsatisfactory system performance, including call backs during the warranty period through no fault of the design; the Contractor shall reimburse the Owner on a time and material basis for services rendered at the Architect/Engineer's standard hourly rates in effect at the time the services are requested. The Contractor shall be responsible for making payment to the Owner for services required that are product, installation or workmanship related. Payment is due within 30 days after services are rendered.

3.8 RECORD DOCUMENTS

A. Refer to the Division 1 Section: PROJECT CLOSEOUT for requirements. The following paragraphs supplement the requirements of Division 1.

B. Mark specifications to indicate approved substitutions, change orders, and actual equipment and materials used.

C. This Contractor shall maintain at the job site, a separate and complete set of Security Drawings which shall be clearly and permanently marked and noted in complete detail any changes made to the location and arrangement of equipment or made to the Technology Systems and wiring as a result of building construction conditions or as a result of instructions from the Architect or Engineer. All Change Orders, RFI responses, Clarifications and other supplemental instructions shall be marked on the documents. Record documents that merely reference the existence of the above items are not acceptable. Should This Contractor fail to complete Record Documents as required by this contract, This Contractor shall reimburse Architect/Engineer for all costs to develop record documents that comply with this requirement. Reimbursement shall be made at the Architect/Engineer's hourly rates in effect at the time of work.

D. Record actual routing of all conduits sized 2" or larger.

E. The above record of changes shall be made available for the Architect and Engineer's examination during any regular work time.

F. Upon completion of the job, and before final payment is made, This Contractor shall give the marked-up drawings to the Architect/Engineer.

3.9 ADJUST AND CLEAN

A. Contractor shall thoroughly clean all equipment and systems prior to the Owner's final acceptance of the project.

B. Contractor shall clean all foreign paint, grease, oil, dirt, labels, stickers, and other foreign material from equipment.

C. Contractor shall remove all rubbish, debris, etc., accumulated during the Contractor's operations from the premises.

STATEMENT INDICATING READINESS FOR FINAL JOBSITE OBSERVATION

To assist the contractor in a timely close-out of the project, it is crucial that the final jobsite observation is not conducted prior to the project being ready. The contractor is required to review the completion status of the project at the time the observation is scheduled. This review, and the subsequent submittal of this form to the Architect/Engineer, shall indicate the contractor's agreement that the area of the project being requested for final observation is ready as defined below. The following list represents the degree of completeness required prior to requesting a final observation:

1. All cabling pathways (cable tray, ladder rack, conduit sleeves, etc.) are installed, and all cabling has been pulled through them.
2. All mechanical firestop products are installed, and all other penetrations have been sealed.
3. All CCTV cameras, mounts, cabling, and all headend equipment are installed, programmed, and operational.

Prime Contractor: _____ By: _____

Requested Observation Date _____ Today's Date: _____

Contractor shall sign this readiness statement and transmit it to Architect/Engineer at least 10 days prior to the requested date of observation.

It is understood that if the Architect/Engineer finds that the project is not complete as defined above and that the final jobsite observation cannot be completed on the requested date, the Architect/Engineer will return to the site at a later date. All additional visits to the site for the purposes of completing the final observation will be billed T&M to the Contractor at our standard hourly rates, including travel expenses, or the contractor's retainage may be deducted for the same amount.

END OF SECTION

SECTION 28 05 03 - THROUGH PENETRATION FIRESTOPPING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Through-Penetration Firestopping.

1.2 QUALITY ASSURANCE

A. Manufacturer: Company specializing in manufacturing products specified in this Section.

B. Installer: Individuals performing work shall be certified by the manufacturer of the system selected for installation.

1.3 REFERENCES

A. UL 263 - Fire Tests of Building Construction and Materials

B. UL 723 - Surface Burning Characteristics of Building Materials

C. ANSI/UL 1479 - Fire Tests of Through Penetration Firestops

D. UL 2079 Tests for Fire Resistance of Building Joint Systems

E. UL Fire Resistance Directory Through Penetration Firestop Systems (XHEZ)

F. Intertek / Warnock Hersey - Directory of Listed Products

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials

H. ASTM E814 - Standard Test Method for Fire Tests of Through-Penetration Firestops

I. HCAI - Health Care Access and Information (California)

J. 2015 International Building Code

K. NFPA 5000 - Building Construction Safety Code

1.4 SUBMITTALS

A. Submit under provisions of Section 28 05 00.

B. Submit Firestopping Installers Certification for all installers on the project.

C. Shop Drawings: Submit for each condition requiring firestopping. Include descriptions of the specific penetrating item, actual wall/floor construction, manufacturer's installation instructions, and UL or Intertek / Warnock Hersey Assembly number.

D. Through-Penetration Firestop System Schedule: Indicate locations of each through-penetration firestop system, along with the following information:

1. Types of penetrating items.
2. Types of constructions penetrated, including fire-resistance ratings and, where applicable, thicknesses of construction penetrated.
3. Through-penetration firestop systems for each location identified by firestop design designation of qualified testing and inspecting agency.
4. F ratings for each firestop system.

E. Maintain a notebook on the job site at all times that contains copies of approved submittals for all through penetration firestopping to be installed. Notebook shall be made available to the Authority Having Jurisdiction at their request and turned over to the Owner at the end of construction as part of the O&M Manuals.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Store, protect and handle products on site. Accept material on site in factory containers and packing. Inspect for damage. Protect from deterioration or damage due to moisture, temperature changes, contaminants, or other causes. Follow manufacturer's instructions for storage.

B. Install material prior to expiration of product shelf life.

1.6 PERFORMANCE REQUIREMENTS

A. General: For penetrations through the following fire-resistance-rated constructions, including both empty openings and openings containing penetrating items, provide through-penetration firestop systems that are produced and installed to resist spread of fire according to requirements indicated, resist passage of smoke and other gases, and maintain original fire-resistance rating of construction penetrated.

1. Fire-resistance-rated walls including fire partitions, fire barriers, and smoke barriers.
2. Fire-resistance-rated horizontal assemblies including floors, floor/ceiling assemblies, and ceiling membranes of roof/ceiling assemblies.

B. Rated Systems: Provide through-penetration firestop systems with the following ratings determined per UL 1479:

1. F-Rated Systems: Provide through-penetration firestop systems with F-ratings indicated, but not less than that equaling or exceeding fire-resistance rating of constructions penetrated.

2. L-Rated Systems: Provide through-penetration firestop systems with L-ratings of not more than 5.0 CFM/sq.ft. at both ambient temperature and 400F for smoke barriers.

C. For through-penetration firestop systems exposed to light, traffic, moisture, or physical damage, provide products that, after curing, do not deteriorate when exposed to these conditions both during and after construction.

D. For through-penetration firestop systems exposed to view, provide products with flame-spread and smoke-developed indexes of less than 25 and 450, respectively, as determined per ASTM E 84.

E. For through-penetration firestop systems in air plenums, provide products with flame-spread and smoke-developed indexes of less than 25 and 50, respectively, as determined per ASTM E 84.

1.7 MEETINGS

A. Pre-installation meeting: A pre-installation meeting shall be scheduled and shall include the Construction Manager, General Contractor, all Subcontractors associated with the installation of systems penetrating fire barriers, Firestopping Manufacturer's Representative, and the Owner.

1. Review foreseeable methods related to firestopping work.
2. Tour representative areas where firestopping is to be installed; inspect and discuss each type of condition and each type of substrate that will be encountered, and preparation to be performed by other trades.

1.8 WARRANTY

A. Provide one year warranty on parts and labor.

B. Warranty shall cover repair or replacement of firestop systems which fail in joint adhesion, cohesion, abrasion resistance, weather resistance, extrusion resistance, migration resistance, stain resistance, general durability, or appear to deteriorate in any manner not clearly specified by the manufacturer as an inherent quality of the material.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Products: Subject to compliance with requirements, provide one of the through-penetration firestop systems indicated for each application that are produced by one of the following manufacturers. All firestopping systems installed shall be provided by a single manufacturer.

1. 3M; Fire Protection Products Division
2. Hilti, Inc.
3. RectorSeal Corporation, Metacaulk
4. Tremco; Sealant/Weatherproofing Division
5. Johns-Manville
6. Specified Technologies Inc. (S.T.I.)
7. Spec Seal Firestop Products
8. AD Firebarrier Protection Systems
9. Wiremold/Legrand: FlameStopper
10. Dow Corning Corp.
11. Fire Trak Corp.
12. International Protective Coating Corp.
13. HoldRite

2.2 THROUGH PENETRATION FIRESTOP SYSTEMS

A. Provide materials and systems classified by or listed by Intertek / Warnock Hersey to provide firestopping equal to time rating of construction being penetrated.

B. All firestopping materials shall be free of asbestos, lead, PCB's, and other materials that would require hazardous waste removal.

C. Firestopping shall be flexible to allow for normal penetrating item movement due to expansion and contraction.

D. Firestopping systems for plumbing and wet pipe sprinkler piping shall be moisture resistant.

E. Provide firestopping systems capable of supporting floor loads where systems are exposed to possible floor loading or traffic.

F. Provide firestopping systems allowing continuous insulation for all insulated pipes.

G. Provide firestopping systems classified by UL or listed by Intertek / Warnock Hersey for penetrations through all fire rated construction. Firestopping systems shall be selected from the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory Category XHEZ based on substrate construction and penetrating item size and material and shall fall within the range of numbers listed:

1. Combustible Framed Floors and Chase Walls - 1 or 2 Hour Rated:

   a. F Rating = Floor/Wall Rating
   b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	FC 0000-0999*
Metallic Pipe or Conduit	FC 1000-1999
Non-Metallic Pipe or Conduit	FC 2000-2999
Electrical Cables	FC 3000-3999
Cable Trays	FC 4000-4999
Insulated Pipes	FC 5000-5999
Bus Duct and Misc. Electrical	FC 6000-6999
Duct without Damper and Misc. Mechanical	FC 7000-7999
Multiple Penetrations	FC 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

2. Non-Combustible Framed Walls - 1 or 2 Hour Rated:

   a. F Rating = Wall Rating
   b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	WL 0000-0999*
Metallic Pipe or Conduit	WL 1000-1999
Non-Metallic Pipe or Conduit	WL 2000-2999
Electrical Cables	WL 3000-3999
Cable Trays	WL 4000-4999
Insulated Pipes	WL 5000-5999
Bus Duct and Misc. Electrical	WL 6000-6999
Duct without Damper and Misc. Mechanical	WL 7000-7999
Multiple Penetrations	WL 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

3. Concrete or Masonry Floors and Walls - 1 or 2 Hour Rated:

a. F Rating = Wall/Floor Rating
b. L Rating = Penetrations in Smoke Barriers

Penetrating Item	UL System No.
No Penetrating Item	CAJ 0000-0999*
Metallic Pipe or Conduit	CAJ 1000-1999
Non-Metallic Pipe or Conduit	CAJ 2000-2999
Electrical Cables	CAJ 3000-3999
Cable Trays	CAJ 4000-4999
Insulated Pipes	CAJ 5000-5999
Bus Duct and Misc. Electrical	CAJ 6000-6999
Duct without Damper and Misc. Mechanical	CAJ 7000-7999
Multiple Penetrations	CAJ 8000-8999

*Alternate method of firestopping is patching opening to match original rated construction.

H. Any opening in walls or floors not covered by the listed series of numbers shall be coordinated with the firestopping manufacturer.

I. Any openings in floors or walls not described in the UL or listed by Intertek / Warnock Hersey Fire Resistance Directory, or outlined in manufacturer's information shall be sealed in a manner agreed upon by the Firestopping Manufacturer, Owner, and the Authority Having Jurisdiction.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Ensure all surfaces that contact seal materials are free of dirt, dust, grease, oil, rust, or loose materials. Clean and repair surfaces as required. Remove laitance and form-release agents from concrete.

B. Ensure substrate and penetrating items have been permanently installed prior to installing firestopping systems. Ensure penetrating items have been properly spaced and have proper clearance prior to installing firestopping systems.

C. Surfaces to which sealing materials are to be installed must meet the selected UL or Intertek / Warnock Hersey system substrate criteria.

D. Prime substrates where recommended in writing by through-penetration firestop system manufacturer. Confine primer to area of bond.

3.2 INSTALLATION

A. In existing construction, provide firestopping of openings prior to and after installation of penetrating items. Remove any existing coatings on surfaces prior to firestopping installation. Temporary firestopping shall consist of packing openings with fire resistant mineral wool for the full thickness of substrate, or an alternate method approved by the Authority Having Jurisdiction. All openings shall be temporarily firestopped immediately upon their installation and shall remain so until the permanent UL or listed by Intertek / Warnock Hersey listed firestopping system is installed.

