RQAW | DCCM

ADDENDUM NO. 1

Job Name:	Kokomo Bus Maintenance Facility
Project Number:	700-6054
Date of Addendum:	**10/22/2025**

_____

Licensed Architect
State of Indiana Registration No. 10700168

THIS ADDENDUM FORMS A PART OF THE CONTRACT DOCUMENTS AND IS ISSUED IN ACCORDANCE WITH THE INSTRUCTIONS TO BIDDERS. ACKNOWLEDGE RECEIPT OF THIS ADDENDUM BY SIGNING THE ADDENDUM ACKNOWLEDGEMENT SECTION OF YOUR PROPOSAL.

Specifications:

1. **REVISE** section 00 11 16 Invitation to Bid as follows:
   A. Revised date of bids to be received date to November 12th.

2. **REVISE** section 00 21 14 Instructions to Bidders as follows:
   A. Section 1.11 Prebid Conference, note A. has a revised date of November 4th for the pre-bid conference.
   B. Section 1.21 Bid Opening, note B. has a revised date of November 12th for the bid opening.

Additional Notes: The revised specification sections have been included in the revised project manual included with this addendum.

END OF ADDENDUM 1

Project: Kokomo Bus Maintenance Facility

Bidding RFI #01

Date: 10.22.2025

Question(s):

Page 15 and 16 in the specs have dates for pre-bid meeting on the 4th of November and bid due date on the 12th of November.

Page 19 and 22 in the specs have dates for pre-bid meeting on the 21st of October and bid due on the 29th of October.

This has me questioning which dates are accurate and to be true.

Can you clarify for me the date and times for both the pre-bid and bid due date.

Response:

The bids will be due on November 12th and the pre-bid meeting will be held on November 4th. An addendum will be issued with the corrected dates implemented in the specifications.

PROJECT MANUAL

for

Kokomo Bus Maintenance Facility

919 Millbrook Lane, Kokomo, IN 46901

Project No: 700-6054

PREPARED FOR:

The City of Kokomo
100 S. Union Street
Kokomo, IN 46901

RQAW

DCCM

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INVITATION TO BID

NOTICE is hereby given that sealed bids will be received as follows:

BY: The City of Kokomo

FOR: Kokomo Bus Maintenance Facility
919 Millbrook Lane
Kokomo, IN 46901

Bids will be opened and publicly read aloud at:

- **Kokomo City Council Chambers**
- **1st Floor of Kokomo City Hall, 100 S. Union Street**
- **Kokomo, IN 46901**

At the following day and time: **November 12, 2025 at 10:00 AM (local time).**

Bids should be delivered to the following location prior to 10:00 AM on the date of the bid:

- **Kokomo City Board of Works' Office**
- **100 S. Union Street**
- **Kokomo, IN 46901**

Bids received after the date and time set for receipt and opening of bids as herein indicated will be returned unopened.

Bids will be received for a single prime contract.

Bids shall be in full accordance with the Construction Documents which are now on file with the Owner or with the Architect and may be examined by prospective Bidders at the following location:

Board of Public Works Clerk's Office
100 S. Union Street
Kokomo, IN 46901

Bidders may obtain complete sets of Construction Documents from:

Eastern Engineering
9901 Allisonville Road
Fishers, IN 46038
p: 317-598-0661
f: 317-598-0630

DOCUMENT AVAILABILITY: Documents will be available on a non-refundable basis. See printers website for additional details.

Individual sheets of Drawings or Specifications may be purchased for the costs listed on the plan room website.

Bids shall include BID SECURITY in the form of a Bid Bond or certified check in the amount of a sum no less than 10 percent of the Bid Sum including all add alternates.

Refer to other bidding requirements described in Section 00 21 14 - Instructions to Bidders and Section 00 31 00 - Information Available to Bidders.

There will be a mandatory Pre-Bid Meeting held in the Engineering Conference Room on the 2nd floor of Kokomo City Hall at 10:00 AM on Tuesday, November 4th, 2025.

All Contractors submitting bids on this project must attend the pre-bid meeting. Contractors who do not attend the pre-bid meeting will have their bid returned unopened.

The Contract Documents, including specifications and plans are on file and may be obtained at the City Board of Works' Office located on the third floor, City Hall, Kokomo City Hall, Kokomo, Indiana.

All bids must be received in the City Board of Works' Office, Third Floor, City Hall, 100 South Union Street, Kokomo, Indiana, prior to 10:00 A.M. on the 12th day of November, 2025 as stated above. Bids received after the aforementioned deadline will be returned to the bidder unopened.

Copies of the detailed specifications for said services and the necessary bid documents are on file in said Board of Works' Office where copies may be obtained.

Each bid shall be submitted on a BOW Approved Bid Form, a copy which may be obtained at the Board of Works' Office and a Financial Statement.

The BOW reserves the right to accept or reject any or all bids and to waive any irregularities in submitting a bid, whichever is in the best interest of the City of Kokomo.

The Contractor to whom the work is awarded will be required to furnish a Performance Bond in an amount equal to the contract amount before commencing work.

END OF SECTION

SECTION 00 21 14

INSTRUCTIONS TO BIDDERS

1.1 SUMMARY

A. Document Includes:
1. Intent.
2. Contract Time.
3. Definitions.
4. Contract Documents identification.
5. Availability of documents.
6. Examination of documents.
7. Inquiries and Addenda.
8. Product substitutions.
9. Site examination.
10. Prebid conference.
11. Subcontractors.
12. Submission procedure.
13. Bid ineligibility.
14. Security deposit.
15. Performance Assurance.
16. Bid Form requirements.
17. Tax Exemption.
18. Bid Form signature.
19. Additional Bid information.
20. Bid opening.
21. Duration of offer.
22. Acceptance of offer.

1.2 INTENT

A. The intent of this Bid request is to obtain an offer to perform work to complete the project for a Stipulated Sum contract, in accordance with Contract Documents.

1.3 CONTRACT TIME

A. The Contract Time has been identified in the Bid Form.

1.4 DEFINITIONS

A. Bidding Documents: Contract Documents supplemented with Invitation to Bid, Instructions to Bidders, Information Available to Bidders, Bid Form, Bid Form Supplements and Appendices, and bid securities, identified.

B. Contract Documents: Defined in AIA Document A201-2017 Article 1, including issued Addenda.

C. Bid: Executed Bid Form and required attachments submitted in accordance with these Instructions to Bidders.

D. Bid Sum: Monetary sum identified by the Bidder in the Bid Form.

1.5 CONTRACT DOCUMENTS IDENTIFICATION

A. The Contract Documents are identified as Project number 700-6054 as prepared by RQAW Corporation located at 8770 North Street Ste. 110, Fishers, IN 46038.

1.6 AVAILABILITY OF DOCUMENTS

A. Bidding Documents may be obtained as stated in Invitation to Bid.

B. Bidding Documents are made available only for the purpose of obtaining offers for this Project. Their use does not grant a license for other purposes.

1.7 EXAMINATION OF DOCUMENTS

A. Bidding Documents may be viewed at the office of the Architect/Engineer or construction association plan room facilities identified in the Invitation to Bid.

B. Upon receipt of Bidding Documents verify documents are complete. Notify Architect/Engineer if documents are incomplete.

C. Immediately notify Architect/Engineer upon finding discrepancies or omissions in Bidding Documents.

1.8 INQUIRIES AND ADDENDA

A. Direct questions in writing on “Bidders Request for Information Form” and deliver to the office of the Architect/Engineer; Email the Project Manager, Zachary Isaacs, at zisaacs@dccm.com

B. Verbal answers are not binding on any party.

C. Submit questions not less than 4 days before date set for receipt of Bids. Replies will be made by Addenda.

D. Addenda may be issued during bidding period. Addenda will be sent to known Bidders. Addenda become part of the Contract Documents. Include resultant costs in the Bid Sum.

1.9 PRODUCT SUBSTITUTIONS

A. Where Bidding Documents stipulate particular Products, substitution requests will be considered by Architect/Engineer up to 4 days before receipt of Bids.

B. With each substitution request, provide sufficient information for Architect/Engineer to determine acceptability of proposed products.

C. When a request to substitute a Product is made, Architect/Engineer may approve the substitution. Approved substitutions will be identified by Addenda.

D. In submission of substitutions to Products specified, Bidders shall include in their Bid, changes required in the Work and changes to Contract Time and Contract Sum to accommodate such approved substitutions. Later claims by the Bidder for an addition to the Contract Time or Contract Sum because of changes in Work necessitated by use of substitutions will not be considered.

E. A request constitutes a representation that Bidder:
1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
2. Will provide same warranty for Substitution as for specified product.
3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
4. Waives claims for additional costs or time extension which may subsequently become apparent.
5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.
6. The product shall be readily available in sufficient quantity to prevent delay of any work, available in the same range of colors, textures, dimensions, gages, types, and finishes as the material specified.
7. The product shall be equal in strength, durability, efficiency, serviceability, ease and cost of maintenance and compatible with the building design and not necessitate design modifications by the Architect/Engineer nor impose additional work of require changes in the work.

1.10 SITE EXAMINATION

A. Examine Project site before submitting a Bid.

B. Contact the Owner or Architect/Engineer to arrange date and time to visit Project site. After the pre-bid conference, a site visit will be made for those that want to attend.

C. No claims for extra compensation shall be allowed due to failure of any Bidder to examine conditions which exist neither at the building site nor for conditions or difficulties encountered in execution of work which may have been avoided by such examination.

1.11 PREBID CONFERENCE

A. A pre-bid conference is scheduled 10:00 AM local time, on November 4th in the Engineering Conference Room on the 2nd floor of the Kokomo City Hall located at 100 S. Union Street, Kokomo, IN 46901. There will be a tour of the project area immediately after the pre-bid conference.

B. General contract Bidders, subcontractors and suppliers are invited to attend.

C. Representatives of the Owner and Architect/Engineer will be in attendance.

D. Summarized minutes of this meeting will be circulated to known Bidders. These minutes will not form part of Contract Documents.

E. Information relevant to Bidding Documents will be issued by Addendum.

1.12 SUBCONTRACTORS

A. The Owner reserves the right to reject a proposed Subcontractor for reasonable cause.

B. Refer to AIA Document A201-2017, Article 5 of General Conditions.

1.13 SUBMISSION PROCEDURE

A. Bidders shall be solely responsible for delivery of Bids in manner and time prescribed.

B. Submit two copies of executed offer on Bid Forms provided, signed and sealed with required security deposit in a closed opaque envelope, clearly identified with Bidder's name, Project name, and Owner's name on the outside.

C. The following items must be included with the Bid:
1. Bid Bond
2. Form No. 96 (Revised 2013) Contractor's Bid for Public Work
3. Section 00 41 13 Bid Form – Stipulated Price
4. Section 00 43 00 Bid Form Supplements
5. Section 00 43 23 Alternates

D. An abstract summary of submitted Bids will be made available to all Bidders following bid opening.

1.14 BID INELIGIBILITY

A. Bids that are unsigned, improperly signed or sealed, conditional, illegible, obscure, contain arithmetical errors, erasures, alterations, or irregularities of any kind, may be declared unacceptable at Owner's discretion.

B. Bid Forms, Appendices, and enclosures which are improperly prepared may be declared unacceptable at Owner's discretion.

C. Failure to provide security deposit, bonds or insurance requirements may invalidate the Bid at the discretion of the Owner.

1.15 SECURITY DEPOSIT

A. Bids shall be accompanied by security deposit as follows:
1. Bid Bond or certified check in the amount of a sum no less than 5 percent of the Bid Sum plus all add alternates on AIA Document A310 - Bid Bond.

B. Endorse Bid Bond or certified check in name of the Owner as obligee, signed and sealed by the principal (Contractor) and surety.

C. Security deposit of accepted Bidder will be returned after delivery to the Owner of the required Performance and Payment Bonds by the accepted Bidder.

D. Include the cost of security deposit in the Bid Sum.

E. After a Bid has been accepted, security deposits will be returned to the respective Bidders.

F. If no contract is awarded, security deposits will be returned.

1.16 PERFORMANCE ASSURANCE

A. Accepted Bidder: Provide a Performance and Payment bond as described in Document 00 73 13 - Supplementary Conditions - AIA.

B. Include the cost of performance assurance bonds in the Bid Sum and identify the cost when requested by the Owner.

1.17 BID FORM REQUIREMENTS

A. Complete requested information in the Bid Form and Bid Form Supplements.

1.18 TAX EXEMPTION

A. Materials supplied for this project are exempt from Indiana State sales tax.
   1. Call 765-456-7400 for tax ID number request.

1.19 BID FORM SIGNATURE

A. Sign Bid Form, as follows:
   1. Sole Proprietorship: Signature of sole proprietor in the presence of a witness who will also sign. Insert the words "Sole Proprietor" under the signature. Affix seal.
   2. Partnership: Signature of all partners in the presence of a witness who will also sign. Insert the word "Partner" under each signature. Affix seal to each signature.
   3. Corporation: Signature of a duly authorized signing officers in their normal signatures. Insert the officer's capacity in which the signing officer acts, under each signature. Affix the corporate seal. If the Bid is signed by officials other than the president and secretary of the company, or the president/secretary/treasurer of the company, submit a copy of the by-law resolution of their board of directors authorizing them to do so, with the Bid Form in the bid envelope.
   4. Joint Venture: Signature of each party of the joint venture under their respective seals in a manner appropriate to such party as described above, similar to requirements for Partnerships.

1.20 ADDITIONAL BID INFORMATION

A. The two apparent low bidders for each Prime Contract are required to complete and submit Document 00 43 00 - Bid Form Supplements within 48 hours of Bid opening.

B. The Owner and Architect/Engineer have the right to choose the Subcontractor, Material or Equipment for any particular item where the Bidder fails to list same.
   1. When products are named and a list of acceptable manufacturers is included in the specifications, Bidders shall select one of the named manufacturers in his Subcontractors and Materials List.
   2. After the submission and approval of this Subcontractors and Materials List by the Architect/Engineer and the Owner, the Contractor shall make no changes or alterations without the written approval of the Architect/Engineer and the Owner.

C. If proposed subcontractor of supplier submitted for approval does not fully comply with the Bid Documents, the Architect/Engineer or Owner may reject such proposed subcontractor or supplier. The Bidder must then submit and acceptable and qualified substitution for that portion of the work at no additional cost to the Owner and further the Contractor does not have the option to withdraw his/her bid without forfeiture of the bid security.

1.21 BID OPENING

A. Bids will be opened publicly immediately after time for receipt of Bids.

B. Bids will be opened at 10:00 AM local time on November 12th, 2025 at Kokomo City Board of Works' Office, 3rd Floor of Kokomo City Hall, 100 S. Union Street, Kokomo, IN 46901.

1.22 DURATION OF OFFER

A. Bids shall remain open to acceptance and shall be irrevocable for a period of Sixty (60) days after bid closing date.

1.23 ACCEPTANCE OF OFFER

A. The Owner reserves the right to accept or reject any or all offers.

B. After acceptance by the Owner, the Architect/Engineer, on behalf of the Owner, will issue to the accepted Bidder, a written Letter of Intent.

C. Notwithstanding delay in the preparation and execution of the Agreement, accepted Bidder shall be prepared, upon written Notice to Proceed, to commence work within seven (7) days following receipt of official written order of the Owner to proceed, or on date stipulated in such order.