B. Install penetration seal materials in accordance with printed instructions of the UL or Intertek / Warnock Hersey Fire Resistance Directory and with the manufacturer's printed application instructions.

C. Install dams as required to properly contain firestopping materials within openings and as required to achieve required fire resistance rating. Remove combustible damming after appropriate curing.

3.3 CLEANING AND PROTECTING

A. Clean excess fill materials adjacent to openings as Work progresses by methods and with cleaning materials that are approved in writing by through-penetration firestop system manufacturers and that do not cause damage.

B. Provide final protection and maintain conditions during and after installation that ensure that through-penetration firestop systems are without damage or deterioration at time of Substantial Completion. If, despite such protection, damage or deterioration occurs, remove damaged or deteriorated through-penetration firestop systems immediately and install new materials to produce systems complying with specified requirements.

3.4 INSPECTION

A. All penetrations shall be inspected by the manufacturer's representative to ensure proper installation.

B. Access to firestop systems shall be maintained for examination by the Authority Having Jurisdiction at their request.

C. Proceed with enclosing through-penetration firestop system with other construction only after inspection reports are issued and firestop installations comply with requirements.

D. The Contractor shall allow for visual destructive review of 5% of installed firestop systems (minimum of one) to prove compliance with specifications and manufacturer's instructions and details. Destructive system removal shall be performed by the Contractor and witnessed by the Architect/Engineer and manufacturer's factory representative. The Architect/Engineer shall have sole discretion of which firestop system installations will be reviewed. The Contractor is responsible for all costs associated with this requirement including labor and material for removing and replacing the installed firestop system. If any firestop system is found to not be installed per manufacturer's specific instructions and details, all firestop systems are subject to destructive review and replacement at the Architect/Engineer's discretion and the Contractor's expense.

END OF SECTION

SECTION 28 31 00 - FIRE ALARM AND DETECTION SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Fire alarm and detection systems.

1.2 RELATED WORK

A. Section 26 05 53 - Electrical Identification: Refer to electrical identification for color and identification labeling requirements.

1.3 QUALITY ASSURANCE

A. Manufacturer: Company specializing in smoke detection and fire alarm systems with ten years' experience.

B. Installer: A factory-authorized Electrical or Security Contractor licensed with the State and local jurisdiction with five years' experience in the design, installation, and maintenance of fire alarm systems by that manufacturer.

C. Qualifications: The person managing/overseeing the preparation of shop drawings and the system installation/programming/testing shall be trained and certified by the system manufacturer and shall be Fire Alarm Certified by NICET, minimum Level 2. This person's name and certification number shall appear on the start-up and testing reports.

1.4 REFERENCES

A. ASME A17.1 - Safety Code for Elevators and Escalators

B. NFPA 70 - National Electrical Code (NEC)

C. NFPA 72 - National Fire Alarm and Signaling Code

D. NFPA 101 - Life Safety Code

E. UL 2017 - General Purpose Signaling Devices and Systems

F. UL 217 / 268 - Standard for Smoke Alarms / Smoke Detectors for Fire Alarm Systems

1.5 SUBMITTALS

A. Submit shop drawings and product data under provisions of Section 26 05 00 and as noted below.

1. Failure to comply with all the following and all the provisions in 26 05 00 will result in the shop drawing submittal being rejected without review.
2. Failure to submit the fire alarm without all requirements fulfilled in a single comprehensive submittal will be grounds to require a complete resubmittal.

B. Provide product catalog data sheets as shop drawings.

1. Provide a product catalog data sheet for each item shown on the Electrical Symbols List and for each piece of equipment that is not shown on the drawings, but required for the operation of the system.
2. Where a particular Electrical Symbols List item has one or more variations (such as those denoted by subscripts, etc.) a separate additional product catalog data sheet shall be provided for each variation that requires a different part number to be ordered. The corresponding Electrical Symbols List symbol shall be shown on the top of each sheet.
3. Where multiple items and options are shown on one data sheet, the part number and options of the item to be used shall be clearly denoted.

C. Submit CAD Floor Plans as Shop Drawings:

1. The complete layout of the entire system, device addresses, auxiliary equipment, and manufacturer's wiring requirements shall be shown.

D. About all fire alarm circuits, provide the following: manufacturer's wiring requirements (manufacturer, type, size, etc.) and voltage drop calculations.

E. Provide installation and maintenance manuals under provisions of Section 26 05 00.

F. Submit manufacturer's certificate that system meets or exceeds specified requirements.

G. Provide information on the system batteries as follows: total battery capacity, total capacity used by all devices on this project, total available future capacity.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Section 26 05 00.

B. Store and protect products under provisions of Section 26 05 00.

1.7 REGULATORY REQUIREMENTS

A. System: UL or FM Global listed.

B. Conform to requirements of NFPA 101.

C. Conform to requirements of Americans with Disabilities Act (ADA).

D. Conform to UL 864 Fire Alarm, UL 1076 Security, UL2017 General Signaling, and UL 2572 Mass Notification Communications.

1.8 SYSTEM DESCRIPTION

A. Performance Statement: This specification section and the accompanying fire alarm specific design documents describe the minimum material quality, required features, and operational requirements of the system. These documents do not convey every wire that must be installed and every equipment connection that must be made. Based on the equipment described and the performance required of the system, as presented in these documents, the Vendor and the Contractor are solely responsible for determining all wiring, programming and miscellaneous equipment required for a complete and operational system.

B. This section of the specifications includes the furnishing, installation and connection of the microprocessor controlled, intelligent reporting, fire alarm equipment required to form a complete coordinated system that is ready for operation. It shall include, but is not limited to, alarm initiating devices, control panels, auxiliary control devices, annunciators, power supplies, and wiring as indicated on the drawings and specified herein.

C. Extending the Existing Fire Alarm System: Provide all items, components, devices, hardware, software, programming, expansion components, conduit, wiring etc. needed to extend fire alarm system. This includes, but is not limited to, additional power supplies, initiating devices and circuits, signaling devices and circuits, monitoring devices and circuits, auxiliary control and related devices such as, door holders and their control, smoke damper control, fan shutdown, etc. The existing fire alarm system shall be extended such that the existing fire alarm system's functionality, integrity and annunciation shall be equivalent to pre-construction conditions, unless noted otherwise. The functionality and integrity shall be maintained during construction. The entire system shall be able to be completely reset from any single reset location point. The entire system shall be annunciated at any annunciation location.

D. Extending the Existing Notifier NFS2-3030 Fire Alarm System: The existing control panel shall remain and shall be operational throughout construction. The system shall only be disabled to make new connections and to modify the programming. A fire watch shall be provided for all areas affected during outages. All system outages must be scheduled with the Owner at least one week prior. Individual devices may be disabled as needed based on construction activities to reduce the potential for false alarms, but all devices must be operational when the Contractor is not physically on site. New initiating devices may be connected to the existing signaling line circuits where capacity is available. Provide additional signaling line circuits as needed based on existing and new device quantity, including replacement of existing panel components. Provide new notification circuits to serve the new devices, including all necessary power supplies, amplifiers, batteries, and 120-volt input circuits. All new devices shall be programmed to provide the same sequence of operation as the existing devices of the same type, unless noted otherwise.

E. Fire Alarm System: NFPA 72; Automatic and manual fire alarm system, non-coded, analog-addressable with automatic sensitivity control of certain detectors, multiplexed signal transmission.

F. Drawings: Only device layouts and some equipment have been shown on the contract drawings. Wiring and additional equipment to make a complete and functioning system has not been shown, but shall be submitted on the shop drawings.

1.9 PROJECT RECORD DOCUMENTS

A. Submit documents under the provisions of Section 26 05 00.

B. Include location of end-of-line devices.

C. Provide a CAD drawing of each area of the building (minimum scale of 1/16" = 1'-0") showing each device on the project and its address. The devices shall be shown in their installed location and shall be labeled with the same nomenclature as is used in the fire alarm panel programming.

1.10 OPERATION AND MAINTENANCE DATA

A. Submit data under provisions of Section 26 05 00.

B. Include operating instructions, and maintenance and repair procedures.

C. Include results of testing of all devices and functions.

D. Include manufacturer's representative's letter stating that system is operational.

E. Include the CAD floor plan drawings.

F. Include shop drawings as reviewed by the Architect/Engineer and the local Authority Having Jurisdiction.

1.11 WARRANTY

A. Provide one (1) year warranty on all materials and labor from Date of Substantial Completion.

B. Warranty requirements shall include furnishing and installing all software upgrades issued by the manufacturer during the one (1) year warranty period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Notifier by Honeywell

2.2 FIRE ALARM PATHWAY CLASS AND SURVIVABILITY LEVEL

A. Pathway Class:

1. Pathway Class B: Circuits NOT capable of transmitting an alarm beyond the location of the fault condition. Wiring of outgoing and return conductors is permitted to be run in the same conduit or cable.

B. Pathway Survivability Level:

1. Pathway Survivability Level 0: Circuits have no requirements for pathway survivability beyond the requirements of the code.

2.3 SIGNALING LINE CIRCUIT DEVICES

A. Combination Devices: Subscripts identify combination type devices when applicable. Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.

B. Signal Line Device(s):

1. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Sequence of operation as follows:

1) DH = Door Hold Release

C. FA-120; Smoke Detectors:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

    a. Device types are as follows:

        1) Blank = Photoelectric

2. (BLANK) Analog Photoelectric Type Sensor: Shall use the photoelectric principle to measure smoke density and send data to the control panel, representing the analog level of smoke density measured.
3. Each smoke detector shall connect directly to an SLC loop, unless listed as stand-alone.
4. Each smoke detector shall be mounted, as shown on the drawings, on a twist-lock base with all mounting hardware provided. Provide a two-piece head/base design.
5. Each smoke detector shall have a manual switching means to set the internal identifying code (address) of that detector, which the control panel shall use to identify its address with the type of sensor connected.

D. FA-122; Duct Smoke Detectors, Sampling Tube Type:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

    a. Duct-type smoke detectors shall use the same analog photoelectric sensor technology, with the same features specified for standard smoke detectors, except with additional features as specified below.
    b. Provide sampling tubes and mounting hardware to match the duct to which it is attached. Where the detector housing is larger than the duct height, Contractor shall fabricate a mounting bracket for the detector and attach it according to the fire alarm manufacturer's recommendations.
    c. Provide a remote alarm LED indicator device (FA-242) if detector is not visible from a floor-standing position. If detector is located above a suspended ceiling, mount remote indicator in ceiling directly below detector with a white single-gang faceplate labeled: Duct Smoke Detector.

E. FA-130; Manual Pull Stations:

1. Manual pull station, addressable, double action with plastic break rod, reset key lock, semi-flush mount, red high abuse plastic or cast metal construction with white lettering. Provided with all necessary mounting hardware.
2. Manual stations shall connect directly to an SLC loop. Stations shall provide address setting means using rotary decimal or DIP switches.

F. FA-161; Addressable Control Module:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

    a. Device types are as follows:

        1) Blank = Refer to Plans
        2) DH = Door Hold Open

2. Relay that represents an addressable control point used primarily for the control of auxiliary devices as indicated on the drawings. Contractor to provide additional child relay(s), as required, rated for the electrical load being controlled (Contractor to match voltage, amps, etc.).
3. Relay shall connect directly to an SLC loop and receive power from a separate 24 VDC circuit.
4. The relay shall be mounted in an enclosure located in an accessible service location as near as possible to the device(s) being controlled, unless otherwise shown on the drawings. All mounting hardware shall be provided.
5. The relay shall supply 24 VDC power to the device(s) being controlled, unless otherwise indicated on the drawings.

2.4 NOTIFICATION APPLIANCE DEVICES

A. Combination Devices: Subscripts identify combination type devices when applicable. Contractor shall provide the combination device or provide multiple device(s) to meet the functionality when the manufacturer does not offer the required functionality with a single device.

B. Notification Appliance Device(s):

1. Subscripts: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. Device types as follows:

1) W = Weather Proof
2) Candela Ratings:

a) ## = 15 Candela; 30 Candela; 75 Candela; 110 Candela; 177 Candela

C. Notification Device(s):

1. Wall Mounted: Red housing with white lettering or pictogram.
2. Ceiling Mounted: Red housing with white lettering or pictogram.

D. FA-200; Visual Alarm Devices:

1. Wall or ceiling mounted, refer to plans.
2. High intensity (Candela rating as scheduled on the drawings) xenon strobe or equivalent under a lens. Candela rating shall be visible from exterior of the device.
3. The maximum pulse duration shall be 0.2 seconds with a maximum duty cycle of 40%. The flash rate shall be 1 Hz. Where more than two strobes are visible from any one location, the fire alarm visual devices shall be synchronized.
4. Device, housing, and backbox shall be UL listed for fire alarm/emergency applications.