D. The accepted bidder shall assist and cooperate with the Owner to prepare the Agreement, and within seven (7) days following its presentation shall execute Agreement and return it to the Owner.

END OF SECTION

SECTION 00 31 00

INFORMATION AVAILABLE TO BIDDERS

1.1 SUMMARY

A. Document Includes:
   1. Subsurface investigation report.

1.2 SUBSURFACE INVESTIGATION REPORT

A. A copy of a geotechnical report dated August 6, 2025 is included with this document.

B. This report identifies properties of below grade conditions and offers recommendations for design of foundations, prepared primarily for use of Architect/Engineer.

C. Recommendations described are not requirements of this Contract, unless specifically referenced in Contract Documents.

D. This report, by its nature, cannot reveal all conditions existing on the site. Should subsurface conditions be found to vary substantially from this report, changes in design and construction of foundations will be made, with resulting credits or expenditures to Contract Price/Sum accruing to Owner.

END OF SECTION

Docusign Envelope ID: 948317CE-C5C5-4556-99AE-E144A629A147

GEOTECHNICAL EVALUATION REPORT

CITY OF KOKOMO – BUS MAINTENANCE FACILITY
KOKOMO, INDIANA

SME Project Number: 100883.00
August 6, 2025

Docusign Envelope ID: 948317CE-C5C5-4556-99AE-E144A629A147

11800 Exit 5 Parkway
Suite 106
Fishers, IN 46037

T (317) 876-0200

www.sme-usa.com

August 6, 2025

Mr. Jon Pyke
Director of Engineering
City of Kokomo
100 South Union Street
Kokomo, Indiana 46901

c/o
Mr. Zach Isaacs
Project Architect
RQAW | DCCM
8770 North Street, Suite 110
Fishers, Indiana 46038

Via E-mail: zisaacs@dccm.com

RE: Geotechnical Evaluation Report
City of Kokomo – Bus Maintenance Facility
919 Millbrook Lane
Kokomo, Indiana
SME Project No. 100883.00

Dear Mr. Pyke:

We have completed our geotechnical evaluation for the referenced project. This report presents the results of our observations and analyses, our geotechnical recommendations, and a discussion of potential construction considerations based on the information disclosed by the borings.

We appreciate this opportunity to be of service. If you have questions or require additional information, please contact me.

Sincerely,

SME

Michael J. Hammond, PE
Senior Project Engineer

Enclosure: SME Geotechnical Evaluation Report; Dated August 6, 2025

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1. INTRODUCTION

This report presents the results of the geotechnical evaluation performed by SME for the proposed City of Kokomo – Bus Maintenance Facility located in Kokomo, Indiana. This evaluation was conducted in general accordance with the scope of services outlined in SME Proposal No. P02819.25, dated July 11, 2025. Our services for this evaluation were authorized by Mr. Jon Pyke with the City of Kokomo on July 14, 2025.

SME received the following information which was used in the evaluation and preparation of this report:

- A proposed geotechnical borings plan titled “City of Kokomo – Bus Maintenance Facility” which was prepared by RQAW | DCCM and dated June 18, 2025.
- Sheets S001 through S008, S100, S110, S120, S300, and S500 from a preliminary plan set titled “City of Kokomo – Bus Maintenance Facility” which was prepared by RQAW | DCCM and provided to SME on July 10, 2025.

SME completed four borings (B1 through B4) at the project site on July 18, 2025. Refer to the boring logs included in Appendix A for the specific depth of each individual boring. The approximate boring locations are depicted on Image No. 1 and on the Boring Location Diagram located in Appendix A (Figure No. 1). Soil descriptions and the field and laboratory test results are presented on the boring logs. Exploration and laboratory testing procedures are presented in Section 4.

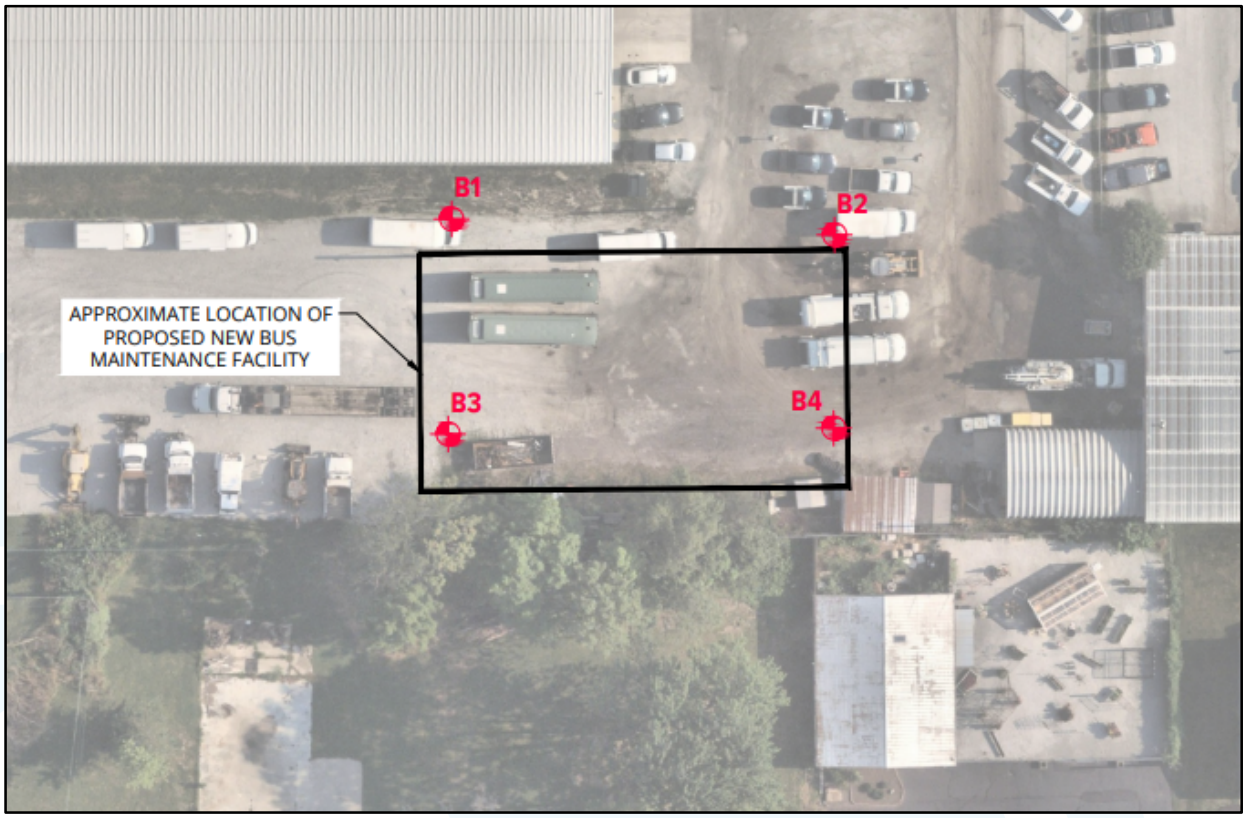

IMAGE NO. 1: Excerpt from Figure No. 1 in Appendix A – Boring Location Diagram (north facing upward)

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1.1 SITE CONDITIONS

SITE CONDITIONS

SITE FEATURE	DESCRIPTION
Location	The project site is located at the existing City of Kokomo bus maintenance facility at 919 Millbrook Lane in Kokomo, Indiana. The proposed location of the new bus maintenance facility structure will be located just southeast of the larger existing bus storage facility structure and west of the smaller existing bus maintenance facility structure. The location of the proposed new bus maintenance facility building is currently gravel covered. and used for
Terrain and Topography	The existing project area consists of gravel-covered areas currently used for parking and storage. The topography is relatively flat, with elevations ranging from approximately 810 to 812 feet based on limited review of Google Earth ground surface elevation data and field-collected measurements obtained by SME. Site topographic information was not provided at the time of this report.
Existing Structures	The proposed building site is situated between two existing single-story warehouse structures. The larger existing bus storage facility building, located on the north side of the property, has a footprint of approximately 28,000 square feet and has a finished floor elevation (FFE) of 811.00 feet. The smaller existing maintenance facility, on the east side of the property has an estimated footprint of about 9,600 square feet and has a FFE of 812.44 feet. The existing buildings appear to be slab-on-grade. Additionally, the provided geotechnical borings plan included locations of existing fuel tanks located just south of the proposed new bus maintenance facility building. Based on our site visit and Google Earth aerials, we have assumed these are underground storage tanks. We have assumed that the tanks will be removed as a part of the proposed development. The footprint of the underground tanks appear to be within proposed zone-of-influence of the wall foundations.
Historic Aerial and Topographic Review	A review of publicly available aerial imagery (dating back to 1957) indicates that the site was historically used for agricultural purposes until the construction of roadways and the existing warehouse buildings at 919 Millbrook Lane to the north and east of the proposed project area. The proposed building area appears to have been used for parking and storage beginning sometime between 1981 and 1998.

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1.2 PROJECT DESCRIPTION

PROJECT DESCRIPTION

PROPOSED FEATURE	DESCRIPTION
New Bus Maintenance Structure	The proposed bus maintenance facility structure will be a single-story building with a mezzanine in the southwest corner of the proposed building. The building will have a footprint of about 7,200 square feet, 60 feet by 120 feet in plan dimensions. The structure will be slab-on-grade.
Structure Loading	Proposed column and wall loads and/or anticipated vehicle loading were not provided at the time of this report. We have assumed maximum column loads of 80 kips and maximum wall loads of 2 kips per lineal foot.
Pavements and Utilities	Additional plans for site development were not provided at the time of this report. We have assumed that there will be site development features surrounding the building including pavements and utilities. Our scope of services does not include providing recommendations and/or considerations for the design and construction of pavements and utilities.
Proposed Site Grading	Proposed grading was not available at the time of this report. However, we have assumed cuts/fills up to about 1 to 2 feet for the general site grading.
Finish Floor Elevation (FFE)	A proposed FFE was not provided at the time of this report. We have assumed that the proposed FFE will match one of the existing adjacent structures at about 811 to 812 feet.

The recommendations of this report are based on the information provided above and the results of the field and laboratory evaluation. Contact SME if the final design information is different than discussed herein.

1.3 SUBSURFACE CONDITIONS

The borings were conducted in areas with varying surface cover. At Borings B1 and B3, surficial layers of sand and/or gravel were observed with approximate thicknesses of 1 inch and 6 inches, respectively. Beneath these surface materials at borings B1 and B3, clay fill was encountered and extended to depths of approximately 2 feet at B1 and 5 feet at B3. At Borings B2 and B4, fill material was encountered at the surface and consisted of sand with gravel and varying amounts of asphalt fragments and extended to depths of approximately 2.4 feet and 2 feet, respectively.

Beneath the fill, the subsurface conditions primarily consisted of natural clays, with varying amounts of sand and gravel. A layer of clayey sand was encountered in boring B1 at approximately 9.5 to 10 feet below surface grade. The natural clay soils varied in strength ranging from soft to hard and had moisture contents ranging from about 8 to 23 percent.

Groundwater was not encountered at borings B1 through B4 during or upon completion of the drilling, nor following removal of the drill tooling from the borings.

In cohesive soils (clays), a long time may be required for the groundwater level in the borehole to reach an equilibrium position. Therefore, the use of groundwater level observation wells (piezometers) is necessary to accurately determine the hydrostatic groundwater level within cohesive soils.

Refer to the Field Testing Procedures in Appendix B for additional information about groundwater level measurements. If more information regarding groundwater levels at this site is required, then we recommend performing additional subsurface assessment(s).

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2. ANALYSIS AND RECOMMENDATIONS

2.1 SITE PREPARATION AND EARTHWORK

2.1.1 EXISTING FILL CONSIDERATIONS

Based on information obtained from the borings, existing fill was encountered in the proposed building area. We consider the fill to be undocumented or uncontrolled since the origin of the existing fill is not known, we are not aware of records documenting the fill placement and any compaction operations, and because of the variable composition and density of the fill.

Based on the condition of the existing fill encountered in the borings, we recommend the existing fill be removed from beneath foundation areas per the recommendations in Section 2.2. However, the existing fill can be considered for support of floor slabs, provided the subgrade soils are evaluated by SME at the time of construction, and prepared as described below, prior to floor slab construction. Subgrade improvements including compaction in-place and/or removal of unsuitable materials and replacement with engineered fill could be necessary to achieve suitable subgrade conditions.

There are inherent risks of greater than typical settlement and poor structural performance associated with constructing structures over undocumented fills. The increased risks associated with supporting slabs-on-grade and pavements over the existing fill at this site could include greater than typical post-construction settlement, resulting in differential movements and associated cracking of the slabs. These risks can be reduced, but not eliminated, if SME further evaluates the existing fill at floor slab subgrades as discussed below and in Section 2.1.2. If SME will not evaluate the fill or if the risks described above are not acceptable to the Owner, then the existing fill should be completely removed from within the proposed building footprints and replaced with engineered fill.

If the existing fill will remain in-place for support of floor slabs, further evaluation of the existing fill must be conducted by SME during construction and prior to placing engineered fill to raise site grades. Further evaluation of existing fill should include observing the condition of the fill in hand-auger borings or shallow test pits, testing the fill using a dynamic cone penetrometer (DCP), observing the condition of the fill in the sides of the foundation excavations, and observing the response of the surface of the fill when subjected to a proofroll. Existing fill to remain in-place should be of sufficient strength and free of deleterious materials, such as excessive debris and organics. Unsuitable existing fill that cannot be improved in-place should be removed (i.e., undercut) and replaced with engineered fill that is placed and compacted per the requirements outlined in Section 2.1.4 of this report.

The recommendations provided in the following report sections are based on the assumption that existing fill will be removed below proposed foundations, but suitable existing fill that has been appropriately evaluated by SME will remain in-place and be used to support the floor slabs. If the Owner does not accept the stated assumptions and risks, please contact SME for revised recommendations.

2.1.2 GENERAL SITE SUBGRADE PREPARATION

In the building footprint area, completely remove existing utilities and below-grade tanks and other structures from the previous construction to expose suitable existing fills or natural soils, and backfill the excavations with properly placed engineered fill meeting the requirements of Section 2.1.4.

If it is necessary for existing utilities to be abandoned in-place, the utilities must not conflict with the proposed construction, they must be fully grouted, and the suitability of the existing backfill must be verified for structural support. Do not abandon utilities in-place within the zone of influence of proposed foundations.

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After stripping the site and removing deleterious materials, after cuts are made to design subgrade levels, but prior to filling, we recommend the exposed subgrade be subjected to a comprehensive proof-rolling program in the presence of SME. The purpose of proof-rolling is to locate areas of unsuitably soft/loose, yielding, or disturbed subgrade. Proof-rolling should be performed with heavy pneumatic-tire construction equipment such as a fully loaded, tandem-axle dump truck. Areas of unsuitable subgrade revealed during proof-rolling should be mechanically improved (compacted) in-place or removed and replaced with engineered fill. In areas that are not accessible to proof-rolling equipment, we recommend the exposed subgrade be evaluated by SME with hand-operated equipment such as dynamic cone penetrometers and hand augers.

The predominantly clayey soils encountered on site are susceptible to disturbance due to weather and activity on-site. Therefore, care should be exercised during construction to avoid disturbance of the subgrade and to ensure that clayey soils are suitably prepared prior to the placement of engineered fill. Areas of prepared subgrade may be protected from disturbance during construction by placing a layer of crushed aggregate or crushed concrete over the subgrade.