E. Audio Horn Alarm Devices:

1. Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.
2. Wall or ceiling mounted, refer to plans.
3. Sound Rating: 85 dB at 10 feet. Sound levels for alarm signals shall not exceed 120 dBA in the occupied area.

4. Device shall be capable of a high and low dB level setting. Unless noted otherwise, the device shall be set to the high setting at building completion.
5. Device, housing, and backbox shall be UL listed for fire alarm/emergency applications.

F. FA-211; Combination Audio Horn and Visual Alarm Device:

1. Wall or ceiling mounted, refer to plans.
2. Combine audio and visual components into a single device. Refer to the corresponding paragraphs above for requirements of each component.
3. (W) Weatherproof Audio/Visual Notification Device: Electronic horn with high intensity strobe, square housing, 75 Candela, suitable for wet locations. Provide with weatherproof back box.

a. Mounting: Semi-flush wall.
b. Conduit shall not be exposed.

2.5 NOTIFICATION APPLIANCE CIRCUIT PANEL (NAC)

A. As shown on the plans or as a Contractor's option if not shown, furnish and install NAC extender panels as necessary to provide remote power supply for notification appliance circuits (NAC). Contractor shall indicate quantity and locations of each NAC on the shop drawing submittals.

B. Each NAC shall be self-contained remote power supply with batteries, and battery charger mounted in a surface lockable cabinet. Battery capacity shall be sufficient for operation for 24 hours in a non-alarm state followed by alarm for 15 minutes, plus 25% spare capacity for future devices. Each NAC provides a minimum of up to 4 outputs, 2A continuous, or 6A full load total capacity.

C. Power for each NAC shall be from a local 120 VAC emergency circuit. Provide two #12 conductors and one #12 ground in 1/2" conduit to each NAC from a dedicated 20A/1P circuit breaker with a red handle and a manufacturer's standard handle lock-on device. Coordinate panel and circuit number with the Architect/Engineer prior to installation.

D. NAC extender panels may be installed only in locations coordinated with the Architect/Engineer.

2.6 ANNUNCIATION

A. FA-242; Fire Alarm Remote Indicator and Test Switch:

1. Red LED type.
2. Key switch test selector.
3. Mounts flush to a single gang box.

2.7 CONNECTIONS TO AUXILIARY DEVICES PROVIDED BY OTHERS

A. FA-271; Door Hold Device:

1. Subscript: Subscripts are used to define the device type, installation, and identify the device with a specific sequence of operation.

a. DH - Door Hold Open

2. (BLANK) Integral with door hardware, 120 VAC. Furnished and installed by GC. Fire alarm control and power connections by EC.

2.8 WIRING

A. Fire alarm wiring/cabling shall be furnished and installed by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes. Cabling shall be UL listed and labeled as complying with the Electrical Code for power-limited fire alarm signal service.

B. Fire Alarm Cable:

1. Manufacturers:

a. Comtran Corp.
b. Helix/HiTemp Cables, Inc.
c. Rockbestos-Suprenant Cable Corp.
d. West Penn Wire/CDT.
e. Radix.

PART 3 - EXECUTION

3.1 SEQUENCES OF FIRE ALARM OPERATION

A. Maintain existing sequence of operation.

B. AHU and Mechanical Fan Shutdown Sequence:

1. The fire alarm system shall utilize addressable relays to de-energize all AHU motor controllers and mechanical fans. Coordinate other requirements with HVAC installer.
2. The fire alarm system shall directly shut down the AHU or mechanical fan through the local HVAC control device (i.e., variable frequency drive or motor starter).
3. Where a facility has more than one AHU or mechanical fan, each shall be shutdown individually based on input from initiation devices in the area served by the unit or designated for each air distribution system.

C. Door Holder Release Sequence:

1. The fire alarm system shall utilize an addressable relay to open the power connection to integral and magnetic door holders.
2. The fire alarm system shall utilize an addressable relay to open the 'hold' switch circuitry, integral to the power door.

3.2 INSTALLATION

A. Install system in accordance with manufacturer's instructions and referenced codes.

B. Devices:

1. General:

   a. All ceiling-mounted devices shall be located where shown on the reflected ceiling and floor plans. If not shown on the reflected ceiling or reflected floor drawings, the devices shall be installed in the relative locations shown on the floor drawings in a neat and uniform pattern.
   b. All devices shall be coordinated with luminaires, diffusers, sprinkler heads, piping and other obstructions to maintain a neat and operable installation. Mounting locations and spacing shall not exceed the requirements of NFPA 72.
   c. Where the devices are to be installed in a grid type ceiling system, the detectors shall be centered in the ceiling tile.
   d. The location of all fire alarm devices shall be coordinated with other devices mounted in the proximity. Where a conflict arises with other items or with architectural elements that will not allow the device to be mounted at the location or height shown, the Contractor shall notify the Architect/Engineer to coordinate a different acceptable location.

2. Per the requirements of NFPA, detector heads shall not be installed until after the final construction cleaning unless required by the local Authority Having Jurisdiction (AHJ). If detector heads must be installed prior to final cleaning (for partial occupancy, to monitor finished areas or as otherwise required by the AHJ), they shall not be installed until after the fire alarm panel is installed, with wires terminated, ready for operation. Any detector head installed prior to the final construction cleaning shall be removed and cleaned prior to closeout.
3. Duct-type Analog Smoke Detectors:

   a. Duct-type analog smoke detectors shall be installed on the duct where shown on the drawings and details. The sampling tubes shall be installed in the respective duct at the approximate location where shown on the electrical drawings to meet the operation requirements of the system.
   b. All detectors shall be accessible.
   c. Duct-type detectors shall be installed according to the manufacturer's instructions.

4. Manual Pull Stations:

   a. Stations shall be located where shown and at the height noted on the drawings.

5. Addressable Relays and Monitor Modules:

   a. Modules shall be located as near to the respective monitor or control devices as possible, unless otherwise indicated on the drawings.
   b. All modules shall be mounted in or on a junction box in an accessible location.

6. Notification Appliance Devices:

   a. Devices shall be located where shown on the drawings.
   b. Wall-mounted audio, visual and audio/visual alarm devices shall be mounted as denoted on the drawings.

C. Wiring:

1. Fire alarm wiring/cabling shall be provided by the Contractor in accordance with the manufacturer's recommendations and pursuant to National Fire Codes.
2. Wiring shall be installed in conduit from device to above accessible ceiling. Exposed plenum-rated cable (FPLP) shall be used above accessible ceilings supported every 4 feet, maintaining a minimum of 5 inches clearance from all lighting ballasts.
3. In exposed ceilings, wiring shall be installed in conduit.
4. Fire alarm cabling shall not be installed in the same bridle rings or cable trays designated for the cabling of other systems.
5. All junction boxes with SLC and NAC circuits shall be identified on cover. Refer to Identification Section 26 05 13 for color and identification requirements.
6. Fire Alarm Power Branch Circuits: Building wiring as specified in Section 26 05 13.
7. Notification Appliance Circuits shall provide the features listed below. These requirements may require separate circuits for visual and audible devices.

    a. Fire alarm temporal audible notification for all audio appliances.
    b. Synchronization of all visual devices where two or more devices are visible from the same location.
    c. Ability to silence audible alarm while maintaining visual device operation.

8. Notification Appliance Circuits shall not span floors.
9. Signal line circuits connecting devices shall not span floors.
10. No wiring other than that directly associated with fire alarm detection, alarm, or auxiliary fire protection functions shall be in fire alarm conduits. Wiring splices shall be avoided to the extent possible, and if needed, they shall be made only in junction boxes and enclosed by plastic wire nut-type connectors. Transposing or changing color coding of wires shall not be permitted. All conductors in conduit containing more than one wire shall be labeled on each end, in all junction boxes, and at each device with "E-Z Markers" or equivalent. Conductors in cabinets shall be carefully formed and harnessed so that each drops off directly opposite its terminal. Cabinet terminals shall be numbered and coded, and no unterminated conductors are permitted in cabinets or control panels. All controls, function switches, etc., shall be clearly labeled on all equipment panels.

D. Fire Alarm Cabling Color Code: Provide circuit conductors with insulation color coding as follows, or using colored tape at each conductor termination and in each junction box.

1. Power Branch Circuit Conductors: In accordance with Section 26 05 53.
2. Signaling Line Circuit: Overall red jacket with black and red conductors.
3. DC Power Supply Circuit: Overall red jacket with violet and brown conductors.
4. Notification Appliance Circuit: Overall red jacket with blue and white conductors.
5. Door Release Circuit: Gray conductors.
6. Central Station Trip Circuit: Orange conductors.
7. Central Station Fire Alarm Loop: Black and white conductors.

E. Devices surface mounted in finished areas shall be mounted on surface backboxes furnished by fire alarm equipment supplier. Backboxes shall be painted to match device, shall be the same shape and size as the device shall not have visible knockouts.

F. Make conduit and wiring connections to door release devices, sprinkler flow and pressure switches, sprinkler valve monitor switches, fire suppression system control panels, duct analog smoke detectors and all other system devices shown or noted on the Contract Documents or required in the manufacturer's product data and shop drawings.

3.3 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Section 26 05 00.

B. Test in accordance with NFPA 72, Chapter 14 and local fire department requirements. Submit documentation with O & M manuals in accordance with Section 14.6 of the Code.

3.4 MANUFACTURER'S FIELD SERVICES

A. Provide manufacturer's field services under provisions of Section 26 05 00.

B. Include services of certified technician to supervise installation, adjustments, final connections, and system testing.

C. Note that room numbers depicted on the architectural/engineering drawings will not necessarily reflect the actual room (signage) numbers that the Owner selects. Contractor and fire alarm manufacturer shall coordinate the actual room numbers as the Owner directs to identify each device. This list shall be a part of the floor plan record drawing to be turned in at the project closeout.

END OF SECTION

SECTION 31 10 00 – SITE CLEARING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Clearing and protection of vegetation.

B. Removal of existing debris.

1.2 RELATED REQUIREMENTS

A. Section 01 10 00 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 57 13 - Temporary Erosion and Sediment Control.

D. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products.

E. Section 02 41 00 - Demolition: Removal of built elements and utilities.

F. Section 31 22 00 - Grading: Topsoil removal.

G. Section 31 22 00 - Grading: Fill material for filling holes, pits, and excavations generated as a result of removal operations.

H. Section 31 23 23 - Fill: Filling holes, pits, and excavations generated as a result of removal operations.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.1 SITE CLEARING

A. Comply with other requirements specified in Section 01 70 00.

B. Minimize production of dust due to clearing operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.

3.2 EXISTING UTILITIES AND BUILT ELEMENTS

A. Coordinate work with utility companies and owner; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not disrupt public utilities without permit from authority having jurisdiction.

D. Protect existing structures and other elements that are not to be removed.

3.3 VEGETATION

A. Scope: Remove trees, shrubs, brush, and stumps in areas to be covered by building structure, paving, playing fields, lawns, and planting beds.

B. Do not remove or damage vegetation beyond the limits indicated on drawings.

C. Install substantial, highly visible fences at least 3 feet high to prevent inadvertent damage to vegetation to remain:

1. At vegetation removal limits.
2. Around trees to remain within vegetation removal limits; locate no closer to tree than at the drip line.
3. See Section 01 50 00 and engineering drawings for fence construction requirements.

D. In areas where vegetation must be removed but no construction will occur other than pervious paving, remove vegetation with minimum disturbance of the subsoil.

E. Vegetation Removed: Do not burn, bury, landfill, or leave on site, except as indicated.
   1. Trees: Treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.
   2. Existing Stumps: Treat as specified for other vegetation removed; remove stumps and roots to depth of 18 inches.

F. Restoration: If vegetation outside removal limits or within specified protective fences is damaged or destroyed due to subsequent construction operations, replace at no cost to Owner.

3.4 DEBRIS

A. Remove debris, junk, and trash from site.

B. Leave site in clean condition, ready for subsequent work.

C. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION 31 10 00

SECTION 31 22 00 – GRADING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Removal and storage of topsoil.

B. Rough grading the site for site structures, building pads, parking lot and sidewalks.

C. Finish grading for planting.

D. Subgrade preparation.

1.2 RELATED REQUIREMENTS

A. Section 31 10 00 - Site Clearing.

B. Section 31 23 16 - Excavation.

C. Section 31 23 16.13 - Trenching: Trenching and backfilling for utilities.

D. Section 31 23 16.26 - Rock Removal.

E. Section 31 23 23 - Fill: Filling and compaction.

F. Section 32 92 23 - Sodding: Finish ground cover.

G. Section 32 93 00 - Plants: Topsoil in beds and pits.

1.3 QUALITY ASSURANCE

A. Before grading and trenching operations begin, contact the respective utility owners so they may locate their lines and prevent unnecessary damage thereto.

B. Where there exists the potential for a conflict between the proposed line with an existing utility line, locate and expose any utility in advance of the proposed construction so determinations as to the required adjustments can be made.

C. Perform Work in accordance with the IDOT SSRBC latest edition and City of Crystal Lake standards.

PART 2 PRODUCTS

2.1 MATERIALS

A. Topsoil: See Section 31 23 23.

B. Other Fill Materials: See Section 31 23 23.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench mark and intended elevations for the Work are as indicated.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum.

B. Stake and flag locations of known utilities.

C. Locate, identify, and protect from damage above- and below-grade utilities to remain.

D. Protect site features to remain, including but not limited to bench marks, survey control points, existing structures, fences, sidewalks, paving, and curbs, from damage by grading equipment and vehicular traffic.

E. Protect trees to remain by providing substantial fencing around entire tree at the outer tips of its branches; no grading is to be performed inside this line.

F. Protect plants, lawns, rock outcroppings, and other features to remain as a portion of final landscaping.

3.3 ROUGH GRADING

A. Remove topsoil from areas to be further excavated, re-landscaped, or re-graded, without mixing with foreign materials.

B. Remove subsoil from areas to be further excavated, re-landscaped, or re-graded.

C. Do not remove wet subsoil , unless it is subsequently processed to obtain optimum moisture content.

D. When excavating through roots, perform work by hand and cut roots with sharp axe.

E. See Section 31 23 23 for filling procedures.

F. Stability: Replace damaged or displaced subsoil to same requirements as for specified fill.

3.4 SOIL REMOVAL

A. Remove excess excavated topsoil from site.

B. Remove excess excavated subsoil from site.

3.5 FINISH GRADING

A. Before Finish Grading:
   1. Verify building and trench backfilling have been inspected.
   2. Verify subgrade has been contoured and compacted.

B. Remove debris, roots, branches, stones, in excess of 1/2 inch in size. Remove soil contaminated with petroleum products.

C. In areas where vehicles or equipment have compacted soil, scarify surface to depth of 3 inches.

D. Place topsoil in areas indicated.

E. Place topsoil where required to level finish grade.

F. Place topsoil to nominal depth of 6 inches.

G. Place topsoil during dry weather.

H. Remove roots, weeds, rocks, and foreign material while spreading.

I. Near plants spread topsoil manually to prevent damage.

J. Fine grade topsoil to eliminate uneven areas and low spots. Maintain profiles and contour of subgrade.

K. Lightly compact placed topsoil.

3.6 REPAIR AND RESTORATION

A. Existing Facilities, Utilities, and Site Features to Remain: If damaged due to this work, repair or replace to original condition.

B. Trees to Remain: If damaged due to this work, trim broken branches and repair bark wounds; if root damage has occurred, obtain instructions from Architect as to remedy.

C. Other Existing Vegetation to Remain: If damaged due to this work, replace with vegetation of equivalent species and size.

3.7 CLEANING

A. Remove unused stockpiled topsoil and subsoil. Grade stockpile area to prevent standing water.

B. Leave site clean and raked, ready to receive landscaping.

END OF SECTION 31 22 00

SECTION 31 23 00 - FOUNDATION EXCAVATING AND BACKFILLING

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Foundation, excavating, and backfilling within five feet of the building perimeter. Work shall include, but not be limited to, the following items:

1. Removal of all unacceptable soil.
2. Furnish and install acceptable fill.
3. Prepare subgrade for footings and slab on grade.

B. The following items are not a part of this specification:

1. Utility trenching and related backfilling outside the building footprint.
2. Subgrade for exterior walks and paving.

C. Structural notes indicated on the drawings regarding foundation excavating and backfilling shall be considered part of this specification.

1.2 RELATED WORK

A. Pertinent Sections of Division 01.

B. Pertinent Sections of Division 31.

1.3 REFERENCES

A. Codes and Standards: Comply with the provisions of the following codes, specifications and standards, except where more stringent requirements are shown or specified. Where any provisions of other pertinent codes and standards conflict with this specification, the more stringent provision shall govern.

1. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.
2. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort.
3. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using the Modified Effort.
4. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System).
5. ASTM D2940 - Standard Specification for Graded Aggregate Material for Bases or Subbases for Highways or Airports.
6. ASTM D4253 - Standard Test Methods for Maximum Index Density and Unit Weight of Soils Using a Vibratory Table.
7. ASTM D4254 - Standard Test Methods for Minimum Index Density and Unit Weight of Soils and Calculation of Relative Density.
8. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils.
9. ASTM D6938 - Standard Test Methods for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth).

1.4 TESTING

A. Minimum testing frequency and locations:

1. Laboratory Testing:

a. Granular fill: One representative gradation test for each type of material.
b. Cohesive soils: One representative set of Atterberg limits and moisture density test for each type of material used.
c. Non-cohesive soils: One representative moisture density test for each type of material used.

2. Field Testing:

a. The Special Inspector shall determine the location of testing.
b. Testing of final utility trench backfill shall begin at a depth of 2 feet above the top of the pipe.
c. In-place field density test and moisture content tests shall be performed as follows:

1) Fills not within the influence of building foundations and slab on grade: Per civil specifications.
2) For fills within the influence of building foundations and slab on grade, the following criteria shall apply: One test for each 8-inch vertical lift of compacted fill placed per 2,500 square feet of fill area (minimum of two tests per lift per structure for areas smaller than 5,000 square feet).

d. Additional testing may be required by the Special Inspector if noncompliance or a change in conditions occurs.
e. If a test fails, the Contractor shall rework the material, recompact and retest as necessary until specific compaction is achieved in all areas of the trench. All costs associated with this work, including retesting, shall be the responsibility of the Contractor.

1.5 SUBMITTALS

A. Material Test Reports: Provide the Owner and Architect with the on-site material test reports from the Special Inspection Agency indicating the interpreting test results for compliance with this specification.

1.6 PROTECTION

A. Contractor shall provide for design, permits and installation of all cribbing, bracing, shoring and other methods required to safely retain earth banks and excavations.

B. Notify the Architect immediately and discontinue work in affected area if adjacent existing footings are encountered during excavation. Underpin other adjacent structures that may be damaged by excavation work, including service utilities and pipe chases.
C. Notify the Architect of unexpected subsurface conditions and discontinue work in affected areas until notification to resume.
D. Protect benchmarks, existing structures, fences, sidewalks, paving, curbing, etc., from excavation equipment and vehicular traffic.

E. Maintain and protect above and below grade utilities that are to remain.
F. Provide temporary heating or protective insulating materials to protect subgrades and foundations soils against freezing temperatures or frost during cold weather conditions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General: Provide borrow soil materials when sufficient acceptable soil materials are not available from excavations.

B. Acceptable soils shall comply with the following:

1. Meet ASTM D2487 soil classification groups GW, SW,[CL,] [SC] or a combination of these group symbols.
2. Be free of rock or gravel larger than 3 inches in any dimension.
3. Be free of debris, waste, frozen materials, vegetation and other deleterious materials.
4. Have a liquid limit less than 45 and a plasticity index less than 25.
5. Be approved by the Special Inspection Agency.

C. Unacceptable soils shall be defined as following:

1. ASTM D2487 soil classification groups ML, MH, CH, OL, OH, PT[SM] or a combination of these group symbols.
2. Unacceptable soils also to include acceptable soils not maintained within 2 percent of optimum moisture content at time of compaction.

D. Free-Draining Granular Fill: Free-draining granular fill shall comply with the following:

1. Be a naturally or artificially graded mixture of natural or crushed gravel, crushed stone.
2. Be clean and free of fines.
3. Comply with ASTM D2940.
4. Be uniformly graded as follows:

Coarse Aggregate Gradations						
Sieve Size - Percent Passing						
Grade No.	1-1/2"	1"	3/4"	1/2"	3/8"	No. 4
CA7	100	95 ± 5	-	45 ± 15	-	5 max

5. Be approved by the Special Inspection Agency.

E. Engineered Fill and Utility Base Course shall comply with the following:

1. Be a naturally or artificially graded mixture of natural or crushed gravel, crushed stone, natural or crushed sand. Be a recycled concrete crushed to meet the gradation requirements of CA6.
2. Comply with ASTM D2940.
3. Be uniformly graded as follows:

Coarse Aggregate Gradations						
Sieve Size - Percent Passing						
Grade No.	1-1/2"	1"	1/2"	No. 4	No. 16	No. 200

CA6	100 to 90	95 ± 5	75 ± 15	43 ± 13	25 ± 15	8 ± 4

Coarse Aggregate Gradations						
Sieve Size - Percent Passing						
Grade No.	1-1/2"	1"	1/2"	No. 4	No. 30	No. 200
IN#53	100	90 ± 10	67 ± 13	47 ± 13	21 ± 9	7 ± 3

4. Be approved by the Special Inspection Agency.

F. Material Applications: Provide and install material meeting with the above requirements as follows:

1. General fill: Acceptable soils.
2. Backfill against basement and retaining walls for 2 feet directly adjacent to wall: Free-draining granular fill.
3. Backfill at over-excavated areas beneath footings: Engineered fill.
4. Sub-grade layer beneath slabs-on-grade: Refer to drawings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Identify and verify required lines, levels, contours and benchmark elevations for the work are as indicated.

B. Protect plant life, lawns, other features and vegetation to remain as a portion of the final landscaping.

C. Free groundwater is not expected during excavation. Contractor shall provide for de-watering of excavations from surface water, ground water or seepage. Where ground water occurs during excavation, special procedures shall be implemented as recommended by the Geotechnical Engineer of Record.

D. Identify known underground utility locations with stakes and flags.

3.2 EXCAVATION

A. All excavations shall be safely and properly backfilled.

B. All abandoned footings, utilities and other structures that interfere with new construction shall be removed.

C. All unacceptable material and organic material shall be removed from below all proposed slabs-on-grade and the exposed natural soil shall be proof rolled and the compaction verified by the soils testing firm prior to placing fill. Proof-roll with a loaded tandem dump truck, loaded ready-mix truck, roller, or equivalent weight vehicle. Materials exhibiting weakness, such as those exhibiting rutting or pumping, shall be removed and replaced with acceptable compacted fill material.

D. Do not excavate within the 45-degree bearing splay of any adjacent foundations.

E. Remove lumped subsoil, boulders and rock up to 1/3 cubic yard (measured by volume). Provide Owner with unit price per cubic yard for obstructions larger than 1/3 cubic yard.
F. Outside 45-degree bearing splay of foundations, correct areas over excavated with aggregate at no additional cost to the Owner.
G. Within the 45-degree bearing splay of foundations, correct areas over excavated with 2000 psi concrete fill at no additional cost to the Owner. Notify the Architect prior to performing such work.
H. Hand trim final excavation to remove all loose material.
I. Contractor shall form all dams and perform other work necessary for keeping the excavation clear of water during the progress of the work and, at Contractor's expense, shall pump or otherwise remove all surface and perched water which accumulates in the excavations. Perched water that cannot be de-watered in 48 hours of continuous pumping at a minimum rate of 60 gpm in dry weather shall be considered ground water.
J. If de-watering is required to lower the static level of the ground water, it will be paid for by the Owner on a unit price basis per hour as extra compensation.
K. Stockpile excavated material in the area designated and remove excess material not being used, from the site.

3.3 BACKFILLING

A. Verify foundation perimeter drainage system is complete and has been inspected prior to backfilling against foundation walls.

B. Support pipe and conduit during placement and compaction of bedding fill.
C. Systematically backfill to allow necessary time for natural settlement. Do not backfill over porous, wet, spongy, or frozen subgrade surfaces.
D. Backfill areas to contours and elevations with unfrozen materials.
E. Unless noted otherwise on the drawings, make grade changes gradual.
F. Unless noted otherwise on the drawings, slope grade away from the building a minimum of 2 inches in 10 feet.
G. Contractor shall procure the approval of the subgrade from the Special Inspection Agency prior to the start of any filling or bedding operations.
H. Place a minimum width of 24 inches of free-draining granular fill against all basement and retaining walls for the full height of the wall.
I. Do not begin any backfill operations against any concrete walls until the concrete has achieved its specified strength.
J. Do not backfill against below grade walls without necessary bracing to support the walls.
K. Place and mechanically compact granular fill in continuous layers not to exceed 8 inches compacted depth.

L. Employ a placement method that does not disturb or damage adjacent utilities, vapor barriers, foundation perimeter drainage and foundation waterproofing.
M. All surplus fill materials are to be removed from the site.
N. Fill material stockpiles shall be free of unacceptable soil materials.
O. After work is complete, remove all excess stockpile material and repair stockpile area to its original condition.