The contractor should remove or drain ponded surface water and grade the site to prevent surface water from draining toward, or ponding over the proposed building areas. Due to the poorly-draining nature of the clayey subgrade, the near-surface soils are at an elevated risk to experience disturbance such as pumping and/or rutting when exposed to construction traffic. We recommend shaping the site to facilitate surface water control toward the non-structural areas of the site, constructing designated haul roads, and limiting construction vehicle access to designated areas. Summer construction is desirable at this site in an attempt to reduce the amount of subgrade disturbance and required improvements.

After the exposed subgrade is proofrolled and improved as needed, and after the surface is thoroughly compacted, engineered fill may be placed on the prepared subgrade to establish final design subgrade levels. Refer to Section 2.1.4 of this report for materials and compaction requirements for engineered fill.

2.1.3 SUBGRADE PREPARATION FOR FLOOR SLABS

As discussed in Section 2.1.1, we anticipate the final subgrade for the building grade-slabs will primarily consist of engineered fill over suitable and improved existing fill or natural clays. We consider these materials suitable for support of grade-slabs, provided the report recommendations in Sections 2.1.1 and 2.1.2 are followed during construction.

We recommend a vertical modulus of subgrade reaction, k_{30}, of 100 pounds per cubic inch (pci) for the design of floor slabs supported by subgrade soil prepared and verified as described herein. We based this subgrade modulus on empirical relationships between soil type and plate load tests performed with a 30-inch diameter bearing plate. The modulus is the ratio of load in pounds per square-inch (psi) to a 0.05-inch deflection.

Prior to concrete placement for floor slabs, SME should observe and test the building pad subgrade to identify areas of disturbed during construction activities and verify/document the final subgrade conditions are suitable for floor slab support. Recompact unsuitable subgrade identified by SME or remove and replace it with engineered fill. Proofroll the final subgrade in areas accessible with large equipment. SME needs to test areas inaccessible to proofrolling equipment using hand-operated equipment such as cone penetrometers, hand auger probes, and density gauges.

We recommend providing a minimum 6-inch thick slab subbase consisting of an approved INDOT No. 53 dense graded aggregate to provide a leveling surface for construction of slabs, and a moisture capillary break between the slabs and the underlying soils. The thickness of dense-graded aggregate may need to be increased to protect the subgrade from disturbance during construction. When determining the aggregate thickness, consider the time of year, the condition of subgrade soils during construction, and the type and volume of construction equipment to traffic the prepared subgrade. The aggregate must also be compacted per Section 2.1.4 of this report.

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Place a vapor retarder below floor slabs to receive an impermeable floor finish/seal or a floor covering which would retard vapor transmission. The location the vapor retarder (relative to the subbase) should be determined by the Architect/Engineer based on the intended floor usage, planned finishes, and in accordance with ACI recommendations.

Separate slabs by isolation joints from structural walls and columns bearing on their own foundations to permit relative movement. Provide a minimum of 6 inches of engineered fill between the bottom of the slab and the top of the shallow spread foundation below.

Protect the slab-on-grade subgrade soils from frost during winter construction. Frozen soils must be thawed and compacted or removed and replaced prior to slab-on-grade construction.

2.1.4 ENGINEERED FILL REQUIREMENTS

The fill needs to be free of frozen soil, significant organics and construction debris, potentially expansive and/or chemically active materials, particle sizes hindering compaction, cobbles and boulders, shale, slag, and other deleterious materials. Spread fill in level layers with a loose thickness appropriate for the type of equipment used to obtain compaction, but not exceeding 9 inches thick. Thinner lifts will be required in confined spaces and where compaction is achieved using walk-behind rollers/compactors or plate compactors mounted on a backhoe or excavator (e.g., Ho-Pac®). Compact sand fill with a smooth drum vibratory roller or vibratory plate compactors. Compact clay fill by overlapping passes with sheepsfoot or padfoot roller at a moisture content between two percent above and below the optimum moisture content.

Engineered fill should be compacted to 100 percent of maximum dry density as determined in accordance with the Standard Proctor test (ASTM D698) below foundation bearing elevations. Engineered fill intended to support floor slabs should be compacted to at least 98 percent of maximum dry density as determined in accordance with the Standard Proctor test with the upper one foot of the subgrade being compacted to 100 percent. Fill placed in green areas should be compacted to at least 95 percent of maximum dry density as determined in accordance with the Standard Proctor test to limit settlement, which can contribute to uneven surface grades and depressions causing ponding of surface water.

Based on information from the borings, the natural clays, and some of the existing fill are generally considered suitable for reuse as site engineered fill, provided the material meets the requirements previously described. Some of the near surface natural clays are near or above typical optimum moisture contents, and moisture conditioning (discing and drying or chemical modification) will be required.

The successful reuse of the on-site clayey soils (USCS group symbols “CL” and “SC”) for engineered fill will depend on the time of year and the care the earthwork contractor uses during construction. During cold and wet periods, the clayey soils can become saturated, disturbed, and difficult to dry and compact. If such conditions occur, the contractor may have to use imported material, approved by SME, as engineered fill. The contractor should closely review the appended boring logs and perform test pits, as needed, to further evaluate the feasibility of reusing the on-site soils as engineered fill.

Clayey soils are difficult to compact in confined areas, such as in utility trenches and foundation excavations, where smaller, walk-behind type compaction equipment is required to be used. We recommend clayey soils not be used as engineered fill where drainage is required and should be used as engineered fill only in open areas where compaction is achieved with large equipment and where moisture conditioning is feasible. During wetter/colder periods of the year when moisture conditions of the clayey soils will likely not be feasible, we expect it will be necessary to import granular fill to the site and to use the clayey soils on non-structural areas of the site, if feasible. The in-situ moisture contents of the near-surface clays are anticipated to be above typical optimum moisture contents, and moisture-conditioning will be required.

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Granular material should be used to backfill utilities and in other areas where the excavations are narrow, and compaction is often achieved with plate-type compactors or walk-behind rollers. In these instances, and in areas where drainage is required, we recommend using open-graded granular fill material, such as INDOT No. 8 crushed aggregate. INDOT No. 53 crushed aggregate may be used where drainage is not required. Thinner lifts may be required in confined spaces to achieve compaction of the backfill.

The granular backfill placed in exterior pavement and slab-on-grade areas should be capped with at least 18 inches of lean clay, if necessary to match surrounding subgrade soils. Clay surface cap soils should be placed and compacted as engineered fill. The purpose of the clay cap is to create relatively uniform subgrade support conditions, matching the adjacent clay soils, and to reduce the potential for water to accumulate in the granular backfill below the clay cap that can potentially lead to premature pavement distress/failure.

If necessary, we recommend coarse crushed aggregate used to backfill undercuts or to stabilize subgrades consist of a well-graded crushed natural aggregate generally ranging from 1 to 3 inches in size with no more than 7 percent by weight passing the No. 200 sieve (such as INDOT No. 2 crushed aggregate). In cases where granular engineered fill will be placed over the coarse crushed aggregate, the surface of the coarse crushed material must be covered with a suitable non-woven geotextile or choked with INDOT No. 53 dense graded aggregate to help prevent migration of the granular materials into the coarser crushed aggregate.

2.2 FOUNDATIONS

2.2.1 SUBGRADE VERIFICATION

To verify suitable subgrade is exposed at the bearing surface of footing excavations, and that the maximum net allowable soil bearing pressure is achievable, foundation subgrades must be evaluated and tested during construction. By preparing the geotechnical evaluation report, SME is currently the geotechnical engineer of record for this project. We believe it is beneficial to the Owner to provide continuity from design through construction by retaining the current geotechnical engineer of record for this project (SME) to observe and test the foundation subgrades during construction. SME is best-suited to verify the recommendations are properly implemented during construction thereby reducing the potential for additional construction costs due to misunderstandings.

2.2.2 SHALLOW FOUNDATIONS

Borings B1 through B4 were drilled within the proposed building footprint. Fill material was encountered to a depth of about 5 feet at boring B3, and to depths of about 2 to 2.5 feet at borings B1, B2, and B4. Foundation excavations must extend below existing fills to encounter suitable natural underlying soils. Any remaining existing fills that will be considered to support the building floor slab must be further evaluated as discussed in Sections 2.1.1 and 2.1.2. Existing structural elements, underground tanks, and utilities remaining from the previous site development must be completely removed from the proposed building footprint, as discussed in Section 2.1.1. Excavations to remove existing fills and other materials must be backfilled with engineered fill meeting the requirements of Section 2.1.4.

We recommend using a maximum net allowable soil bearing pressure of 1,500 pounds per square foot (psf) for design of shallow column and continuous (wall) foundations bearing on suitable natural stiff to hard clays or engineered fill overlying suitable natural soils. The design bearing pressure provided is based on a minimum factor-of-safety of three (for general shear failure). Suitable natural bearing soils were generally encountered beneath the existing fill.

Once each foundation area is exposed, SME must observe and test the foundation subgrades to verify suitable bearing conditions are present. Unsuitable bearing soils encountered in foundation areas must be undercut to expose suitable bearing material. The foundation can then be constructed to bear directly

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on the suitable soils at the lower undercut level or, more typically, the design bearing surface can be reestablished so the foundation can be constructed at the design bearing elevation. In that case, the excavation should be oversized laterally, and backfilled with granular engineered fill or crushed aggregate as shown on Image No. 2 the *Typical Foundation Undercutting Diagram* below.

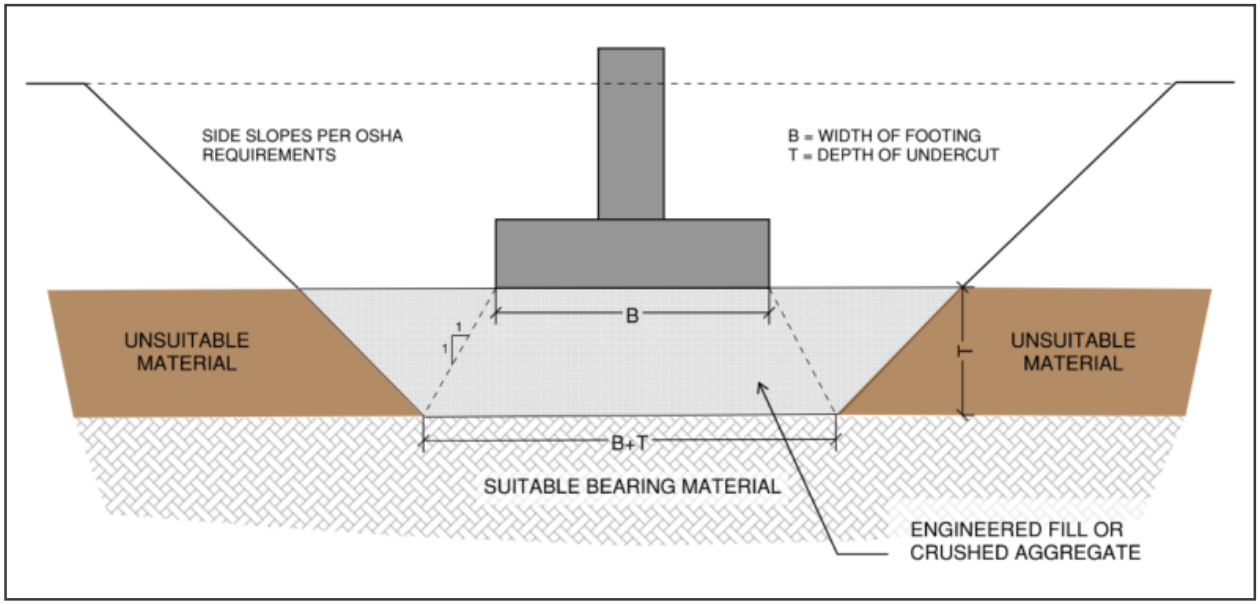

IMAGE NO. 2: Typical Foundation Undercutting Diagram

As indicated in the 2014 Indiana Building Code (Table 1608.2) for sites located in Howard County, shallow foundations must be situated a minimum of 30 inches below final site grade in any unheated areas for protection against frost action during normal winters. The contractor must protect the foundations and proposed bearing soils from freezing during construction if work occurs in the winter months.

Footing trenches should be excavated to a level bearing surface. Bearing surfaces should be cleaned of mud and loose cuttings and should be protected against water accumulation from rainfall, surface drainage, or excavation sidewall seepage prior to placing concrete. Place foundation concrete as soon as foundation excavations have been completed, and the design bearing pressure verified to reduce the potential for disturbance of the foundation subgrade. In cases where the excavation will remain exposed for a longer period of time, protect the subgrade soils with a concrete mud mat and protect the bearing soils from freezing if the work is performed during seasonally cold weather.

The clay soils appear to be mostly suitable for earth-formed foundations (neat trench methods). However, a sand strata and varying amounts of sands and gravels within the clay stratums were encountered in borings, which are subject to sloughing and caving, particularly where these soils are in a wet and/or poorly compacted condition. In such cases where sloughing occurs, the foundations should be constructed using man-made forms. Vertical excavation sidewalls must be maintained during foundation concrete placement and must not be allowed to “mushroom out” at the top to prevent frost related movements.

If side-wall caving occurs (regardless of the method of construction), remove the sloughed soils, re-establish an undisturbed bearing surface, and form the sidewalls as required. Place foundation concrete as soon as practical after foundation excavations have been completed and the design bearing pressure verified to reduce the potential for disturbance of the foundation subgrade.

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For bearing capacity and settlement considerations, we recommend continuous (wall) foundations have a minimum width of 18 inches and column foundations have a minimum lateral dimension of 30 inches. In cases where structural loads are light, the minimum foundation size criteria may govern the size of the foundations and not the recommended allowable soil bearing pressure.

Total settlements for shallow spread foundations bearing on suitable soils are estimated to be 1 inch or less, and differential settlements are estimated to be less than one-half of the total settlement. These settlement estimates are based on the boring information, the design maximum net allowable soil bearing pressure, the anticipated design structural loads (outlined in Section 1.2), our experience with similar structures and soil conditions, and field verification of suitable bearing soils by SME.

2.3 SEISMIC SITE CLASS

Based on the subsurface information obtained from the borings drilled to a maximum depth of 20 feet, our general experience in the project area, and with the specifications provided by the 2014 Indiana Building Code (modified 2012 International Building Code), a Site Classification of “D” applies to this site for structural seismic design.

3. EXCAVATION AND GROUNDWATER MANAGEMENT

Groundwater seepage into shallow excavations is not anticipated to be a significant factor during construction. However, groundwater infiltration and/or accumulations from precipitation events, surface run-off, or perched groundwater conditions could be encountered within shallow excavations. Standard sump pit and pumping procedures are expected to be adequate to control these accumulations on a localized basis. A working surface of either crushed aggregate or crushed concrete may be required to protect the exposed subgrade where seepage is encountered.

Based on the site history and boring logs, there is potential for random areas of undocumented fill with variable depths within the proposed buildings and pavement areas. We recommend the bid documents require prospective contractors to include unit prices for excavating disturbed soils and other unsuitable soils and replacing them with engineered fill. Also, establish a contingency in the construction budget for this work. Actual quantities can be verified during construction by measuring excavation volumes, counting truck loads, or a combination of the two methods.

Take care during demolition and earthwork operations to protect adjoining and adjacent utility structures. Do not undermine existing structures. Where necessary, install temporary shoring/bracing to properly shore/brace existing structures and protect them from distress.

The contractor must provide safely sloped excavations or adequately constructed and braced shoring systems in accordance with federal, state and local safety regulations for individuals working in an excavation that may expose them to the danger of moving ground. If material is stored or heavy equipment is operated near an excavation, use appropriate shoring to resist the extra pressure due to the superimposed loads.

Handle, transport and dispose excavated materials and groundwater in accordance with applicable environmental regulatory requirements. Refer to the project environmental consultant for additional information regarding handling and/or disposal of onsite soils and/or groundwater.

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4. EVALUATION PROCEDURES

4.1 FIELD EXPLORATION

The proposed number, locations, and depths of the borings were determined jointly by RQAW | DCCM and SME. SME located the borings in field and obtained the approximate existing ground surface elevation at the boring locations using our hand-held global positioning system (GPS). The elevations on the boring logs are rounded to the nearest 1/2-foot.

The borings were advanced using a rotary drill rig equipped with continuous flight augers. The borings included soil sampling based on Split-Barrel Sampling procedures.

Groundwater level measurements (or lack thereof) were recorded during and immediately after completion of each boring. After completion of drilling and obtaining groundwater level measurements, the boreholes were backfilled with auger cuttings.

The Field Testing Procedures in Appendix B provides more detailed descriptions of field tests typically performed by SME and referenced in this report.

Soil samples recovered from the field exploration were taken to our laboratory for further observations and testing.

4.2 LABORATORY TESTING

The laboratory testing program consisted of visually classifying the recovered samples in accordance with ASTM D-2488. Based on the laboratory testing, we prepared soil descriptions and assigned a group symbol for the various soil strata observed based on the Unified Soil Classification System (USCS). In addition, moisture content and hand penetrometer tests were performed on portions of cohesive samples obtained.

Upon completion of the laboratory testing, boring logs were prepared and include the soil descriptions, penetration resistances, pertinent field observations, and the results of the laboratory testing. Each log also includes the approximate existing ground surface elevation. Explanations of symbols and terms used on the boring logs are provided on the Boring Log Terminology sheet included in Appendix A.

Soil samples are normally retained in our laboratory for 60 days and are then disposed, unless instructed otherwise.

The Laboratory Testing Procedures in Appendix B provides descriptions of the laboratory tests. The results of the laboratory tests are presented on the boring logs and included in Appendix A.

5. SIGNATURES

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APPENDIX A

BORING LOCATION DIAGRAM (FIGURE NO. 1)
BORING LOG TERMINOLOGY
BORING LOGS (B1 THROUGH B4)

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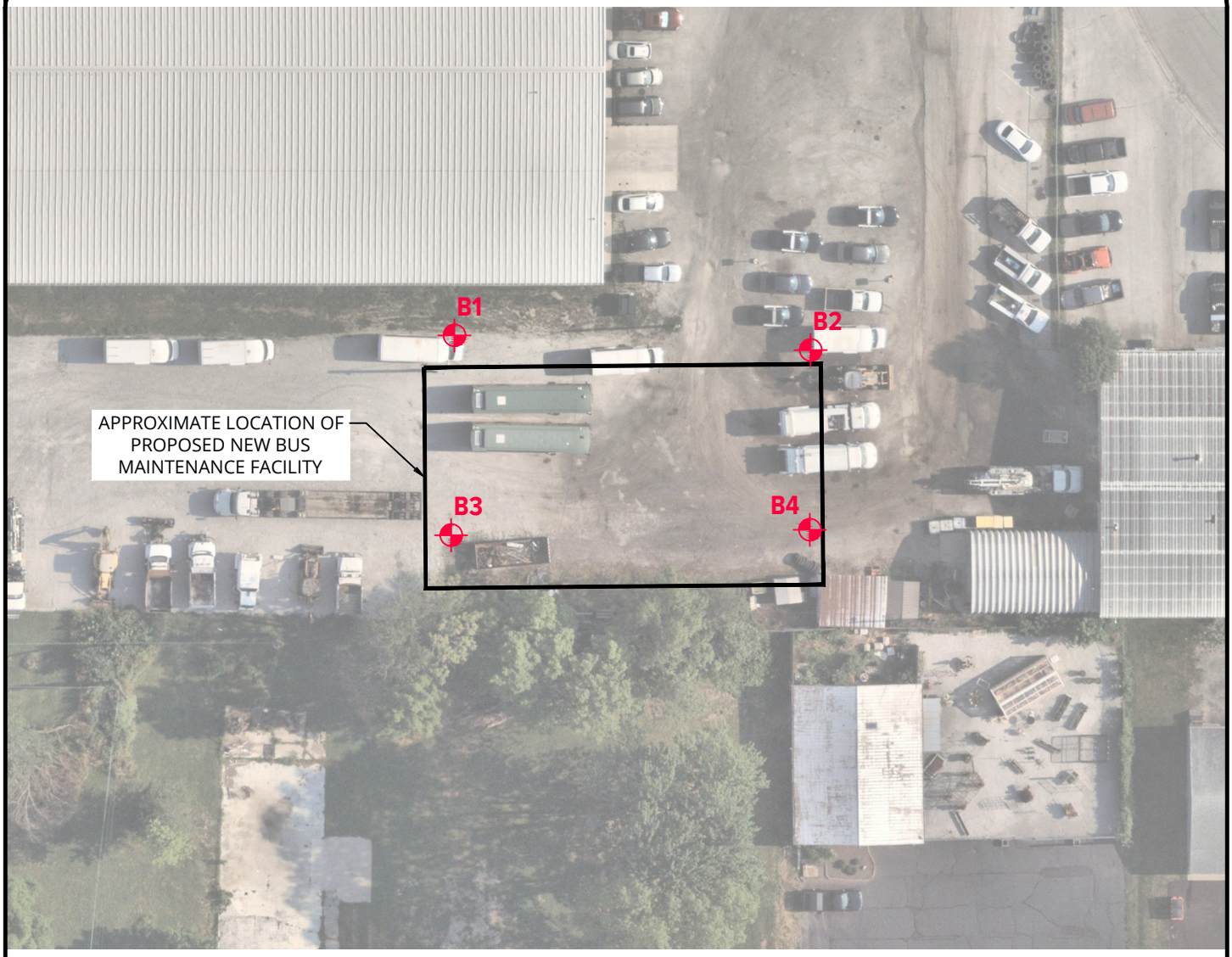

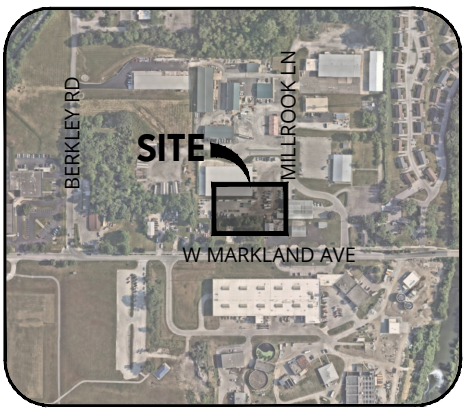

LOCATION MAP

NOT TO SCALE

LEGEND

APPROXIMATE BORING LOCATION

NOTES:

1. BASE DRAWING INFORMATION TAKEN FROM A DRAWING TITLED "PROPOSED GEOTECHNICAL BORINGS PLAN" (SHEET AP102) WITH A LATEST REVISION DATE OF 6-18-2025, PREPARED BY RQAW DCCM.
2. AERIAL IMAGE TAKEN FROM NEARMAP WITH AN IMAGE DATE OF 6-12-2024.

0' 50' 100'

GRAPHIC SCALE: 1" = 50'

AERIAL BACKGROUND OBTAINED FROM: NEARMAP IMAGE DATE 6-12-2024.

No.	Revision Date		
		Date	7-21-2025
		CADD	M. NOWAK-ROCHFORD
		Designer	M. HAMMOND
		Project No.	100883.00

DRAWING NOTE: SCALE DEPICTED IS MEANT FOR 8.5"x11" AND WILL SCALE INCORRECTLY IF PRINTED ON ANY OTHER SIZE MEDIA

BORING LOCATION DIAGRAM
CITY OF KOKOMO -
BUS MAINTENANCE FACILITY
KOKOMO, INDIANA

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FIGURE NO. 1

PLOT DATE: July 21, 2025 - 9:56 AM - matt.nowakrochford

FILE LOCATION: \\sme-inc\pz\WIP\100883.00\CAD\Design Files\BLD\Rev0\100883.00-BLD.dwg

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BORING LOG TERMINOLOGY

UNIFIED SOIL CLASSIFICATION AND SYMBOL CHART

COARSE-GRAINED SOIL (more than 50% of material is larger than No. 200 sieve size.)			
GRAVEL More than 50% of coarse fraction larger than No. 4 sieve size	Clean Gravel (Less than 5% fines)	GW	Well-graded gravel; gravel-sand mixtures, little or no fines
		GP	Poorly-graded gravel; gravel-sand mixtures, little or no fines
	Gravel with fines (More than 12% fines)	GM	Silty gravel; gravel-sand-silt mixtures
		GC	Clayey gravel; gravel-sand-clay mixtures
SAND 50% or more of coarse fraction smaller than No. 4 sieve size	Clean Sand (Less than 5% fines)	SW	Well-graded sand; sand-gravel mixtures, little or no fines
		SP	Poorly graded sand; sand-gravel mixtures, little or no fines
	Sand with fines (More than 12% fines)	SM	Silty sand; sand-silt-gravel mixtures
		SC	Clayey sand; sand–clay-gravel mixtures
FINE-GRAINED SOIL (50% or more of material is smaller than No. 200 sieve size)			
SILT AND CLAY Liquid limit less than 50%		ML	Inorganic silt; sandy silt or gravelly silt with slight plasticity
		CL	Inorganic clay of low plasticity; lean clay, sandy clay, gravelly clay
		OL	Organic silt and organic clay of low plasticity
SILT AND CLAY Liquid limit 50% or greater		MH	Inorganic silt of high plasticity, elastic silt
		CH	Inorganic clay of high plasticity, fat clay
		OH	Organic silt and organic clay of high plasticity
HIGHLY ORGANIC SOIL		PT	Peat and other highly organic soil

OTHER MATERIAL SYMBOLS

Topsoil, Void, Sandstone, Asphalt Concrete, Glacial Till, Siltstone, Aggregate Base, Coal, Limestone, Portland Cement Concrete, Shale, Fill

LABORATORY CLASSIFICATION CRITERIA

GW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 4; $C_C = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
GP	Not meeting all gradation requirements for GW	
GM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
GC	Atterberg limits above "A" line with PI greater than 7	
SW	$C_U = \frac{D_{60}}{D_{10}}$ greater than 6; $C_C = \frac{D_{30}^2}{D_{10} \times D_{60}}$ between 1 and 3	
SP	Not meeting all gradation requirements for SW	
SM	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
SC	Atterberg limits above "A" line with PI greater than 7	

Determine percentages of sand and gravel from grain-size curve. Depending on percentage of fines (fraction smaller than No. 200 sieve size), coarse-grained soils are classified as follows:

Less than 5 percent……..GW, GP, SW, SP
More than 12 percent……GM, GC, SM, SC
5 to 12 percent……..Cases requiring dual symbols

- SP-SM or SW-SM (SAND with Silt or SAND with Silt and Gravel)
- SP-SC or SW-SC (SAND with Clay or SAND with Clay and Gravel)
- GP-GM or GW-GM (GRAVEL with Silt or GRAVEL with Silt and Sand)
- GP-GC or GW-GC (GRAVEL with Clay or GRAVEL with Clay and Sand)

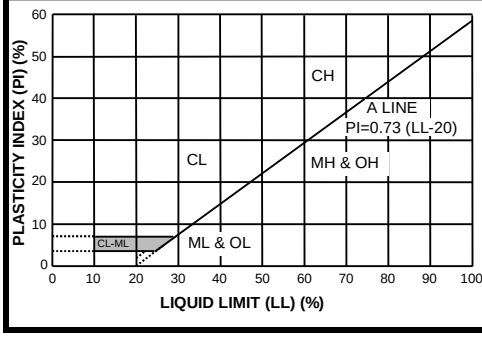
If the fines are CL-ML:

- SC-SM (SILTY CLAYEY SAND or SILTY CLAYEY SAND with Gravel)
- SM-SC (CLAYEY SILTY SAND or CLAYEY SILTY SAND with Gravel)
- GC-GM (SILTY CLAYEY GRAVEL or SILTY CLAYEY GRAVEL with Sand)

PARTICLE SIZES

Boulders	-	Greater than 12 inches
Cobbles	-	3 inches to 12 inches
Gravel- Coarse	-	3/4 inches to 3 inches
Fine	-	No. 4 to 3/4 inches
Sand- Coarse	-	No. 10 to No. 4
Medium	-	No. 40 to No. 10
Fine	-	No. 200 to No. 40
Silt and Clay	-	Less than (0.074 mm)

PLASTICITY CHART



VISUAL MANUAL PROCEDURE

When laboratory tests are not performed to confirm the classification of soils exhibiting borderline classifications, the two possible classifications would be separated with a slash, as follows:

For soils where it is difficult to distinguish if it is a coarse or fine-grained soil:

- SC/CL (CLAYEY SAND to Sandy LEAN CLAY)
- SM/ML (SILTY SAND to SANDY SILT)
- GC/CL (CLAYEY GRAVEL to Gravelly LEAN CLAY)
- GM/ML (SILTY GRAVEL to Gravelly SILT)

For soils where it is difficult to distinguish if it is sand or gravel, poorly or well-graded sand or gravel; silt or clay; or plastic or non-plastic silt or clay:

- SP/GP or SW/GW (SAND with Gravel to GRAVEL with Sand)
- SC/GC (CLAYEY SAND with Gravel to CLAYEY GRAVEL with Sand)
- SM/GM (SILTY SAND with Gravel to SILTY GRAVEL with Sand)
- SW/SP (SAND or SAND with Gravel)
- GP/GW (GRAVEL or GRAVEL with Sand)
- SC/SM (CLAYEY to SILTY SAND)
- GM/GC (SILTY to CLAYEY GRAVEL)
- CL/ML (SILTY CLAY)
- ML/CL (CLAYEY SILT)
- CH/MH (FAT CLAY to ELASTIC SILT)
- CL/CH (LEAN to FAT CLAY)
- MH/ML (ELASTIC SILT to SILT)

DRILLING AND SAMPLING ABBREVIATIONS

2ST	–	Shelby Tube – 2" O.D.
3ST	–	Shelby Tube – 3" O.D.
AS	–	Auger Sample
GS	–	Grab Sample
LS	–	Liner Sample
NR	–	No Recovery
PM	–	Pressuremeter
RC	–	Rock Core diamond bit. NX size, except where noted
SB	–	Split Barrel Sample 1-3/8" I.D., 2" O.D., except where noted
VS	–	Vane Shear
WS	–	Wash Sample

OTHER ABBREVIATIONS

WOH	–	Weight of Hammer
WOR	–	Weight of Rods
SP	–	Soil Probe
PID	–	Photo Ionization Device
FID	–	Flame Ionization Device

DEPOSITIONAL FEATURES

Parting	–	as much as 1/16 inch thick
Seam	–	1/16 inch to 1/2 inch thick
Layer	–	1/2 inch to 12 inches thick
Stratum	–	greater than 12 inches thick
Pocket	–	deposit of limited lateral extent
Lens	–	lenticular deposit
Hardpan/Till	–	an unstratified, consolidated or cemented mixture of clay, silt, sand and/or gravel, the size/shape of the constituents vary widely
Lacustrine	–	soil deposited by lake water
Mottled	–	soil irregularly marked with spots of different colors that vary in number and size
Varved	–	alternating partings or seams of silt and/or clay
Occasional	–	one or less per foot of thickness
Frequent	–	more than one per foot of thickness
Interbedded	–	strata of soil or beds of rock lying between or alternating with other strata of a different nature

DESCRIPTION OF RELATIVE QUANTITIES

The visual-manual procedure uses the following terms to describe the relative quantities of notable foreign materials, gravel, sand or fines:

Trace	–	particles are present but estimated to be less than 5%
Few	–	5 to 10%
Little	–	15 to 25%
Some	–	30 to 45%
Mostly	–	50 to 100%

CLASSIFICATION TERMINOLOGY AND CORRELATIONS

Cohesionless Soils

Relative Density	N_{60} (N-Value) (Blows per foot)
Very Loose	0 to 4
Loose	5 to 10
Medium Dense	11 to 30
Dense	31 to 50
Very Dense	51 to 80
Extremely Dense	Over 81

Cohesive Soils

Consistency	N_{60} (N-Value) (Blows per foot)	Undrained Shear Strength (kips/ft^2)
Very Soft	<2	0.25 or less
Soft	2 - 4	> 0.25 to 0.50
Medium	5 - 8	> 0.50 to 1.0
Stiff	9 - 15	> 1.0 to 2.0
Very Stiff	16 - 30	> 2.0 to 4.0
Hard	> 30	> 4.0 or greater

Standard Penetration 'N-Value' = Blows per foot of a 140-pound hammer falling 30 inches on a 2-inch O.D. split barrel sampler, except where noted. N60 values as reported on boring logs represent raw N-values corrected for hammer efficiency only.