3.4 COMPACTION

A. Compact all fill that will support building footings or floor slabs to 9598 percent of the maximum dry density in accordance with ASTM D1557. For relative cohesionless fill materials, where the percent passing the #200 sieve is less than 10 and the moisture density curve indicates only slight sensitivity to changing moisture content, compaction requirements should be changed to 75 percent relative density in accordance with ASTM D4253 and ASTM D4254.

B. Compact all fills that support paving and landscape per civil specifications.

3.5 FOUNDATIONS

A. Each footing excavation should be cleared of all obstructions and other organic or deleterious materials.

B. Localized areas of unstable or unacceptable material may be discovered during the stripping and excavation operation and may require over-excavation and backfilling. The Special Inspection Agency shall be present during the proof rolling to evaluate any localized areas and make recommendations regarding over-excavation, backfilling and recompaction of these areas. Fill placement and compaction shall be inspected and tested by the Special Inspection Agency.
C. Footing elevations shown on the drawings designate a minimum depth of footing where an appropriate soil bearing pressure is expected. Footings, piers and/or walls shall be lowered or extended as required to reach soil meeting the design bearing pressure. This work shall be performed per the recommendations of the Special Inspection Agency.
D. All footing excavations shall be recompacted by hand-operated, vibratory compaction equipment, except where compaction will degrade the integrity of subgrade soils. In these instances, bottom of footing excavations should be hand-trimmed to remove loosened material.
E. All excavation and recompacted surfaces shall be inspected and tested to a depth of 2.0 feet below the excavated elevation by the Special Inspection Agency. Additional field density tests should be performed for each one foot of fill material placed. Any areas not in compliance with the compaction requirements should be corrected and re-tested prior to placement of fill material.
F. For foundation areas where over excavation is performed, place and mechanically compact Engineered fill material in continuous layers not to exceed 6 inches compacted depth.

3.6 SLAB-ON-GRADE

A. All disturbed areas after the clearing and stripping operation should be proof-rolled and recompacted with a heavy vibratory drum roller (approved by the Special Inspection Agency) in the static mode. The compactor should make a minimum of 10 passes, with a minimum of one foot overlap of each pass. The compactor speed should be less than 0.2 MPH.

B. The [Special]Inspection Agency shall monitor proof-rolling and compaction operations. This area should then be tested for compaction to a depth of 2.0 feet below the compacted surface prior to the placement of any structural fill material.

C. Refer to drawings and Geotechnical report for required sub-grade preparation beneath slabs-on-grade.

3.7 UTILITY TRENCH BACKFILL (AT SLAB-ON-GRADE LOCATIONS)

A. Excavate and backfill utility trenches under wall footings as shown on the drawings.

B. Place utility base course on subgrades free of mud, frost, snow, or ice.

C. Place and compact utility base course on trench bottoms and where indicated.

D. Lay underground utilities on 6" sand bedding, which meets the acceptable criteria of Section 2.1B.

E. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

F. After connection joints are made, any misalignment can be corrected by tamping the sand around the utilities.

G. Place and compact initial backfill of acceptable sand to a height of 6 inches over the utility pipe or conduit in 6 inch layers meeting specified compaction requirements.

H. Carefully compact initial backfill under pipe haunches and compact evenly up on both sides and along the full length of utility piping or conduit to avoid damage or displacement of piping or conduit.

I. Place and compact final backfill using acceptable soil to final subgrade elevation meeting specified compaction requirements.

J. Backfill voids with acceptable soil while installing and removing shoring and bracing.

K. Special Inspection Agency shall monitor and test compacted backfill to verify final compaction meets the specified requirement.

3.8 TOLERANCES

A. Top surface of backfilling under paved areas: Plus or minus 1/2 inch from required elevation.

B. Top surface of general backfilling: Plus or minus 1 inch from required elevation.

END OF SECTION

SECTION 31 23 16 – EXCAVATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Excavating for slabs-on-grade, curb & gutter and paving.

1.2 RELATED REQUIREMENTS

A. Geotechnical report prepared by ECS; bore hole locations and findings of subsurface materials.

B. Section 01 57 13 - Temporary Erosion and Sedimentation Control: Slope protection and erosion control.

C. Section 02 41 00 - Demolition: Shoring and underpinning.

D. Section 31 22 00 - Grading: Soil removal from surface of site.

E. Section 31 22 00 - Grading: Grading, Subgrade preparation.

F. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

G. Section 31 23 23 - Fill: Fill materials, filling, and compacting.

PART 2 PRODUCTS

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench mark and intended elevations for the work are as indicated.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 31 22 00 for additional requirements.

3.3 EXCAVATING

A. Excavate to accommodate new structures and construction operations.

B. Notify Architect and Engineer of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

C. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

D. Do not interfere with 45 degree bearing splay of foundations.

E. Cut utility trenches wide enough to allow inspection of installed utilities.

F. Hand trim excavations. Remove loose matter.

G. Correct areas that are over-excavated and load-bearing surfaces that are disturbed; see Section 31 23 23.

H. Grade top perimeter of excavation to prevent surface water from draining into excavation.

I. Remove excavated material that is unsuitable for re-use from site.

J. Stockpile excavated material to be re-used in area designated on site in accordance with Section 31 22 00.

K. Remove excess excavated material from site.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.

B. Provide for visual inspection of load-bearing excavated surfaces before placement of foundations.

3.5 PROTECTION

A. Prevent displacement of banks and keep loose soil from falling into excavation; maintain soil stability.

B. Protect bottom of excavations and soil adjacent to and beneath foundation from freezing.

END OF SECTION 31 23 16

SECTION 31 23 16.13 – TRENCHING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Backfilling and compacting for utilities outside the building to utility main connections.

1.2 RELATED REQUIREMENTS

A. Section 31 22 00 - Grading: Site grading.

1.3 PRICE AND PAYMENT PROCEDURES

A. See Section 01 22 00 - Unit Prices, for general requirements applicable to unit prices for earthwork.

1.4 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

1.5 REFERENCES

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials ; 2015

B. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) ; 2012.

C. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)) ; 2012.

D. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) ; 2010

E. IDOT SSRBC latest edition.

F. City of Crystal Lake standards.

1.6 SUBMITTALS

A. Materials Sources: Submit name of imported materials source.

B. Compaction Density Test Reports.

1.7 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where indicated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. Refer to typical section and details in plans.

B. See City of Crystal Lake Standards for allowed materials.

C. If the City of Crystal Lake Standards do not list a specific material, the IDOT SSRBC will govern.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

3.2 PREPARATION

A. Identify required lines, levels, contours, and datum locations.

B. See Section 31 22 00 for additional requirements.

3.3 TRENCHING

A. Notify Architect of unexpected subsurface conditions and discontinue affected Work in area until notified to resume work.

B. Slope banks of excavations deeper than 4 feet to angle of repose or less until shored.

C. Do not interfere with 45 degree bearing splay of foundations.

D. Cut trenches wide enough to allow inspection of installed utilities.

E. Hand trim excavations. Remove loose matter.

F. Remove excavated material that is unsuitable for re-use from site.

G. Stockpile excavated material to be re-used in area designated in Section 31 22 00.

H. Remove excess excavated material from site.

I. Reference the City of Crystal Lake Standards for trench details for the various utilities.

3.4 PREPARATION FOR UTILITY PLACEMENT

A. Cut out soft areas of subgrade not capable of compaction in place. Backfill with well compacted CA-6 aggregate or as approved by Engineer.

B. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

C. Until ready to backfill, maintain excavations and prevent loose soil from falling into excavation.

3.5 BACKFILLING

A. Backfill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

H. Slope grade away from building minimum 2 inches in 10 ft , unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.
   1. Thrust bearing surfaces: Fill with concrete.
   2. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated:
   1. Under paving, slabs-on-grade, and similar construction: 97 percent of maximum dry density.

K. Reshape and re-compact fills subjected to vehicular traffic.

3.6 BEDDING AND FILL AT SPECIFIC LOCATIONS

A. Utility Piping and Conduits:
   1. Bedding: Use City of Crystal Lake Standards.

2. Cover/backfill with aggregate listed in the City of Crystal Lake Standards.
3. If the City of Crystal Lake standards do not list a specific material, the IDOT SSRBC will govern.
3. Fill up to subgrade elevation.
4. Compact in maximum 8 inch lifts to 95 percent of maximum dry density.

3.7 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.

B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D1557 ("modified Proctor"), AASHTO T 180, or ASTM D698 ("standard Proctor").

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

END OF SECTION 31 23 16.13

SECTION 31 23 23 – FILL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Filling , backfilling, and compacting for building volume below grade.

B. Backfilling and compacting for utilities outside the building to utility main connections.

C. Filling holes, pits, and excavations generated as a result of removal (demolition) operations.

1.2 RELATED REQUIREMENTS

A. Geotechnical report prepared by ECS; bore hole locations and findings of subsurface materials.

B. Section 01 57 13 - Temporary Erosion and Sediment Control: Slope protection and erosion control.

C. Section 03 30 00 - Cast-in-Place Concrete.

D. Section 31 22 00 - Grading: Removal and handling of soil to be re-used.

E. Section 31 22 00 - Grading: Site grading.

F. Section 31 23 16 - Excavation: Removal and handling of soil to be re-used.

G. Section 31 23 16.13 - Trenching: Excavating for utility trenches outside the building to utility main connections.

H. Section 32 14 16 - Brick Unit Paving: Leveling bed placement under pavers.

1.3 DEFINITIONS

A. Finish Grade Elevations: Indicated on drawings.

B. Subgrade Elevations: Based on finished grade and applicable typical sections.

1.4 REFERENCE STANDARDS

A. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials ; 2015

B. ASTM C136/C136M - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates ; 2014.

C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) ; 2012.

D. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)) ; 2012.

E. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) ; 2011.

F. ASTM D4318 - Standard Test Methods for Liquid Limit, Plastic Limit, and Plasticity Index of Soils ; 2010.

G. IDOT SSRBC latest edition.

H. City of Crystal Lake Standards

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Fill Composition Test Reports: Results of laboratory tests on proposed and actual materials used , including manufactured fill.

D. Compaction Density Test Reports.

1.6 QUALITY ASSURANCE

A. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When fill materials need to be stored on site, locate stockpiles where indicated.
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.1 FILL MATERIALS

A. General Fill:
   1. Satisfactory Soils: Satisfactory soils for backfilling trenches shall be approved selected material taken from the trench or other excavation, suitable for compaction and meeting the following requirements:
      a. ASTM D 2487 Soil Classification Groups GW, GP, GM, SW, SP and SM or a combination of these groups: free of rock or gravel larger than 3 inches in any dimension, debris, waste, frozen materials, vegetation and other deleterious matter.
   2. Unsatisfactory Soils: Unsatisfactory soils not suitable for backfilling trenches are defined as follows:
      a. Soil Classification Groups GC, SC, CL, ML, OL, CH, MH, OH and PT according to ASTM D2487 or a combination of the these groups.
      b. Material not suitable for embankment, fill or backfill or in excess of requirements shall be hauled off site.

B. Aggregate Base Course under parking lots, curb & gutter and sidewalks shall meet the following gradation requirements:
   1. Refer to typical sections and details in the engineering drawings.

C. Topsoil: See Section 31 22 00.

2.2 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of soil material.

B. Where fill materials are specified by reference to a specific standard, test and analyze samples for compliance before delivery to site.

C. If tests indicate materials do not meet specified requirements, change material and retest.

D. Provide materials of each type from same source throughout the Work.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench marks and intended elevations for the Work are as indicated.

B. Identify required lines, levels, contours, and datum locations.

C. See Section 31 22 00 for additional requirements.

D. Verify subdrainage, dampproofing, or waterproofing installation has been inspected.

3.2 PREPARATION

A. Scarify and proof roll subgrade surface to a depth of 6 inches to identify soft spots. Subgrade to be prepared per IDOT SSRBC Section 301.

B. Cut out soft areas of subgrade not capable of compaction in place. Backfill with general fill as directed by Geotechnical Engineer.

C. Compact subgrade to density equal to or greater than requirements for subsequent fill material.

D. Until ready to fill, maintain excavations and prevent loose soil from falling into excavation.

3.3 FILLING

A. Fill to contours and elevations indicated using unfrozen materials.

B. Fill up to subgrade elevations unless otherwise indicated.

C. Employ a placement method that does not disturb or damage other work.

D. Systematically fill to allow maximum time for natural settlement. Do not fill over porous, wet, frozen or spongy subgrade surfaces.