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BORING B 1

BORING DEPTH: 20 FEET

PROJECT NAME: City of Kokomo - Bus Maintenance Facility
PROJECT NUMBER: 100883.00
CLIENT: City of Kokomo
PROJECT LOCATION: Kokomo, Indiana
DATE STARTED: 7/18/25 **COMPLETED:** 7/18/25
BORING METHOD: Hollow-stem Augers
DRILLER: CD (Black Sheep) **RIG NO.:** 7822DT (ATV)
LOGGED BY: BC **CHECKED BY:** MJH

ELEVATION: 810.5± FT NAVD88

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES
810	0	0.1 1 inch of GRAVEL (810.4)			
		FILL- Sandy LEAN CLAY with Gravel- Gray and Brown- Stiff to Very Stiff (CL)	SB1	24	6 6 4 4
	2.0	(808.5)			
		Sandy LEAN CLAY- Brown and Gray- Medium to Stiff (CL)	SB2	24	3 2 4 4
	5.0	(805.5)			
805	5	Sandy LEAN CLAY with Gravel- Brown- Medium to Stiff (CL)	SB3	24	1 4 2 3
	9.5	(801.0)	SB4	20	2 3 5 6
	10.0	Fine to Medium CLAYEY SAND with Gravel- Gray and Brown- Moist (SC) (800.5)			
800	10				
		Sandy LEAN CLAY with Gravel- Brown- Very Stiff to Hard (CL)	SB5	15	7 10 11
795	15				
	19.0	(791.5)			
		Sandy LEAN CLAY with Gravel- Gray- Medium to Stiff (CL)	SB6	18	2 4 5
	20.0	(790.5)			
790	20	END OF BORING AT 20.0 FEET.			

HAMMER EFFICIENCY: 60%
DATE:
N_{60} -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120

MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

SHEAR STRENGTH (KSF)
▽ HAND PENE.
⊠ TORVANE SHEAR
● UNC. COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
◈ TRIAXIAL (UU)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

	DEPTH (FT)	ELEV (FT)
CAVE-IN OF BOREHOLE AT:	6.0	804.5

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. No hammer efficiency data was available, and the graphic output illustrates the field measured blow counts.

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BORING B 2

BORING DEPTH: 20 FEET

PROJECT NAME: City of Kokomo - Bus Maintenance Facility
PROJECT NUMBER: 100883.00
CLIENT: City of Kokomo
PROJECT LOCATION: Kokomo, Indiana

DATE STARTED: 7/18/25 **COMPLETED:** 7/18/25 **BORING METHOD:** Hollow-stem Augers

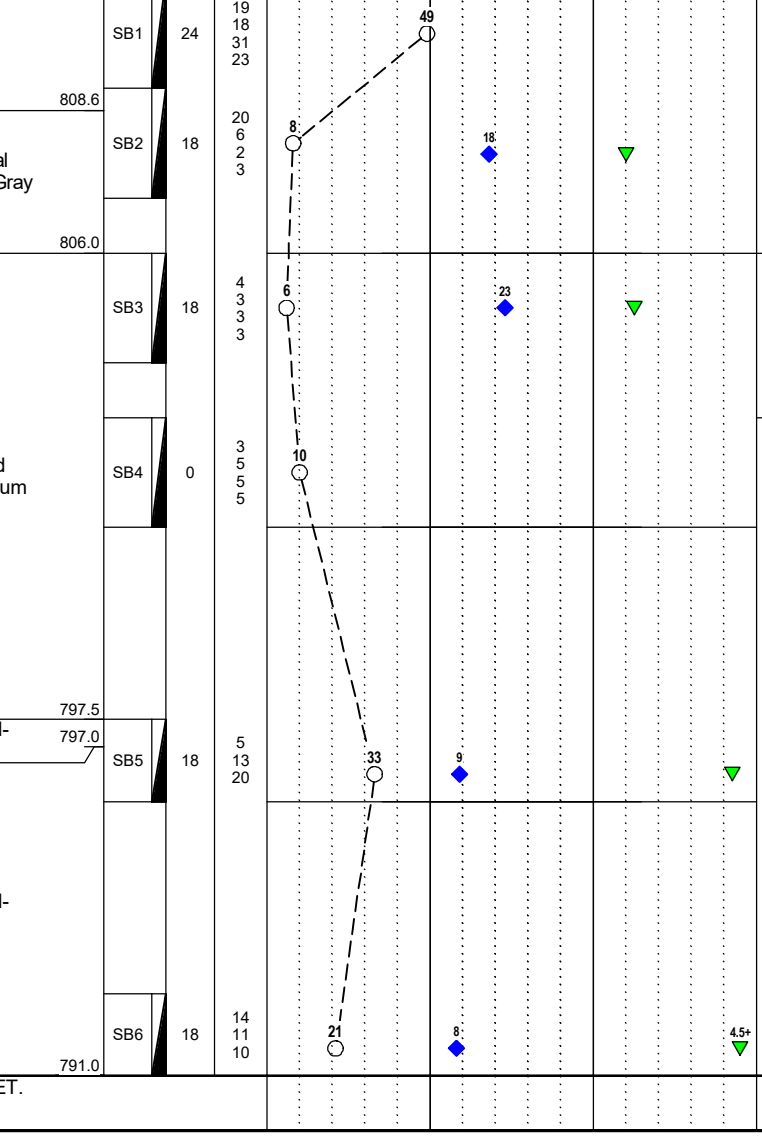
DRILLER: CD (Black Sheep) **RIG NO.:** 7822DT (ATV) **LOGGED BY:** BC **CHECKED BY:** MJH

ELEVATION: 811± FT NAVD88

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES	REMARKS
810	0	FILL- Fine to Coarse Sand with Gravel- Occasional Asphalt Fragments- Gray and Brown- Moist- Dense (SP)	SB1	24	19 18 31 23	
	2.4 / 808.6					
		Sandy LEAN CLAY- Occasional Gravel Seam from 3 to 4 feet- Gray and Brown- Medium (CL)	SB2	18	20 6 2 3	
	5.0 / 806.0					
805	5	Sandy LEAN CLAY- Brown and Gray with Black Nodules- Medium to Stiff (CL)	SB3	18	4 3 3 3	No sample recovery at sample SB4.
			SB4	0	3 5 5 5	Driller reported driving gravel.
800	10					
	13.5 / 797.5					
	14.0 / 797.0	Sandy LEAN CLAY with Gravel- Brown- Hard (CL)	SB5	18	5 13 20	
795	15	Sandy LEAN CLAY with Gravel- Gray- Very Stiff to Hard (CL)				
			SB6	18	14 11 10	
	20.0 / 791.0					
790		END OF BORING AT 20.0 FEET.				

HAMMER EFFICIENCY: 60%
DATE:
N_{60} --

DRY DENSITY (pcf) -- ■ (90 100 110 120)
MOISTURE & ATTERBERG LIMITS (%) (PL MC LL) (10 20 30 40)
SHEAR STRENGTH (KSF) (1 2 3 4)
▽ HAND PENE.
⊠ TORVANE SHEAR
● UNC. COMP.
⊡ VANE SHEAR (PK)
× VANE SHEAR (REM)
⊕ TRIAXIAL (UU)



GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

	DEPTH (FT)	ELEV (FT)
CAVE-IN OF BOREHOLE AT:	7.0	804.0

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. No hammer efficiency data was available, and the graphic output illustrates the field measured blow counts.

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BORING B 3

BORING DEPTH: 20 FEET

PROJECT NAME: City of Kokomo - Bus Maintenance Facility
PROJECT NUMBER: 100883.00
CLIENT: City of Kokomo
PROJECT LOCATION: Kokomo, Indiana
DATE STARTED: 7/18/25 **COMPLETED:** 7/18/25
BORING METHOD: Hollow-stem Augers
DRILLER: CD (Black Sheep) **RIG NO.:** 7822DT (ATV)
LOGGED BY: BC **CHECKED BY:** MJH

ELEVATION: 811.5± FT NAVD88

ELEVATION (FEET)	DEPTH (FEET)	PROFILE DESCRIPTION	SAMPLE TYPE/NO. INTERVAL	RECOVERY LENGTH (INCHES)	SPT BLOWS PER SIX INCHES
811.0	0	6 inches of GRAVEL and SAND			
810	0.5	LEAN CLAY with Sand- Brown and Gray- Very Stiff to Medium (CL)	SB1	24	13 9 5 4
			SB2	13	4 3 4 5
806.5	5.0	Sandy LEAN CLAY with Gravel- Brown- Soft to Stiff (CL)	SB3	18	2 2 2 4
805					
803.5	8.0	Sandy LEAN CLAY with Gravel- Occasional Roots- Brown- Medium to Stiff (CL)	SB4	24	3 2 3 5
800	10				
798.0	13.5	Sandy LEAN CLAY with Gravel- Brown- Hard (CL)	SB5	18	20 24 32
795	15				
793.0	18.5	Sandy LEAN CLAY with Gravel- Occasional Sand Seams- Gray- Stiff (CL)	SB6	18	15 8 6
791.5	20.0	END OF BORING AT 20.0 FEET.			

HAMMER EFFICIENCY: 60%
DATE:
N_{60} -- ○
10 20 30 40

DRY DENSITY (pcf) -- ■
90 100 110 120
MOISTURE & ATTERBERG LIMITS (%)
PL MC LL
10 20 30 40

HAND PENE. ▽
TORVANE SHEAR ⊠
UNC. COMP. ●
VANE SHEAR (PK) ⊡
VANE SHEAR (REM) ×
TRIAXIAL (UU) ⊕
SHEAR STRENGTH (KSF)
1 2 3 4

REMARKS

GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

	DEPTH (FT)	ELEV (FT)
CAVE-IN OF BOREHOLE AT:	5.0	806.5

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. No hammer efficiency data was available, and the graphic output illustrates the field measured blow counts.

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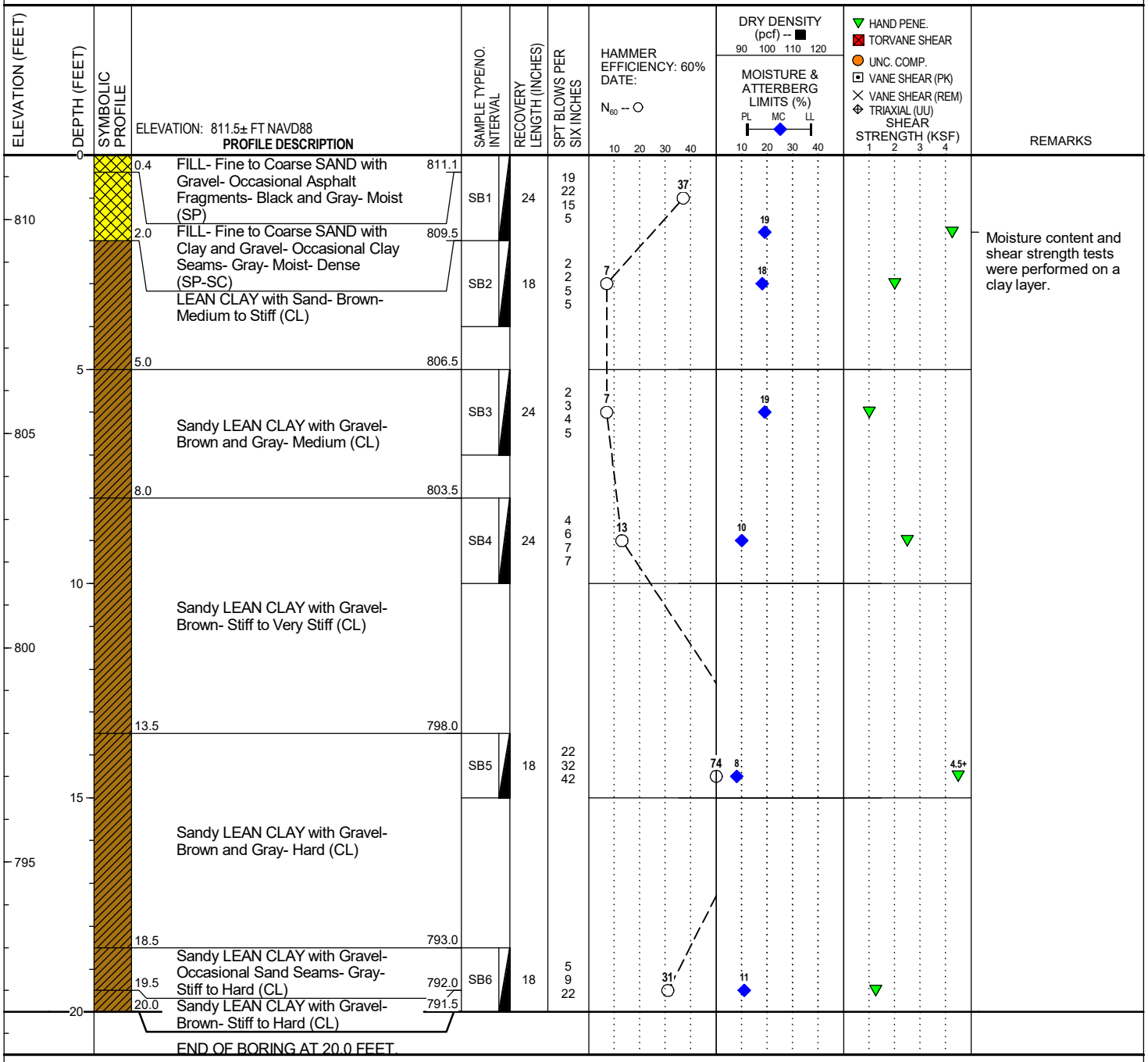
BORING B 4

BORING DEPTH: 20 FEET

PROJECT NAME: City of Kokomo - Bus Maintenance Facility
PROJECT NUMBER: 100883.00
CLIENT: City of Kokomo
PROJECT LOCATION: Kokomo, Indiana
DATE STARTED: 7/18/25 **COMPLETED:** 7/18/25
BORING METHOD: Hollow-stem Augers
DRILLER: CD (Black Sheep) **RIG NO.:** 7822DT (ATV)
LOGGED BY: BC **CHECKED BY:** MJH



GROUNDWATER & BACKFILL INFORMATION

GROUNDWATER WAS NOT ENCOUNTERED

	DEPTH (FT)	ELEV (FT)
CAVE-IN OF BOREHOLE AT:	6.0	805.5

BACKFILL METHOD: Auger Cuttings

NOTES:
1. The indicated stratification lines are approximate. The in-situ transitions between materials may be gradual.
2. The colors depicted on the symbolic profile are solely for visualization purposes and do not necessarily represent the in-situ colors encountered.
3. No hammer efficiency data was available, and the graphic output illustrates the field measured blow counts.

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APPENDIX B

FIELD TESTING PROCEDURES
LABORATORY TESTING PROCEDURES
LIMITATIONS PERTAINING TO SUBSURFACE CONDITIONS

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FIELD TESTING PROCEDURES

STANDARD PENETRATION TESTS

The Standard Penetration Tests (SPT) generally follow the American Standard Test Method (ASTM) D-1586 “Standard Test Method for SPT and Split-Barrel Sampling of Soils”. It is typically performed using a 2-inch O.D. split-spoon sampler, which is driven to obtain samples at selected intervals. The number of blows of a 140-pound hammer dropping 30 inches is recorded for each of three or four, 6-inch penetration intervals for an 18 or 24-inch drive at each sample location. The sum of blow counts for the second and third 6-inch penetration intervals equals the raw (uncorrected) N-value for a given sample interval (i.e. 5-4-2, N = 6). We periodically calibrate SME’s drill rig auto-hammers. The hammer efficiency determined from this calibration is used to calculate the corrected N-values (N_{60}), as reported on the logs. When sampling in rock or hard soil, where a penetration of 6 inches or less was obtained for 50 hammer blows, the actual blow count and depth of penetration in inches for that interval is recorded (i.e. 50/2”). When sampling in very loose or very soft soil, where a penetration of more than 6 inches is obtained for a single hammer blow, the actual depth of penetration for that hammer blow is recorded (i.e. 1-0-0). Where the sampling equipment advanced under its own weight, “WOH” (weight of hammer) and the corresponding penetration depth are shown on the boring logs.

INFILTRATION TESTS

In-situ infiltration tests generally follow the double-ring infiltrometer field test procedures outlined in Appendix E in the Low Impact Development (LID) Manual for Michigan (dated 2008) prepared by the Southeast Michigan Council of Governments (SEMCOG). This procedure is also referenced in the States of Indiana, Ohio, and Kentucky applicable local manuals. The double-ring infiltrometer field test set-up consists of performing a boring or test pit to the test depth, installing an outer 6-inch-diameter standpipe and an inner 4-inch-diameter standpipe, and then driving the standpipes a suitable distance, per the referenced manual, below the bottom of the test depth. Soil is pre-soaked with approximately 12 inches of water for approximately one hour. The water drop rate per the last 30 minutes of the soaking period determines the subsequent interval for infiltration readings (i.e., 10- or 30-minute intervals). After completing the soaking period, standpipes are filled with water to a height of approximately 12 inches above the test depth, and water level changes in the standpipes are measured with a water level measuring tape with markings every 0.01 feet and recorded after the time intervals. This procedure is repeated until a minimum of four consecutive height changes within 1/4-inch of one another are measured. The height drop that occurred during the final time interval or the average stabilized rate is used to calculate the infiltration rate. After completion of the double-ring infiltrometer field test, the standpipes are removed, and the test hole is backfilled.

DYNAMIC CONE PENETROMETER (DCP)

USACE TESTS

Dynamic Cone Penetrometer (DCP) testing designed by the U.S. Army Corps of Engineers (USACE) is conducted to estimate the California Bearing Ratio (CBR) of the subgrade materials and existing pavement sub-layers. The USACE DCP consists of a 5/8-inch-diameter steel rod with a steel cone attached to one end driven by a sliding dual mass hammer. The rate of penetration per blow is measured at selected penetration, or hammer drop, intervals. CBR is an index commonly used in pavement design that provides an indication of subgrade support characteristics. The Corps of Engineers developed relationships to estimate the CBR value from the results of the USACE DCP test.

SME DCP TESTS

SME Dynamic Cone Penetrometer (DCP) test consists of dropping a 10-pound slide hammer that falls 24 inches and drives a rod with a 1-1/8-inch conical tip into the subgrade. The number of hammer drops required to drive the cone penetrometer are recorded for each six-inch increment and are used to estimate the relative density of the granular soils. The DCP blow counts were used to estimate Standard Penetration Test resistances (N-values) commonly used in geotechnical evaluations, based on empirical correlations developed by SME.

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PRESSUREMETER TESTING

Pressuremeter testing in the field models the static loading characteristics of the soil and the resulting analyses based on pressuremeter test results are considered to be a more accurate indicator of the ultimate foundation bearing pressure, and associated settlement, than analyses using empirical correlations based on dynamic test methods, such as the Standard Penetration Test (SPT) and/or dynamic cone penetrometer (DCP) tests. Results of the SPT and/or DCP were recorded, at the pressuremeter test locations and depths to provide additional information on the relative density of the in-place subgrade, and to correlate the pressuremeter test results with data obtained at other site locations. The pressuremeter test depths were selected to provide representative information corresponding to the bearing soils anticipated within the stress influence zone of the proposed footings at the design bearing levels.

In the pressuremeter test, a radial expandable cylindrical probe is inserted into a prepared borehole at the selected testing depth. After obtaining N-values from driving a standard 2-inch O.D. diameter split-spoon sampler, borehole preparation consisted of then driving a 3-inch O.D. split-spoon sampler (or using a roller bit with wash rotary methods) to develop the appropriately sized borehole diameter for the pressuremeter probe. The cylindrical probe was inserted into the borehole to the sampling depth and then expanded against the sides of the borehole by pressurizing fluid within the system using a hydraulic screw-jack console positioned at the ground surface.

Simultaneous measurements of pressure and volume change within the probe were observed at the pressuremeter console and recorded. The pressure was incrementally increased until the maximum probe volume was reached, or until significant creep deformation (soil failure) was observed.

MUCK PROBE

The muck probe consists of a smooth rod about 1/2-inch in diameter manually pushed into the subgrade until encountering significant resistance (determined “by feel”), presumably indicating the bottom of organic soil stratum.

VANE SHEAR TESTING

In-situ vane shear testing generally follows the American Standard Test Method (ASTM) D-2573 “Standard Test Method for Field Vane Shear Test in Cohesive Soil”. Per the ASTM, the field vane shear test consists of placing a four-bladed vane (sized based on the expected cohesive soil strength) in the undisturbed soil and rotating it from the surface at a constant rate to determine the torque required to shear a cylindrical surface with the vane. This torque, or moment, is then converted to the unit shearing resistance of the failure surface by limit equilibrium analysis. Friction of the vane rod and instrument is either minimized during readings by an open hole, casing, or accounted for and subtracted from the total torque to determine the torque applied to the vane. After initially shearing the soil to determine the peak “undisturbed” ultimate shear strength, the test can be repeated to determine the remolded “residual” ultimate shear strength. The ratio of the peak shear strength divided by the remolded shear strength equals the degree of sensitivity.

DEGREE OF SENSITIVITY

DEGREE OF SENSITIVITY	DESCRIPTION
2	Insensitive
4	Moderately Sensitive
8	Extra Sensitive

ELECTRICAL RESISTIVITY TESTING

Field or laboratory resistivity testing generally follows the American Standard Test Method (ASTM) G-57 “Standard Test Method for Measurement of Soil Resistivity Using the Four-Electrode Method”.

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FIELD TESTING

Per the ASTM, the field Wenner four-electrode method requires four metal electrode probes placed with equal separation at various distances in a straight line. The probes are inserted in the surface of the soil to a depth not exceeding 5 percent of the minimum separation of the electrodes (or 12 inches maximum, whichever is less). The electrode

separation is selected with consideration of the soil strata location and depth of interest. A voltage is impressed between the outer electrodes and the voltage drop between the inner electrodes is measured. The resulting resistivity measurement represents the average resistivity of a hemisphere of soil of a radius equal to the electrode separation.

LABORATORY TESTING

Soil is tamped into a soil box to resemble the compaction where the soil sample was taken until the soil is level with the top of the box. Two brass pins are inserted at the premanufactured distances into the soil sample with two endpins connected to the box. The four test leads are connected to the soil box. A voltage is impressed between the two endpins to measure the resistance, and soil resistivity is calculated based on the product-specified conversion.

CONE PENETRATION TESTING

Cone Penetration Tests (CPT) measures the soil resistance to the penetration of a standard 10 square centimeter (cm) projected area. The cone is hydraulically pushed into the soil at approximately a 2 cm per second rate. Soil resistance is recorded in kilograms per square cm at 20 cm depth intervals. Soil friction values are measured by a friction sleeve at each test interval.

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LABORATORY TESTING PROCEDURES

VISUAL ENGINEERING CLASSIFICATION

Visual classification was performed on recovered samples. The appended General Notes and Unified Soil Classification System (USCS) sheets include a brief summary of the general method used visually classify the soil and assign an appropriate USCS group symbol. The estimated group symbol, according to the USCS, is shown in parentheses following the textural description of the various strata on the boring logs appended to this report. The soil descriptions developed from visual classifications are sometimes modified to reflect the results of laboratory testing.

MOISTURE CONTENT

Moisture content tests were performed by weighing samples from the field at their in-situ moisture condition. These samples were then dried at a constant temperature (approximately 110° C) overnight in an oven. After drying, the samples were weighed to determine the dry weight of the sample and the weight of the water that was expelled during drying. The moisture content of the specimen is expressed as a percent and is the weight of the water compared to the dry weight of the specimen.

HAND PENETROMETER TESTS

In the hand penetrometer test, the unconfined compressive strength of a cohesive soil sample is estimated by measuring the resistance of the sample to the penetration of a small calibrated, spring-loaded cylinder. The maximum capacity of the penetrometer is 4.5 tons per square-foot (tsf). Theoretically, the undrained shear strength of the cohesive sample is one-half the unconfined compressive strength. The undrained shear strength (based on the hand penetrometer test) presented on the boring logs is reported in units of kips per square-foot (ksf).

TORVANE SHEAR TESTS

In the Torvane test, the shear strength of a low strength, cohesive soil sample is estimated by measuring the resistance of the sample to a torque applied through vanes inserted into the sample. The undrained shear strength of the samples is measured from the maximum torque required to shear the sample and is reported in units of kips per square-foot (ksf).

LOSS-ON-IGNITION (ORGANIC CONTENT) TESTS

Loss-on-ignition (LOI) tests are conducted by first weighing the sample and then heating the sample to dry the moisture from the sample (in the same manner as determining the moisture content of the soil). The sample is then re-weighed to determine the dry weight and then heated for four hours in a muffle furnace at a high temperature (approximately 440° C). After cooling, the sample is re-weighed to calculate the amount of ash remaining, which in turn is used to determine the amount of organic matter burned from the original dry sample. The organic matter content of the specimen is expressed as a percent compared to the dry weight of the sample.

ATTERBERG LIMITS TESTS

Atterberg limits tests consist of two components. The plastic limit of a cohesive sample is determined by rolling the sample into a thread and the plastic limit is the moisture content where a 1/8-inch thread begins to crumble. The liquid limit is determined by placing a 1/2-inch-thick soil pat into the liquid limits cup and using a grooving tool to divide the soil pat in half. The cup is then tapped on the base of the liquid limits device using a crank handle. The number of drops of the cup to close the gap formed by the grooving tool 1/2 inch is recorded along with the corresponding moisture content of the sample. This procedure is repeated several times at different moisture contents and a graph of moisture content, and the corresponding number of blows is plotted. The liquid limit is defined as the moisture content at a nominal 25 drops of the cup. From this test, the plasticity index can be determined by subtracting the plastic limit from the liquid limit.

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LIMITATIONS PERTAINING TO SUBSURFACE CONDITIONS

EXISTING FILL

It is sometimes difficult to distinguish between existing fill present at a site and natural soils based on samples and cuttings from small-diameter boreholes, especially if portions of the fill do not contain man-made materials, debris, topsoil, or organic layers, and when the fill appears similar in composition to the local natural soils. Therefore, consider the delineation of fill described on the logs, if encountered, to be approximate.

The composition of existing site fill, if encountered, may change abruptly over short distances and will vary from what is reported on the logs. The descriptions of debris within fill may not accurately indicate the quantity, composition, or size of the debris, and may not fully include the types of debris existing within the site fills. Perform test pits if existing fill is encountered to further evaluate the condition of the fill, particularly if the fill will be utilized for support of overlying structures and/or other improvements.

GROUNDWATER

Hydrostatic groundwater levels, and perched groundwater conditions, will fluctuate throughout the year, based on variations in precipitation, evaporation, run-off, and other factors. The groundwater information reported on the logs represent conditions at the time the readings were taken and may vary from the groundwater conditions encountered at other times.

SUBSURFACE PROFILE

The profile described in this report and included on the logs is a generalized description of the conditions observed. The stratification depths described in this report and shown on the logs indicate a zone of transition from one soil type to another. They are not meant to delineate exact depths of change between soil types. Soil conditions may vary between or away from the exploration locations. Refer to the logs for the soil descriptions, rock descriptions (when applicable), and results of the field and laboratory tests at the specific exploration locations.

If only borings with hollow-stem or solid-stem augers are performed, consider thickness measurements of surficial materials reported on the logs (e.g., gravel, asphalt, concrete, aggregate base) to be approximate since mixing of the surface materials with the underlying subgrade can occur while advancing the augers, and it is difficult to measure the thickness of surface materials in small-diameter boreholes. Perform additional evaluations for more accurate measurements of surface materials, such as test pits for topsoil and gravel thicknesses, coring for pavement thicknesses, and hand sampling for aggregate thickness.

RADON

The need for radon control systems for this project was not evaluated as part of our current scope of services. Contact the local building authority to verify whether radon control systems are necessary to meet the applicable local building codes or other requirements. If radon control methods are required, incorporate the recommendations regarding the below-slab leveling course materials and vapor retarders presented in this report with the specific materials and measures necessary to meet the applicable radon control methods. Contact SME for further recommendations.

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APPENDIX C

IMPORTANT INFORMATION ABOUT THIS GEOTECHNICAL-ENGINEERING REPORT GENERAL COMMENTS

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Important Information about This

Geotechnical-Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

The Geoprofessional Business Association (GBA) has prepared this advisory to help you – assumedly a client representative – interpret and apply this geotechnical-engineering report as effectively as possible. In that way, clients can benefit from a lowered exposure to the subsurface problems that, for decades, have been a principal cause of construction delays, cost overruns, claims, and disputes. If you have questions or want more information about any of the issues discussed below, contact your GBA-member geotechnical engineer. Active involvement in the Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk-confrontation techniques that can be of genuine benefit for everyone involved with a construction project.