E. Maintain optimum moisture content of fill materials to attain required compaction density.

F. Granular Fill: Place and compact materials in equal continuous layers not exceeding 6 inches compacted depth.

G. Soil Fill: Place and compact material in equal continuous layers not exceeding 8 inches compacted depth.

H. Slope grade away from building minimum 2 inches in 10 feet , unless noted otherwise. Make gradual grade changes. Blend slope into level areas.

I. Correct areas that are over-excavated.
   1. Other areas: Use general fill, flush to required elevation, compacted to minimum 97 percent of maximum dry density.

J. Compaction Density Unless Otherwise Specified or Indicated:

K. Reshape and re-compact fills subjected to vehicular traffic.

3.4 FILL AT SPECIFIC LOCATIONS

A. At Lawn Areas:
   1. Use general fill.
   2. Fill up to subgrade elevations.
   3. Compact to 90 percent of maximum dry density.
   4. See Section 31 22 00 for topsoil placement.

B. Under Pavers Set on Sand Leveling Bed:
   1. Use aggregate referenced in the typical sections within the engineering drawings.
   2. Fill up to bottom of sand leveling bed.
   3. Compact to 95 percent of maximum dry density.
   4. See unit pavers section for leveling bed placement.

3.5 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.

B. Evaluate results in relation to compaction curve determined by testing uncompacted material in accordance with ASTM D698 ("standard Proctor"), ASTM D1557 ("modified Proctor"), or AASHTO T 180.

C. If tests indicate work does not meet specified requirements, remove work, replace and retest.

D. Frequency of Tests:
   1. Take soil density tests uniformly throughout the placing of fill material so that quality control can be maintained at all times. Minimum requirements are as follows:
      a. One field density test for each 25 CY of structural fill, minimum one each lift.

b. One field density test per day for each type of fill on any day when fill is placed, regardless of quantity.
c. Proof roll compacted fill at surfaces that will be under slabs-on-grade and pavements.

END OF SECTION 31 23 23

SECTION 32 11 23 – AGGREGATE BASE COURSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Aggregate base course.

B. Paving aggregates.

1.2 RELATED REQUIREMENTS

A. Section 31 22 00 - Grading: Preparation of site for base course.

B. Section 31 23 16.13 - Trenching: Compacted fill over utility trenches under base course.

C. Section 31 23 23 - Fill: Topsoil fill at areas adjacent to aggregate base course.

D. Section 31 23 23 - Fill: Compacted fill under base course.

E. Section 32 12 16 - Asphalt Paving: Finish and binder asphalt courses.

F. Section 32 13 13 - Concrete Paving: Finish concrete surface course.

G. Section 32 14 16 - Brick Unit Paving.

H. Section 33 05 13 - Manholes and Structures: Manholes including frames.

1.3 REFERENCE STANDARDS

A. AASHTO M 147 - Standard Specification for Materials for Aggregate and Soil-Aggregate Subbase, Base and Surface Courses; American Association of State Highway and Transportation Officials ; 1965 (2004).

B. AASHTO T 180 - Standard Specification for Moisture-Density Relations of Soils Using a 4.54 kg (10-lb) Rammer and a 457 mm (18 in.) Drop; American Association of State Highway and Transportation Officials ; 2015

C. ASTM D698 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Standard Effort (12,400 ft-lbf/ft3 (600 kN-m/m3)) ; 2012.

D. ASTM D1556 - Standard Test Method for Density and Unit Weight of Soil in Place by the Sand-Cone Method ; 2007.

E. ASTM D1557 - Standard Test Methods for Laboratory Compaction Characteristics of Soil Using Modified Effort (56,000 ft-lbf/ft3 (2,700 kN m/m3)) ; 2012.

F. ASTM D2167 - Standard Test Method for Density and Unit Weight of Soil in Place by the Rubber Balloon Method ; 2008.

G. ASTM D2487 - Standard Practice for Classification of Soils for Engineering Purposes (Unified Soil Classification System) ; 2011.

H. ASTM D6938 - Standard Test Method for In-Place Density and Water Content of Soil and Soil-Aggregate by Nuclear Methods (Shallow Depth) ; 2010.

I. IDOT SSRBC latest edition

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Materials Sources: Submit name of imported materials source.

C. Aggregate Composition Test Reports: Results of laboratory tests on proposed and actual materials used.

D. Compaction Density Test Reports.

1.5 DELIVERY, STORAGE, AND HANDLING

A. When necessary, store materials on site in advance of need.

B. When aggregate materials need to be stored on site, locate where directed by Owner.

C. Aggregate Storage, General:
   1. Separate differing materials with dividers or stockpile separately to prevent intermixing.
   2. Prevent contamination.
   3. Protect stockpiles from erosion and deterioration of materials.

PART 2 PRODUCTS

2.1 MATERIALS

A. Coarse Aggregate: Coarse aggregate, conforming to State of Illinois Highway Department standard and referenced in the typical sections within the engineering drawings.

B. Fine Aggregate: Sand; conforming to State of Illinois Highway Department standard and referenced in the typical sections within the engineering drawings.

2.2 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for testing and analysis of aggregate materials.

B. If tests indicate materials do not meet specified requirements, change material and retest.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that survey bench marks and intended elevations for the work are as indicated.

B. Verify substrate has been inspected, gradients and elevations are correct, and is dry.

3.2 PREPARATION

A. Correct irregularities in substrate gradient and elevation by scarifying, reshaping, and re-compacting.

B. Do not place aggregate on soft, muddy, or frozen surfaces.

3.3 INSTALLATION

A. Under Bituminous Concrete Paving:
   1. Place coarse aggregate to a total compacted thickness as referenced in the typical sections within the engineering drawings.
   2. Compact to 95 percent of maximum dry density.

B. Under Portland Cement Concrete Paving:
   1. Place coarse aggregate to a total compacted thickness as referenced in the typical sections within the engineering drawings.
   2. Compact to 95 percent of maximum dry density.

C. Place aggregate in maximum 4 inch layers and roller compact to specified density.

D. Level and contour surfaces to elevations and gradients indicated.

E. Add water to assist compaction. If excess water is apparent, remove aggregate and aerate to reduce moisture content.

F. Use mechanical tamping equipment in areas inaccessible to compaction equipment.

3.4 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Scheduled Compacted Thickness: Within 1/4 inch.

3.5 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection and testing.

B. Compaction density testing will be performed on compacted aggregate base course in accordance with ASTM D1556/D1556M, ASTM D2167, or ASTM D6938.

C. Results will be evaluated in relation to compaction curve determined by testing uncompacted material in accordance with AASHTO T 180, ASTM D698 ("standard Proctor"), or ASTM D1557 ("modified Proctor").

D. If tests indicate work does not meet specified requirements, remove work, replace and retest.

E. Frequency of Tests: Per IDOT SSRBC specifications but not less than one per area.

F. Proof roll compacted aggregate at surfaces that will be under slabs-on-grade, curb & gutter and pavements.

3.6 CLEANING

A. Remove unused stockpiled materials, leave area in a clean and neat condition. Grade stockpile area to prevent standing surface water.

END OF SECTION 32 11 23

SECTION 32 12 16 – ASPHALT PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hot-mix Asphalt Pavement Patching.

B. Hot-mix Asphalt paving.

1.2 RELATED REQUIREMENTS

A. Section 09 91 13 - Exterior Painting: Pavement markings.

B. Section 31 22 00 - Grading: Preparation of site for paving and base.

C. Section 31 23 23 - Fill: Compacted subgrade for paving.

D. Section 32 11 23 - Aggregate Base Courses: Aggregate base course.

E. Section 32 17 23.13 - Painted Pavement Markings: Concrete bumpers.

1.3 REFERENCE STANDARDS

A. IDOT SSRBC latest edition.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Engage a firm experienced in manufacturing hot-mix asphalt similar to that indicated for this project and with a record of successful in-service performance. Firm shall be a registered and approved paving mix manufacturer for IDOT.

B. Installer Qualifications: Engage an experienced installer who has completed hot-mix asphalt paving similar in material, design and extent to that indicated for this project and with a record of successful in-service performance.

1.5 REGULATORY REQUIREMENTS

A. Comply with materials, workmanship and other applicable requirements of Section 442 PAVEMENT PATCHING and other applicable section of the IDOT SSRBC. Measurement and payment provisions set forth in the IDOT SSRBC do not apply this Section. The Schedule of Prices included in the Bid Form shall govern payment for furnishing the labor, material and equipment for the construction of hot-mix asphalt surfaces.

1.6 FIELD CONDITIONS

A. Do not place asphalt when ambient air or base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 MATERIALS

A. Asphalt Cement: In accordance with IDOT SSRBC.

B. Aggregate for Binder Course: In accordance with IDOT SSRBC.

C. Aggregate for Surface Course: In accordance with IDOT SSRBC.

D. Fine Aggregate: In accordance with IDOT SSRBC.

E. Prime Coat on Aggregate Bases: Shall be MC-30 in accordance with IDOT SSRBC.

F. Tack Coat on HMA bases: Shall be SS-1 in accordance with IDOT SSRBC.

2.2 ASPHALT PAVING MIXES AND MIX DESIGN

A. Binder Course: Conforming to IDOT SSRBC specifications for hot-mix asphalt binder course, IL-19.0, N50.

B. Surface Course: Conforming to IDOT SSRBC specifications for hot-mix asphalt surface course, Mixture D, N50.

2.3 SOURCE QUALITY CONTROL

A. Test mix design and samples in accordance with IDOT SSRBC but no less than once per day unless authorized by Owner and Engineer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that compacted subgrade is dry and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.2 BASE COURSE

A. See Section 32 11 23.

3.3 PREPARATION – PRIME COAT

A. Apply prime coat in accordance with IDOT SSRBC.

B. Apply primer on aggregate base or subbase at uniform rate of 0.35 gal/sq yd.

3.4 PREPARATION - TACK COAT

A. Apply tack coat in accordance with IDOT SSRBC.

B. Apply tack coat on asphalt or concrete surfaces over subgrade surface at uniform rate of 0.10 gal/sq yd.

3.5 PLACING HOT-MIX ASPHALT PAVEMENT

A. Place asphalt binder course within 24 hours of applying prime coat.

B. Compact pavement by rolling to specified density. Do not displace or extrude pavement from position. Hand compact in areas inaccessible to rolling equipment.

C. Perform rolling with consecutive passes to achieve even and smooth finish, without roller marks.

D. Construct joints to ensure a continuous bond between adjoining paving sections. Construct joints free of depressions at same elevation as other sections of hot-mix asphalt course.

3.6 COMPACTION

A. Compaction will be in accordance with IDOT SSRBC

B. Protection: After final rolling, do not permit vehicular traffic on pavement until it has cooled and hardened.

3.7 TOLERANCES

A. Flatness: Maximum variation of 1/4 inch measured with 10 foot straight edge.

B. Compacted Thickness: Within 1/4 inch of specified or indicated thickness.

C. Variation from True Elevation: Within 1/2 inch.

3.8 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for quality control.

B. In-place Density: Testing Agency will perform density testing during paving operations by nuclear method.

C. Remove and replace or install additional hot-mix asphalt where test results or measurement indicate that it does not comply with specified requirements. Cost for removal and replacement of deficient paving will be borne by Contractor,

END OF SECTION 32 12 16

SECTION 32 13 13 – CONCRETE PAVING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Concrete sidewalks, stair steps, integral curbs, gutters, median barriers, parking areas, and roads.

1.2 RELATED REQUIREMENTS

A. Section 03 10 00 - Concrete Forming and Accessories.

B. Section 03 20 00 - Concrete Reinforcing.

C. Section 03 30 00 - Cast-in-Place Concrete.

D. Section 31 22 00 - Grading: Preparation of site for paving and base and preparation of subsoil at pavement perimeter for planting.

E. Section 31 23 23 - Fill: Compacted subbase for paving.

F. Section 32 11 23 - Aggregate Base Courses

G. Section 32 12 16 - Asphalt Paving: Asphalt wearing course.

1.3 REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International ; 2010 (Errata 2012).

B. ACI 330R-01 – Guide for Design and Construction of Concrete Parking Lots.

C. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International ; 2000.

D. ACI 305R - Hot Weather Concreting; American Concrete Institute International ; 2010.

E. ACI 306R - Cold Weather Concreting; American Concrete Institute International ; 2010.

F. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens ; 2015a.

G. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete ; 2015.

H. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete ; 2011.

I. IDOT SSRBC latest edition.

1.4 SUBMITTALS

A. Product Data: For each type of manufactured material and product indicated.

B. Design Mixtures: For each concrete pavement mixture. Include alternate mixture designs when characteristics of materials, project conditions, weather, test results, or other circumstances warrant adjustments.

C. For Bid Alternate #2 Concrete Pavement: Contractor to provide construction joint layout to Owner, and/or Engineer for approval prior to construction. Joint Spacing shall be in accordance to ACI 330R-01.

1.5 QUALITY ASSURANCE

A. Hot weather placement: When hot weather conditions exist, that will impair the quality and strength of concrete, place concrete in full compliance with ACI 305.

B. Cold weather placement: Protect all concrete work from physical damage or reduced strength, which could be caused by frost, freezing action, or low temperatures in full compliance with ACI 306.

C. Do not place concrete when base surface temperature is less than 40 degrees F, or surface is wet or frozen.

PART 2 PRODUCTS

2.1 PAVING ASSEMBLIES

A. Concrete Sidewalks: Comply with materials, workmanship, and other applicable requirements of Section 424 PORTLAND CEMENT CONCRETE SIDEWALK and other applicable sections of the IDOT SSRBC. Measurement and payment provisions set forth in the IDOT SSRBC do not apply to this Section. Sidewalk width shall be match the existing sidewalk adjacent to pour. Newly installed sidewalk shall be pitched to allow drainage per ADA Standards. Sidewalk base shall be installed on subgrade that has been compacted to a least 90% of standard proctor density. Sidewalk shall be installed on 2" CA-6 aggregate base which has been compacted and rolled. PCC shall be finished with a light broomed surface. The Schedule of Prices included in the Bid Form shall govern payment for furnishing the labor, material, and equipment for the removal and/or replacement of concrete sidewalk. CA-6 aggregate base is included in concrete sidewalks pay item.

B. Curb and Gutter / Barrier Curb: Any City of Crystal Lake requirements regarding expansion and contraction joints shall govern construction. Where proposed curb connects to an existing curb, the existing curb shall be saw cut and then two (2) 18" long x ¾" (#6) dowel bars shall be drilled and installed 9" into the existing and proposed curb, as well as preformed expansion joints. Curb and gutter cross-section shall match the adjacent curb and gutter. Concrete curb and gutter shall be installed on 4" CA-6 aggregate base. 2-#4 steel reinforcing bars 20' long shall be placed over all trenches. Comply with materials, workmanship, and other applicable requirements of Section 606 CONCRETE GUTTER, CURB, MEDIAN, AND PAVED DITCH and other applicable sections of the IDOT SSRBC. Measurement and payment provisions set forth in the IDOT SSRBC do not apply to this Section. The Schedule of Prices included in the Bid Form shall govern payment for furnishing the labor, material, and equipment for the removal and/or replacement of concrete curb and gutter. CA-6 aggregate base is included in concrete curb and gutter pay item.

C. Bid Alternate #2 Concrete Pavement: Concrete shall be Class PV per IDOT SSRBC. Per the geotechnical report prepared by ECS Midwest, LLC., the portland cement concrete thickness shall be six (6) inches and the aggregate base course shall be six (6) inches.

2.2 FORM MATERIALS

A. Form Materials: As specified in Section 03 10 00 , conform to IDOT SSRBC.

2.3 REINFORCEMENT

A. Reinforcing Steel and Welded Wire Reinforcement: Types specified in Section 03 20 00.

2.4 CONCRETE MATERIALS

A. Concrete Materials: Provide in accordance with IDOT SSRBC.

B. Portland Cement shall be ASTM C 150. Fly ash and calcium chloride shall not be used.

2.5 ACCESSORIES

A. Curing Compound: ASTM C309, Type 1, Class A.

2.6 CONCRETE MIX DESIGN

A. Concrete Properties:

1. Concrete mix to comply with IDOT SSRBC standards and the following strength: 4,000 psi at 28 days.

2.7 MIXING

A. Transit Mixers: Comply with ASTM C94.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify compacted subgrade is acceptable and ready to support paving and imposed loads.

B. Verify gradients and elevations of base are correct.

3.2 SUBBASE

A. Prepare subbase in accordance with IDOT SSRBC standards.

3.3 PREPARATION

A. Moisten base to minimize absorption of water from fresh concrete.

B. Coat surfaces of manhole frames with oil to prevent bond with concrete pavement.

C. Notify Engineer, Architect and Owner minimum 24 hours prior to commencement of concreting operations.

3.4 FORMING

A. Place and secure forms to correct location, dimension, profile, and gradient.

B. Assemble formwork to permit easy stripping and dismantling without damaging concrete.

C. Place joint filler vertical in position, in straight lines. Secure to formwork during concrete placement.

3.5 REINFORCEMENT

A. Distributed steel reinforcement (wire mesh or bars) is not required in concrete pavement slabs except where specifically called for by the plans, details or specs. Exceptions which will require distributed steel reinforcement even if not specified in the plans, details or specs include the following:

1. Where soft or weak soils are encountered below the subbase and additional undercuts do not reach adequate soils, place reinforcement specified earlier in this section and contact the Engineer for reinforcement size and spacing.

2. Where irregular pavement panels will be installed. This includes locations where the slab tapers to a sharp angle, when the length to width ratio exceeds 1.5, or when the slab will be formed with a tight radius.

3. When the transverse joints are spaced more than 30 times the slab thickness.

C. When called for in plans and/or details dowels at expansion joints and/or contraction joints shall be provided in conformance with ACI 330R-01.

D. Reinforcement, when used, shall be discontinuous at contraction and expansion joints with dowels installed in conformance with ACI 330R-01.

3.6 PLACING CONCRETE

A. Place concrete in accordance with IDOT SSRBC standards.

B. Ensure reinforcement, inserts, embedded parts, formed joints are not disturbed during concrete placement.

3.7 JOINTS

A. Saw cut contraction joints 3/16 inch wide at an optimum time after finishing. Cut 1/3 into depth of slab.

B. For parking lots, entrances, driveways and roadways, Contractor shall submit a joint plan in accordance with ACI 330R-01

3.8 FINISHING

A. Sidewalk Paving: Light broom, texture perpendicular to direction of travel with troweled and radiused edge 1/4 inch radius.

B. Curbs and Gutters: Light broom, texture parallel to pavement direction.

C. Place curing compound on exposed concrete surfaces immediately after finishing. Apply in accordance with manufacturer's instructions.

3.9 TOLERANCES

A. Maximum Variation of Surface Flatness: 1/4 inch in 10 ft.

3.10 FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
   1. Provide free access to concrete operations at project site and cooperate with appointed firm.
   2. Submit proposed mix design of each class of concrete to inspection and testing firm, Architect and Engineer for review prior to commencement of concrete operations.
   3. Tests of concrete and concrete materials may be performed at any time to ensure conformance with specified requirements.

B. Compressive Strength Tests: ASTM C39/C39M; for each test, mold and cure three concrete test cylinders. Obtain test samples for every 100 cu yd or less of each class of concrete placed.
   1. Take one additional test cylinder during cold weather concreting, cured on job site under same conditions as concrete it represents.
   2. Perform one slump test for each set of test cylinders taken.

C. Maintain records of placed concrete items. Record date, location of pour, quantity, air temperature, and test samples taken.

3.11 PROTECTION

A. Immediately after placement, protect pavement from premature drying, excessive hot or cold temperatures, and mechanical injury.

B. Do not permit pedestrian traffic over pavement until 75 percent design strength of concrete has been achieved.

END OF SECTION 32 13 13

SECTION 32 17 26 – TACTILE WARNING SURFACING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Plastic tactile and detectable warning tiles for pedestrian walking surfaces.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete for sidewalks and platforms.

B. Section 32 17 23.13 - Painted Pavement Markings: Crosswalk and curb markings.

1.3 REFERENCE STANDARDS

A. 49 CFR 27, 37, and 38 - Standards for Accessible Transportation Facilities, Final Rule; Department of Transportation ; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design ; 2010.

C. ATBCB PROWAG - Proposed Accessibility Guidelines for Pedestrian Facilities in the Public Right-of-Way ; 2011.

1.4 WARRANTY

A. Plastic Tiles: Provide manufacturer's standard warranty against manufacturing defects, breakage or deformation.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Plastic Tactile and Detectable Warning Surface Tiles:

2.2 TACTILE AND DETECTABLE WARNING DEVICES

A. Plastic Tactile and Detectable Warning Tiles: ADA Standards compliant, glass fiber and carbon fiber reinforced, exterior grade, matte finish polyester sheet with truncated dome pattern, solid color throughout, internal reinforcing of sheet and of truncated domes, integral radius cut lines on back face of tile; with factory applied removable protective sheeting.

1. Pattern: In-line pattern of truncated domes complying with ADA Standards and IDOT SSRBC.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work area is ready to receive work:

1. Examine work area with installer present.
2. If existing conditions are not as required to properly complete the work of this section, notify Engineer.
3. Do not proceed with installation until deficiencies in existing conditions have been corrected.

B. Verify that dimensions, tolerances, and attachment methods for work in this section are properly coordinated with other work on site.

3.2 INSTALLATION, GENERAL

A. Install in accordance with manufacturer's written instructions and IDOT SSRBC.

1. Do not install damaged, warped, bowed, dented, abraded, or otherwise defective units.
2. Do not install when ambient or substrate temperature has been below 40 degrees F during the preceding 8 daylight hours.

B. Field Adjustment:

1. Cut units to size and configuration shown on drawings.
2. Locate relative to curb line in compliance with ATBCB PROWAG, Sections 304 and 305.
3. Orient so dome pattern is aligned with the direction of ramp.

C. Install units fully seated to substrate, square to straight edges and flat to required slope.

D. Align units so that tops of adjacent units are flush and joints between units are uniform in width.

3.3 PROTECTION

A. Protect installed units from traffic, subsequent construction operations or other imposed loads until concrete is fully cured.

B. Touch-up, repair or replace damaged products prior to Date of Substantial Completion.

END OF SECTION 32 17 26

SECTION 32 92 23 – SODDING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Preparation of subsoil.

B. Placing topsoil.

C. Fertilizing.

D. Sod installation.

E. Maintenance.

1.2 RELATED REQUIREMENTS

A. Section 31 22 00 - Grading: Topsoil material.

B. Section 31 22 00 - Grading: Preparation of subsoil and placement of topsoil in preparation for the work of this section.

C. Section 31 23 23 - Fill: Topsoil material.

1.3 DEFINITIONS

A. Weeds: Includes Dandelion, Jimsonweed, Quackgrass, Horsetail, Morning Glory, Rush Grass, Mustard, Lambsquarter, Chickweed, Cress, Crabgrass, Canadian Thistle, Nutgrass, Poison Oak, Blackberry, Tansy Ragwort, Bermuda Grass, Johnson Grass, Poison Ivy, Nut Sedge, Nimble Will, Bindweed, Bent Grass, Wild Garlic, Perennial Sorrel, and Brome Grass.

1.4 REFERENCE STANDARDS

A. IDOT SSRBC Section 252 and applicable sections thereof.

1.5 SUBMITTALS

A. Certification: Submit certification of grass species and location of sod source.

1.6 QUALITY ASSURANCE

A. Sod Producer: Company specializing in sod production and harvesting certified by the State of Illinois.

1.7 REGULATORY REQUIREMENTS

A. Comply with regulatory agencies for fertilizer and herbicide composition.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Deliver sod on pallets. Protect exposed roots from dehydration.

B. Do not deliver more sod than can be laid within 24 hours.

PART 2 PRODUCTS

2.1 MATERIALS

A. Sod: Salt Tolerant and complying with IDOT SSRBC Section 1081.03(b).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared soil base is ready to receive the work of this section.

3.2 PREPARATION

A. Prepare subgrade in accordance with Section 31 22 00.

B. Place topsoil in accordance with Section 31 22 00.

3.3 FERTILIZING

A. Apply fertilizer in accordance with manufacturer's instructions.

B. Apply after smooth raking of topsoil and prior to installation of sod.

C. Apply fertilizer no more than 48 hours before laying sod.

D. Mix thoroughly into upper 2 inches of topsoil.

E. Lightly water to aid the dissipation of fertilizer.

3.4 LAYING SOD

A. Moisten prepared surface immediately prior to laying sod.

B. Lay sod immediately after delivery to site to prevent deterioration.

C. Lay sod smooth and tight with no open joints visible, and no overlapping; stagger end joints 12 inches minimum. Do not stretch or overlap sod pieces.

D. Where new sod adjoins existing grass areas, align top surfaces.

E. Water sodded areas immediately after installation. Saturate sod to 4 inches of soil.

F. After sod and soil have dried, roll sodded areas to ensure good bond between sod and soil and to remove minor depressions and irregularities. Roll sodded areas with roller in accordance with IDOT SSRBC.

3.5 MAINTENANCE

A. Provide maintenance at no extra cost to Owner; Contractor to provide water.

B. Mow grass at regular intervals to maintain at a maximum height of 2-1/2 inches. Do not cut more than 1/3 of grass blade at any one mowing.