Geotechnical-Engineering Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical-engineering study conducted for a given civil engineer will not likely meet the needs of a civil-works constructor or even a different civil engineer. Because each geotechnical-engineering study is unique, each geotechnical-engineering report is unique, prepared *solely* for the client. *Those who rely on a geotechnical-engineering report prepared for a different client can be seriously misled*. No one except authorized client representatives should rely on this geotechnical-engineering report without first conferring with the geotechnical engineer who prepared it. *And no one – not even you – should apply this report for any purpose or project except the one originally contemplated.*

Read this Report in Full

Costly problems have occurred because those relying on a geotechnical-engineering report did not read it *in its entirety*. Do not rely on an executive summary. Do not read selected elements only. *Read this report in full.*

You Need to Inform Your Geotechnical Engineer about Change

Your geotechnical engineer considered unique, project-specific factors when designing the study behind this report and developing the confirmation-dependent recommendations the report conveys. A few typical factors include:

- the client's goals, objectives, budget, schedule, and risk-management preferences;
- the general nature of the structure involved, its size, configuration, and performance criteria;
- the structure's location and orientation on the site; and
- other planned or existing site improvements, such as retaining walls, access roads, parking lots, and underground utilities.

Typical changes that could erode the reliability of this report include those that affect:

- the site's size or shape;
- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light-industrial plant to a refrigerated warehouse;
- the elevation, configuration, location, orientation, or weight of the proposed structure;
- the composition of the design team; or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes – even minor ones – and request an assessment of their impact. *The geotechnical engineer who prepared this report cannot accept responsibility or liability for problems that arise because the geotechnical engineer was not informed about developments the engineer otherwise would have considered.*

This Report May Not Be Reliable

Do not rely on this report if your geotechnical engineer prepared it:

- for a different client;
- for a different project;
- for a different site (that may or may not include all or a portion of the original site); or
- before important events occurred at the site or adjacent to it; e.g., man-made events like construction or environmental remediation, or natural events like floods, droughts, earthquakes, or groundwater fluctuations.

Note, too, that it could be unwise to rely on a geotechnical-engineering report whose reliability may have been affected by the passage of time, because of factors like changed subsurface conditions; new or modified codes, standards, or regulations; or new techniques or tools. *If your geotechnical engineer has not indicated an "apply-by" date on the report, ask what it should be*, and, in general, *if you are the least bit uncertain* about the continued reliability of this report, contact your geotechnical engineer before applying it. A minor amount of additional testing or analysis – if any is required at all – could prevent major problems.

Most of the "Findings" Related in This Report Are Professional Opinions

Before construction begins, geotechnical engineers explore a site's subsurface through various sampling and testing procedures. *Geotechnical engineers can observe actual subsurface conditions only at those specific locations where sampling and testing were performed*. The data derived from that sampling and testing were reviewed by your geotechnical engineer, who then applied professional judgment to form opinions about subsurface conditions throughout the site. Actual sitewide-subsurface conditions may differ – maybe significantly – from those indicated in this report. Confront that risk by retaining your geotechnical engineer to serve on the design team from project start to project finish, so the individual can provide informed guidance quickly, whenever needed.

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This Report's Recommendations Are Confirmation-Dependent

The recommendations included in this report – including any options or alternatives – are confirmation-dependent. In other words, *they are not final*, because the geotechnical engineer who developed them relied heavily on judgment and opinion to do so. Your geotechnical engineer can finalize the recommendations *only after observing actual subsurface conditions* revealed during construction. If through observation your geotechnical engineer confirms that the conditions assumed to exist actually do exist, the recommendations can be relied upon, assuming no other changes have occurred. *The geotechnical engineer who prepared this report cannot assume responsibility or liability for confirmation-dependent recommendations if you fail to retain that engineer to perform construction observation.*

This Report Could Be Misinterpreted

Other design professionals' misinterpretation of geotechnical-engineering reports has resulted in costly problems. Confront that risk by having your geotechnical engineer serve as a full-time member of the design team, to:

- confer with other design-team members,
- help develop specifications,
- review pertinent elements of other design professionals' plans and specifications, and
- be on hand quickly whenever geotechnical-engineering guidance is needed.

You should also confront the risk of constructors misinterpreting this report. Do so by retaining your geotechnical engineer to participate in prebid and preconstruction conferences and to perform construction observation.

Give Constructors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can shift unanticipated-subsurface-conditions liability to constructors by limiting the information they provide for bid preparation. To help prevent the costly, contentious problems this practice has caused, include the complete geotechnical-engineering report, along with any attachments or appendices, with your contract documents, *but be certain to note conspicuously that you've included the material for informational purposes only*. To avoid misunderstanding, you may also want to note that "informational purposes" means constructors have no right to rely on the interpretations, opinions, conclusions, or recommendations in the report, but they may rely on the factual data relative to the specific times, locations, and depths/elevations referenced. Be certain that constructors know they may learn about specific project requirements, including options selected from the report, *only* from the design drawings and specifications. Remind constructors that they may perform their own studies if they want to, and *be sure to allow enough time* to permit them to do so. Only then might you be in a position to give constructors the information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions. Conducting prebid and preconstruction conferences can also be valuable in this respect.

Read Responsibility Provisions Closely

Some client representatives, design professionals, and constructors do not realize that geotechnical engineering is far less exact than other engineering disciplines. That lack of understanding has nurtured unrealistic expectations that have resulted in disappointments, delays, cost overruns, claims, and disputes. To confront that risk, geotechnical engineers commonly include explanatory provisions in their reports. Sometimes labeled "limitations," many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely*. Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The personnel, equipment, and techniques used to perform an environmental study – e.g., a "phase-one" or "phase-two" environmental site assessment – differ significantly from those used to perform a geotechnical-engineering study. For that reason, a geotechnical-engineering report does not usually relate any environmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated subsurface environmental problems have led to project failures*. If you have not yet obtained your own environmental information, ask your geotechnical consultant for risk-management guidance. As a general rule, *do not rely on an environmental report prepared for a different client, site, or project, or that is more than six months old.*

Obtain Professional Assistance to Deal with Moisture Infiltration and Mold

While your geotechnical engineer may have addressed groundwater, water infiltration, or similar issues in this report, none of the engineer's services were designed, conducted, or intended to prevent uncontrolled migration of moisture – including water vapor – from the soil through building slabs and walls and into the building interior, where it can cause mold growth and material-performance deficiencies. Accordingly, ***proper implementation of the geotechnical engineer's recommendations will not of itself be sufficient to prevent moisture infiltration.*** Confront the risk of moisture infiltration by including building-envelope or mold specialists on the design team. ***Geotechnical engineers are not building-envelope or mold specialists.***

GEOPROFESSIONAL BUSINESS ASSOCIATION

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e-mail: info@geoprofessional.org www.geoprofessional.org

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GENERAL COMMENTS

BASIS OF GEOTECHNICAL REPORT

This report has been prepared in accordance with generally accepted geotechnical engineering practices to assist in the design and/or evaluation of this project. If the project plans, design criteria, and/or other project information referenced in this report and utilized by SME to prepare our recommendations are changed, the conclusions and recommendations contained in this report are not considered valid unless the changes are reviewed, and the conclusions and recommendations of this report are modified or approved in writing.

The discussions and recommendations contained in this report are based on the available project information, described in this report, and the geotechnical data obtained from the field exploration at the locations indicated in the report. Variations in soil and groundwater conditions commonly occur between or away from sampling locations. The nature and extent of the variations may not become evident until the time of construction. If significant variations are observed during construction, SME must be contacted to reevaluate the recommendations of this report.

In the process of obtaining and testing samples and preparing this report, procedures are followed that represent reasonable and accepted practice in the field of geotechnical engineering. Specifically, field logs are prepared during the field exploration that describe field occurrences, sampling locations, and other information. Samples obtained in the field are frequently subjected to additional testing and reclassification in the laboratory and differences may exist between the field logs and the report logs.

The engineer preparing the report reviews the field logs, laboratory classifications, and test data and then prepares the report logs. Our recommendations are based on the contents of the report logs and the information contained therein.

REVIEW OF DESIGN DETAILS, PLANS, AND SPECIFICATIONS

Retain SME to review the design details, project plans, and specifications to verify those documents are consistent with the recommendations contained in this report.

REVIEW OF REPORT INFORMATION WITH PROJECT TEAM

Implementation of our recommendations may affect the design, construction, and performance of the proposed improvements, along with the potential inherent risks involved with the proposed construction. The client and key members of the design team, including SME, should discuss the issues covered in this report so the issues are understood and applied in a manner consistent with the owner's budget, tolerance of risk, and expectations for performance and maintenance.

FIELD VERIFICATION OF GEOTECHNICAL CONDITIONS

SME needs to be retained to continue our services through construction so we may observe and evaluate the actual subsurface conditions relative to the recommendations made in this report, and so we can verify the recommendations of this report are properly implemented during construction. This may avoid misinterpretation of our recommendations by other parties and will allow us to review and modify our recommendations if variations in the site subsurface conditions are encountered.

PROJECT INFORMATION FOR CONTRACTOR

This report and any future addenda or other reports regarding this site needs to be made available to prospective contractors prior to submitting their proposals for their information only and to supply them with facts relative to the subsurface evaluation and laboratory test results. If the selected contractor encounters subsurface conditions during construction, which differ from those presented in this report, the contractor needs to promptly describe the nature and extent of the differing conditions in writing and SME needs to be notified so we can verify those conditions. The construction contract needs to include provisions for dealing with differing conditions, and contingency funds for potential problems during earthwork and foundation construction. We would be pleased to assist with the development of contract provisions based on our experience.

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The contractor needs to be prepared to handle environmental conditions encountered at this site, which may affect the excavation, removal, or disposal of soil; dewatering of excavations; and health and safety of workers. Any Environmental Assessment reports prepared for this site need to be made available for review by bidders and the successful contractor.

THIRD PARTY RELIANCE/REUSE OF THIS REPORT

This report has been prepared solely for the use of our Client for the project specifically described in this report. This report cannot be relied upon by other parties not involved in the project, unless specifically allowed by SME in writing. SME also is not responsible for the interpretation by other parties of the geotechnical data and the recommendations provided herein.

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Passionate People Building
and Revitalizing our World

SME®

CONTRACTOR'S BID FOR PUBLIC WORK - FORM 96

State Form 52414 (R2 / 2-13) / Form 96 (Revised 2013)
Prescribed by State Board of Accounts

PART I
(To be completed for all bids. Please type or print)

Date *(month, day, year)*:_____

1. Governmental Unit (Owner):_____
2. County :_____
3. Bidder (Firm):_____

   Address:_____

   City/State/ZIPcode:_____
4. Telephone Number:_____
5. Agent of Bidder *(if applicable)*:_____

Pursuant to notices given, the undersigned offers to furnish labor and/or material necessary to complete the public works project of _____ (Governmental Unit) in accordance with plans and specifications prepared by _____ _____ and dated _____ for the sum of _____ $_____

The undersigned further agrees to furnish a bond or certified check with this bid for an amount specified in the notice of the letting. If alternative bids apply, the undersigned submits a proposal for each in accordance with the notice. Any addendums attached will be specifically referenced at the applicable page.

If additional units of material included in the contract are needed, the cost of units must be the same as that shown in the original contract if accepted by the governmental unit. If the bid is to be awarded on a unit basis, the itemization of the units shall be shown on a separate attachment.

The contractor and his subcontractors, if any, shall not discriminate against or intimidate any employee, or applicant for employment, to be employed in the performance of this contract, with respect to any matter directly or indirectly related to employment because of race, religion, color, sex, national origin or ancestry. Breach of this covenant may be regarded as a material breach of the contract.

CERTIFICATION OF USE OF UNITED STATES STEEL PRODUCTS
(If applicable)

I, the undersigned bidder or agent as a contractor on a public works project, understand my statutory obligation to use steel products made in the United States (I.C. 5-16-8-2). I hereby certify that I and all subcontractors employed by me for this project will use U.S. steel products on this project if awarded. I understand that violations hereunder may result in forfeiture of contractual payments.

ACCEPTANCE

The above bid is accepted this _____ day of _____, _____, subject to the following conditions: _____

_____

Contracting Authority Members:

_____ _____

_____ _____

_____ _____

PART II

(For projects of $150,000 or more – IC 36-1-12-4)

Governmental Unit: _____

Bidder (Firm) _____

Date *(month, day, year):* _____

These statements to be submitted under oath by each bidder with and as a part of his bid. Attach additional pages for each section as needed.

SECTION I EXPERIENCE QUESTIONNAIRE

1. What public works projects has your organization completed for the period of one (1) year prior to the date of the current bid?

Contract Amount	Class of Work	Completion Date	Name and Address of Owner

2. What public works projects are now in process of construction by your organization?

Contract Amount	Class of Work	Expected Completion Date	Name and Address of Owner

3. Have you ever failed to complete any work awarded to you? _____ If so, where and why?

4. List references from private firms for which you have performed work.

SECTION II PLAN AND EQUIPMENT QUESTIONNAIRE

1. Explain your plan or layout for performing proposed work. *(Examples could include a narrative of when you could begin work, complete the project, number of workers, etc. and any other information which you believe would enable the governmental unit to consider your bid.)*

2. Please list the names and addresses of all subcontractors *(i.e. persons or firms outside your own firm who have performed part of the work)* that you have used on public works projects during the past five (5) years along with a brief description of the work done by each subcontractor.

3. If you intend to sublet any portion of the work, state the name and address of each subcontractor, equipment to be used by the subcontractor, and whether you will require a bond. However, if you are unable to currently provide a listing, please understand a listing must be provided prior to contract approval. Until the completion of the proposed project, you are under a continuing obligation to immediately notify the governmental unit in the event that you subsequently determine that you will use a subcontractor on the proposed project.

4. What equipment do you have available to use for the proposed project? Any equipment to be used by subcontractors may also be required to be listed by the governmental unit.

5. Have you entered into contracts or received offers for all materials which substantiate the prices used in preparing your proposal? If not, please explain the rationale used which would corroborate the prices listed.

SECTION III CONTRACTOR'S FINANCIAL STATEMENT

Attachment of bidder's financial statement is mandatory. Any bid submitted without said financial statement as required by statute shall thereby be rendered invalid. The financial statement provided hereunder to the governing body awarding the contract must be specific enough in detail so that said governing body can make a proper determination of the bidder's capability for completing the project if awarded.

SECTION IV CONTRACTOR'S NON – COLLUSION AFFIDAVIT

The undersigned bidder or agent, being duly sworn on oath, says that he has not, nor has any other member, representative, or agent of the firm, company, corporation or partnership represented by him, entered into any combination, collusion or agreement with any person relative to the price to be bid by anyone at such letting nor to prevent any person from bidding nor to include anyone to refrain from bidding, and that this bid is made without reference to any other bid and without any agreement, understanding or combination with any other person in reference to such bidding.

He further says that no person or persons, firms, or corporation has, have or will receive directly or indirectly, any rebate, fee, gift, commission or thing of value on account of such sale.

SECTION V OATH AND AFFIRMATION

I HEREBY AFFIRM UNDER THE PENALTIES FOR PERJURY THAT THE FACTS AND INFORMATION CONTAINED IN THE FOREGOING BID FOR PUBLIC WORKS ARE TRUE AND CORRECT.

Dated at _____ this _____ day of _____, _____

_____
(Name of Organization)

By_____

_____
(Title of Person Signing)

ACKNOWLEDGEMENT

STATE OF _____)
) ss
COUNTY OF_____)

Before me, a Notary Public, personally appeared the above-named _____ and swore that the statements contained in the foregoing document are true and correct.