C. Neatly trim edges and hand clip where necessary.

D. Immediately remove clippings after mowing and trimming.

E. Water to prevent grass and soil from drying out.

F. Roll surface to remove irregularities.

G. Control growth of weeds. Apply herbicides in accordance with manufacturer's instructions. Remedy damage resulting from improper use of herbicides.

H. Immediately replace sod to areas that show deterioration or bare spots.

I. Protect sodded areas with warning signs during maintenance period.

END OF SECTION 32 92 23

SECTION 33 05 13 – MANHOLES AND STRUCTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Modular precast concrete manhole sections with tongue-and-groove joints with masonry transition to lid frame, covers, anchorage, and accessories.

1.2 REFERENCE STANDARDS

A. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2012).

B. ASTM C478 - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections; 2015a.

C. ASTM C478M - Standard Specification for Circular Precast Reinforced Concrete Manhole Sections (Metric); 2015a.

D. ASTM C923 - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals; 2008 (Reapproved 2013).

E. ASTM C923M - Standard Specification for Resilient Connectors Between Reinforced Concrete Manhole Structures, Pipes, and Laterals (Metric); 2008b (Reapproved 2013).

F. City of Crystal Lake Standards.

1.3 SUBMITTALS

A. Product Data: Provide manhole covers, component construction, features, configuration, and dimensions.

B. Shop Drawings: Indicate manhole locations, elevations, piping sizes and elevations of penetrations.

PART 2 PRODUCTS

2.1 MATERIALS

A. Manhole Sections: Reinforced precast concrete in accordance with ASTM C478 (ASTM C478M), with resilient connectors complying with ASTM C923 (ASTM C923M).

2.2 COMPONENTS

A. Lid and Frame: Complying with standard details in engineering drawings.

B. Manhole Steps: Complying with standard details in engineering drawings.

2.3 CONFIGURATION

A. Clear Inside Dimensions: As indicated in standard details in engineering drawings.

B. Clear Lid Opening: As indicated in standard details in engineering drawings.

C. Steps: As indicated in standard details in engineering drawings

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify items provided by other sections of Work are properly sized and located.

B. Verify that built-in items are in proper location, and ready for roughing into Work.

C. Verify excavation for manholes is correct.

3.2 MANHOLES

A. Place concrete base pad, trowel top surface level.

B. Place manhole sections plumb and level, trim to correct elevations, anchor to base pad.

C. Cut and fit for pipe.

D. Grout base of shaft sections to achieve slope to exit piping. Trowel smooth. Contour as required.

E. Set cover frames and covers level without tipping, to correct elevations.

F. Coordinate with other sections of work to provide correct size, shape, and location.

END OF SECTION 33 05 13

SECTION 33 11 17 – SITE CASING PIPE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe and fittings for site water lines including domestic water lines and fire water lines.

1.2 RELATED REQUIREMENTS

A. Section 33 11 16 – Site Water Utility Distribution Piping

B. Section 33 41 11 – Site Storm Utility Drainage Piping

1.3 REFERENCES

A. ASTM A 139

B. AWWA C206

1.4 SUBMITTALS

A. Product Data: Provide data on pipe materials and accessories.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

PART 2 PRODUCTS

2.1 PVC SDR 26 CASING PIPE FOR WATERMAIN - OPEN TRENCH

A. Where indicated on plans the proposed 8” watermain shall be encased in PVC SDR 26 pipe.

B. Pipe: Provide new PVC SDR 26 pipe conforming to ASTM D2241 with joints confirming to ASTM D3212

C. Casing Spacers: Spacers shall have a T304 stainless steel shell with PVC lining, stainless steel bolts, and ultra-high molecular weight polymer runners, Cascade Waterworks Mfg. Co. Model CCS or approved equal. Spacers shall be joint restraint spacers. Spacer interval shall be as recommended by the spacer manufacturer and pipe manufacturer.

D. End Seals: Ends of the casing pipe shall be sealed with rubber end seals secured in place with stainless steel bands, Cascade Waterworks Mfg. Co. Model CCES or approved equal.

2.2 FIBERGLASS CASING PIPE – OPEN TRENCH (ALTERNATE BID 2)

A. Where indicated on plans the proposed storm sewer pipes shall be encased in fiberglass casing pipe.

B. Pipe: Provide new fiberglass casing pipe conforming to AWWA M45, AWWA C950 with Flush Bell-Spigot Joints.

C. Casing Spacers: Spacers shall have a T304 stainless steel shell with PVC lining, stainless steel bolts, and ultra-high molecular weight polymer runners, Cascade Waterworks Mfg. Co. Model CCS-JR or approved equal. Spacers shall be joint restraint spacers. Spacer interval shall be as recommended by the spacer manufacturer and pipe manufacturer.

D. End Seals: Ends of the casing pipe shall be sealed with rubber end seals secured in place with stainless steel bands, Cascade Waterworks Mfg. Co. Model CCES or approved equal.

2.3 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 23 16.13.

B. Complying with standard details in engineering drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.2 TRENCHING

A. See the sections on excavation and fill for additional requirements.

B. Form and place concrete for pipe thrust restraints at each change of pipe direction. Place concrete to permit full access to pipe and pipe accessories.

C. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.3 INSTALLATION - PIPE

A. Establish elevations of buried piping to ensure not less than 6 ft of cover.

B. Route pipe in straight line.

C. Provide tie drawings to Engineer and Owner of the location of both ends of the empty casing pipe.

END OF SECTION 33 11 17

SECTION 33 13 00 – DISINFECTING OF WATER UTILITY DISTRIBUTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disinfection of site domestic water lines and site fire water lines specified in Section 33 11 16.

B. Testing and reporting results.

1.2 RELATED REQUIREMENTS

A. Section 33 11 16 - Site Water Utility Distribution Piping.

1.3 PRICE AND PAYMENT PROCEDURES

A. See Section 01 22 00 - Unit Prices, for additional unit price requirements.

1.4 REFERENCE STANDARDS

A. AWWA B300 - Hypochlorites; American Water Works Association ; 2011 (ANSI/AWWA B300).

B. AWWA B301 - Liquid Chlorine; American Water Works Association ; 2010 (ANSI/AWWA B301).

C. AWWA B302 - Ammonium Sulfate; American Water Works Association ; 2010 (ANSI/AWWA B302).

D. AWWA B303 - Sodium Chlorite; American Water Works Association ; 2010.

E. AWWA C651 - Disinfecting Water Mains; American Water Works Association ; 2005 (ANSI/AWWA C651).

F. Standard Specifications for Water and Sewer Construction in Illinois and City of Crystal Lake Standards.

1.5 SUBMITTALS

A. Test Reports: Indicate results comparative to specified requirements.

B. Disinfection report:
   1. Type and form of disinfectant used.
   2. Date and time of disinfectant injection start and time of completion.
   3. Test locations.
   4. Initial and 24 hour disinfectant residuals (quantity in treated water) in ppm for each outlet tested.
   5. Date and time of flushing start and completion.
   6. Disinfectant residual after flushing in ppm for each outlet tested.

C. Bacteriological report:
   1. Date issued, project name, and testing laboratory name, address, and telephone number.
   2. Time and date of water sample collection.
   3. Name of person collecting samples.
   4. Test locations.
   5. Initial and 24 hour disinfectant residuals in ppm for each outlet tested.
   6. Coliform bacteria test results for each outlet tested.
   7. Certification that water conforms, or fails to conform, to bacterial standards per Standard Specifications for Water and Sewer Construction in Illinois and City of Crystal Lake Standards.

1.6 QUALITY ASSURANCE

A. Submit bacteriologist's signature and authority associated with testing.

PART 2 PRODUCTS

2.1 DISINFECTION CHEMICALS

A. Chemicals: As specified in Standard Specifications for Water and Sewer Construction in Illinois and City of Crystal Lake Standards

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping system and water well has been cleaned, inspected , and pressure tested.

B. Schedule disinfecting activity to coordinate with start-up, testing, adjusting and balancing, demonstration procedures, including related systems.

3.2 DISINFECTION

A. Use method prescribed by the applicable state or local codes, or health authority or water purveyor having jurisdiction, or in the absence of any of these follow AWWA C651.

B. Provide and attach equipment required to perform the work.

C. Inject treatment disinfectant into piping system.

D. Maintain disinfectant in system for 24 hours.

E. Flush, circulate, and clean until required cleanliness is achieved; use municipal domestic water.

F. Replace permanent system devices removed for disinfection.

G. Pressure test system to requirements of City of Crystal Lake and Standard Specifications for Water and Sewer Construction in Illinois. Repair leaks and re-test.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 40 00.

B. Test samples in accordance with AWWA C651 and City of Crystal Lake standards.

END OF SECTION 33 13 00

SECTION 33 41 11 – SITE STORM UTILITY DRAINAGE PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Storm drainage piping, fittings, and accessories.

B. Connection of drainage system to municipal sewers.

C. Catch basins, Trench drains, Plant area drains, Paved area drainage, Site surface drainage, Detention tank, and Detention basin.

1.2 RELATED REQUIREMENTS

A. Section 31 23 16 - Excavation: Excavating of trenches.

B. Section 31 23 16.13 - Trenching: Excavating, bedding, and backfilling.

C. Section 31 23 23 - Fill: Bedding and backfilling.

D. Section 33 05 13 - Manholes and Structures.

1.3 DEFINITIONS

A. Bedding: Fill placed under, beside and directly over pipe, prior to subsequent backfill operations.

1.4 REFERENCE STANDARDS

A. ASTM C76 - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe; 2016.

B. ASTM C76M - Standard Specification for Reinforced Concrete Culvert, Storm Drain, and Sewer Pipe (Metric); 2015.

C. ASTM C443 - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets; 2012.

D. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2011.

1.5 SUBMITTALS

A. Product Data: Provide data indicating pipe and pipe accessories.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Project Record Documents:

1. Record location of pipe runs, connections, catch basins, cleanouts, and invert elevations.

PART 2 PRODUCTS

2.1 SEWER PIPE MATERIALS

A. Concrete Pipe: Reinforced, ASTM C76 (ASTM C76M), Class II with Wall type A; mesh reinforcement; bell and spigot end joints.

B. Reinforced Concrete Pipe Joint Device: ASTM C443 (ASTM C443M) rubber compression gasket joint.

C. High-density polyethylene Storm Sewer Pipe (BID ALTERNATE 1): Pipe shall conform have a cell classification of 435400C per ASTM D3350 with a maximum carbon black content of 4%. Pipe shall conform with NCLS testing as specified in Sections 9.5 and 5.1 of AASHTO M294 and ASTM F2306 respectively. Joints and Fittings shall be bell and spigot meeting AASHTO M252, AASHTO M294 or ASTM F2306. Joints shall be watertight according to ASTM D3212. Gaskets shall meet the requirements of ASTM F477 and be installed buy the pipe manufacturer. ADS N-12 WT IB pipe or approved equal.

2.2 PIPE ACCESSORIES

A. Fittings: Same material as pipe molded or formed to suit pipe size and end design, in required tee, bends, elbows, cleanouts, reducers, traps and other configurations required.

2.3 CATCH BASIN, TRENCH DRAIN, CLEANOUT, AND AREA DRAIN COMPONENTS

A. Lids and Drain Covers: Complying with City of Crystal Lake standard details in engineering plans.

2.4 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 23 23.

B. Cover: As specified in Section 31 23 16.13.

PART 3 EXECUTION

3.1 TRENCHING

A. See Section 31 23 16.13 - Trenching for additional requirements.

B. Backfill around sides and to top of pipe with cover fill, tamp in place and compact, then complete backfilling.

3.2 INSTALLATION - PIPE

A. Verify that trench cut is ready to receive work and excavations, dimensions, and elevations are as indicated on layout drawings.

B. Install pipe, fittings, and accessories in accordance with manufacturer's instructions. Seal watertight.

C. Lay pipe to slope gradients noted on layout drawings; with maximum variation from true slope of 1/8 inch in 10 feet.

D. Connect to building storm drainage system, foundation drainage system, and utility/municipal sewer system.

3.3 INSTALLATION - CATCH BASINS, TRENCH DRAINS AND CLEANOUTS

A. Form bottom of excavation clean and smooth to correct elevation.

B. Form and place cast-in-place concrete base pad, with provision for sanitary sewer pipe end sections.

C. Establish elevations and pipe inverts for inlets and outlets as indicated.

D. Mount lid and frame level in grout, secured to top cone section to elevation indicated.

3.4 FIELD QUALITY CONTROL

A. Perform field inspection in accordance with Section 01 40 00 - Quality Requirements.

3.5 PROTECTION

A. Protect pipe and bedding cover from damage or displacement until backfilling operation is in progress.

END OF SECTION 33 41 11