Subscribed and sworn to before me this _____ day of _____, _____.

_____
Notary Public

My Commission Expires:_____

County of Residence:_____

Part of State Form 52414 (R2 / 2-13) / Form 96 (Revised 2013)

BID OF

_____
(Contractor)

_____
(Address)

_____

FOR

PUBLIC WORKS PROJECTS

OF

_____

_____

_____

Filed _____, _____

Action taken _____

_____

SECTION 00 41 13

BID FORM - STIPULATED PRICE

To: City of Kokomo, Board of Public Works and Safety

Project: Kokomo Bus Maintenance Facility

Date: .....

Submitted by: .....
(full name)

(full address) .....

.....

1. OFFER

Having examined the Place of The Work and all matters referred to in the Instructions to Bidders and the Contract Documents prepared by RQAW / DCCM Corporation for the above-mentioned project, we, the undersigned, having become thoroughly familiar with the terms and conditions of the proposed Contract Documents and with local conditions affecting the performance and costs of the work at the place where the Work is to be completed, and having fully inspected the site in all particulars, along with the understanding this agreement, materials used and services rendered must adhere to the Build America, Buy America Act (BABAA) requirements under Title IX of the Infrastructure Investment and Jobs Act ("IIJA"), Pub. L. 177-58, hereby offer to enter into a Contract to perform the Work for the Sum of:

……

……$.....dollars, in lawful money of the United States of America.

We have included the security deposit or Bid Bond as required by the Instruction to Bidders.

All applicable taxes are included in the Bid Sum.

All Allowances described in Section 01 20 00 - Price and Payment Procedures are included in the Bid Sum.

2. ACCEPTANCE

This offer shall be open to acceptance and is irrevocable for sixty (60) days from the bid closing date.

If this bid is accepted by the Owner within the time period stated above, we will:

- Execute the Agreement within seven days of receipt of Notice of Award.

- Furnish the required bonds within seven days of receipt of Notice of Award.

- Commence work within seven (7) days after written Notice to Proceed.

If this bid is accepted within the time stated, and we fail to commence the Work or we fail to provide the required bonds, the security deposit shall be forfeited as damages to the Owner by reason of our failure, limited in amount to the lesser of the face value of the security deposit or the difference between this bid and the bid upon which a Contract is signed.

In the event our bid is not accepted within the time stated above, the required security deposit will be returned to the undersigned, in accordance with the provisions of the Instructions to Bidders; unless a mutually satisfactory arrangement is made for its retention and validity for an extended period of time.

3. CONTRACT TIME

If this Bid is accepted, we will comply with the following milestone schedule:

Notice to Proceed:	November 19th, 2025
Start Construction:	November 29th, 2025
Substantial Completion:	Bidder to provide anticipated number of days to complete scope of work.

Bidder's anticipated number of days to complete scope of work: .....

4. ADDENDA

The following Addenda have been received. The modifications to the Bid Documents noted below have been considered, and all costs are included in the Bid Sum.

Addendum # ..... Dated .....

Addendum # ..... Dated .....

Addendum # ..... Dated .....

Addendum # ..... Dated .....

5. APPENDICES

The following documents are attached to and made a condition of the Bid:

Bid security in form of .....

In accordance with Instruction to Bidders, the following documents will be submitted within 48 hours of bid opening and made a condition of the Bid:

Section 00 43 00 - Bid Form Supplements including:
Appendix A - List of Subcontractors.

6. BID FORM SIGNATURES

The Corporate Seal of

.....
(Bidder - print the full name of your firm)
was hereunto affixed in the presence of:

.....
(Authorized signing officer Title)

(Seal)

.....
(Authorized signing officer Title)

(Seal)

If the Bid is a joint venture or partnership, add additional forms of execution for each member of the joint venture in the appropriate form or forms as above.

END OF SECTION

SECTION 00 43 00

BID FORM SUPPLEMENTS

To: City of Kokomo, Board of Public Works and Safety

Project: Kokomo Bus Maintenance Facility

Date: .....

Submitted by: .....
(full name)

(full address) .....

.....

In accordance with Document 00 21 14 - Instructions to Bidders, we include the Appendices to Bid Form Supplements listed below. The information provided shall be considered an integral part of the Bid Form. The following Appendices are attached to this document:

Appendix A – Subcontractors and Materials List:
Appendix B – Contractors Non-Collusion Affidavit
- Non-Discrimination Provision

BID FORM SUPPLEMENTS SIGNATURES

The Corporate Seal of

.....
(Bidder - print the full name of your firm)

was hereunto affixed in the presence of:

.....
(Authorized signing officer Title)

(Seal)

.....
(Authorized signing officer Title)
(Seal)

APPENDIX A – SUBCONTRACTORS AND MATERIALS LIST

Herewith is the list of subcontractors referenced in the bid submitted by:

(Bidder) .....

To (Owner) City of New Haven, Board of Public Works and Safety

Dated ..... and which is an integral part of the Bid Form.

The two apparent low bidders for General Construction shall submit, in duplicate, completed Subcontractors and Materials List within two (2) days (48 hours) following bid receipt date.

The Owner and Architect/Engineer have the right to choose the Subcontractor, Material or Equipment for any particular item where the Bidder fails to list same.

When products are named, and a list of acceptable manufacturers is included in the specifications, Bidders shall select one of the named manufacturers in his Subcontractors and Materials List.

After the submission and approval of this Subcontractors and Materials List by the Architect/Engineer and the Owner, the Contractor shall make no changes or alterations without the written approval of the Architect/Engineer and the Owner.

The following work will be performed (or provided) by subcontractors and coordinated by us (reference specification sections):

SECTION	MATERIAL AND/OR EQUIPMENT	MANUFACTURER	SUPPLIER	INSTALLER

SECTION	MATERIAL AND/OR EQUIPMENT	MANUFACTURER	SUPPLIER	INSTALLER

APPENDIX B – CONTRACTOR NON-COLLUSION AFFADAVIT

The undersigned bidder or agent, being duly sworn on oath, says that he or she has not, nor has any other member, representative, or agent of the firm, company, corporation or partnership represented by him or her, entered into any combination, collusion or agreement with any person relative to the price to be bid by anyone at such letting nor to prevent any person from bidding nor to include anyone to refrain from bidding, and that this bid made without reference to any other bid and without any agreement, understanding or combination with any other person in reference to such bidding.

He or she further says that no person or persons, firms, or corporation has, have or will receive directly or indirectly, any rebate, fee, gift, commission or thing of value on account of such sale.

OATH AND AFFIRMATION

I HEREBY AFFIRM UNDER THE PENALTIES FOR PERJURY THAT THE FACTS AND INFORMATION CONTAINED IN THE FOREGOING BID FOR PUBLIC WORKS ARE TRUE AND CORRECT.

Dated at _____ this _____ day of _____ , _____

_____
(Name of Organization)

By _____

_____
(Title of Person Signing)

ACKNOWLEDGEMENT

STATE OF _____)
)ss
COUNTY OF _____)

Before me, a Notary Public, personally appeared the above-named _____ and swore that the statements contained in the foregoing document are true and correct.
Subscribed and sworn to before me this _____ day of _____ ,20 _____ .

_____
Notary Public

My Commission Expires: _____

County of Residence: _____

NON-COLLUSION AFFADAVIT
NON-DISCRIMINATION PROVISION

The Contractor on this construction agrees that in the hiring of employees for the performance of work under this contract or any subcontract hereunder, no Contractor, Subcontractor, nor any person acting on behalf of such Contractor or Subcontractor shall discriminate against any employee or applicant for employment, with respect to his or her hire, tenure, terms, conditions or privileges of employment or any matter directly or indirectly related to employment, because of his or her race, color, age, religion, gender, national origin or ancestry. Breach of this covenant may be regarded as a material breach of contract.

_____
(Name of Organization)

By _____

_____
(Title of Person Signing)

Subscribed and sworn to before me this _____ day of _____, 20____ .

_____
Notary Public

My Commission Expires: _____

County of Residence: _____

END OF SECTION

SECTION 00 43 23

ALTERNATES FORM

PART 1 -

1.1 BID INFORMATION

A. Bidder: _____.

B. Prime Contract: _____.

C. Project Name: Kokomo Bus Maintenance Facility

D. Project Location: 919 Millbrook Lane, Kokomo, IN 46901.

E. Owner: The City of Kokomo.

F. Owner Project Number: C2507-1B.

G. Architect: RQAW / DCCM.

H. Architect Project Number: 700-6054.

1.2 BID FORM SUPPLEMENT

A. This form is required to be attached to the Bid Form.

1.3 DESCRIPTION

A. The undersigned Bidder proposes the amount below be added to or deducted from the Base Bid if particular alternates are accepted by Owner. Amounts listed for each alternate include costs of related coordination, modification, or adjustment.

1. Cost-Plus-Fee Contract: Alternate price given below includes adjustment to Contractor's Fee.

B. If the alternate does not affect the Contract Sum, the Bidder shall indicate "NO CHANGE."

C. If the alternate does not affect the Work of this Contract, the Bidder shall indicate "NOT APPLICABLE."

D. The Bidder shall be responsible for determining from the Contract Documents the affects of each alternate on the Contract Time and the Contract Sum.

E. Owner reserves the right to accept or reject any alternate, in any order, and to award or amend the Contract accordingly within [**60**] days of the Notice of Award unless otherwise indicated in the Contract Documents.

F. Acceptance or non-acceptance of any alternates by the Owner shall have no affect on the Contract Time unless the "Schedule of Alternates" Article below provides a formatted space for the adjustment of the Contract Time.

1.4 SCHEDULE OF ALTERNATES

A. Alternate No. 1 (ALT-1):
1. Underside of metal roof ceiling to receive (128) acoustical ceiling panels. Acoustical ceiling panels basis of design not to exclude others:
   a. Manufacturer: Armstrong Ceilings
   b. Model: Tectum Direct-Attach, 24” x 48”
   c. Finish: White (TWH)
      1) Beveled edges, C-20 mounting; install per manufacturer’s specifications.

2. ADD____ DEDUCT____ NO CHANGE____ NOT APPLICABLE____.
3. _____ Dollars ($_____).
4. ADD____ DEDUCT____ calendar days to adjust the Contract Time for this alternate.

B. Alternate No. 2 (ALT-2):
1. Structural main frame to be painted color P-5. Structural metal girts, purlins and secondary structural members to be painted P-3. Paint colors P-5 & P-3 basis of design not to exclude others listed below:
   a. Paint color P-5:
      1) Manufacturer: Sherwin Williams
      2) Color: Cityscape SW7067
      3) Sheen: Semi-gloss
   b. Paint color P-3:
      1) Manufacturer: Sherwin Williams
      2) Color: Ceiling Bright White SW7007
      3) Sheen: Flat

2. ADD____ DEDUCT____ NO CHANGE____ NOT APPLICABLE____.
3. _____ Dollars ($_____).
4. ADD____ DEDUCT____ calendar days to adjust the Contract Time for this alternate.

C. Alternate No. 3 (ALT-3):
1. Maintenance area to receive epoxy flooring finish. Refer to alternate maintenance are flooring finish plan on sheet IN100 for extent of epoxy flooring. Epoxy flooring finish basis of design not to exclude others:
   a. Manufacturer: Sherwin Williams

b. Specification: Resuflor Gard SL (60 Mils) with Accelera 4850; 80/120 Mesh San / 1 Coat of 3746 Epoxy Topcoat
   1) Finish to include grit that ensure commercial slip-coefficients are met.
c. Color: Steel Gray

2. ADD____ DEDUCT____ NO CHANGE____ NOT APPLICABLE____.
3. _____ Dollars ($_____).
4. ADD____ DEDUCT____ calendar days to adjust the Contract Time for this alternate.

D. Alternate No. 4.1 (ALT-4.1):
1. Tire balancer to be provided by Contractor. Tire balancer basis of design not to exclude others:
   a. Manufacturer: Hunter
   b. Model: HDE-32

2. ADD____ DEDUCT____ NO CHANGE____ NOT APPLICABLE____.
3. _____ Dollars ($_____).
4. ADD____ DEDUCT____ calendar days to adjust the Contract Time for this alternate.

E. Alternate No. 4.1 (ALT-4.1):
1. Tire changer to be provided by Contractor. Tire changer basis of design not to exclude others:
   a. Manufacturer: Hunter
   b. Model: TCX635PHD

2. ADD____ DEDUCT____ NO CHANGE____ NOT APPLICABLE____.
3. _____ Dollars ($_____).
4. ADD____ DEDUCT____ calendar days to adjust the Contract Time for this alternate.

F. Alternate No. 4.2 (ALT-4.2):
1. Tire balancer to be provided by Contractor. Tire balancer basis of design not to exclude others:
   a. Manufacturer: Hunter
   b. Model: HDE-32

2. ADD____ DEDUCT____ NO CHANGE____ NOT APPLICABLE____.
3. _____ Dollars ($_____).
4. ADD____ DEDUCT____ calendar days to adjust the Contract Time for this alternate.

G. Alternate No. 4.3 (ALT-4.3):
1. Mig, tig and stick welder with cart and mobile fume extraction unit to be provided by Contractor. Welder and mobile fume extraction unit basis of design not to exclude others:
   a. Manufacturer: Miller
   b. Model: Mutlimatic 220 AC/CD with Cart & Filtair130 Mobile Package
      1) Specification: 120V power input

2. ADD____ DEDUCT____ NO CHANGE____ NOT APPLICABLE____.
3. _____ Dollars ($_____).
4. ADD____ DEDUCT____ calendar days to adjust the Contract Time for this alternate.

H. Alternate No. 4.5 (ALT-4.5):
1. Mobile column lifts to be provided by Contractor. A set of (4) column lifts is required. Column lifts must have a 18,500 lbs. lift capacity. Mobile column lifts basis of design not to exclude others:
   a. Manufacturer: Stertil Koni
   b. Model: ST1085
      1) Specification: Wireless

2. ADD____ DEDUCT____ NO CHANGE____ NOT APPLICABLE____.
3. _____ Dollars ($_____).
4. ADD____ DEDUCT____ calendar days to adjust the Contract Time for this alternate.

I. Alternate No. 4.6 (ALT-4.6):
1. Compressor to be provided by Contractor. Compressor must be rated for 125 psig. Compressor basis of design not to exclude others:
   a. Manufacturer: Ingersoll Rand
   b. Model: UP6-7.5STAS-125

2. ADD____ DEDUCT____ NO CHANGE____ NOT APPLICABLE____.
3. _____ Dollars ($_____).
4. ADD____ DEDUCT____ calendar days to adjust the Contract Time for this alternate.

1.5 SUBMISSION OF BID SUPPLEMENT

A. Respectfully submitted this ____ day of _____, 2012.

B. Submitted By:_____(Insert name of bidding firm or corporation).

C. Authorized Signature:_____(Handwritten signature).

D. Signed By:_____(Type or print name).

E. Title:_____(Owner/Partner/President/Vice President).

END OF SECTION

SECTION 00 52 14

AGREEMENT - AIA

1.1 SUMMARY

A. Document Includes:
1. Agreement.

1.2 AGREEMENT

A. AIA Document A101-2017, Standard Form of Agreement Between Owner and Contractor Where the Basis of Payment is a Stipulated Sum, forms the basis of Agreement between the Owner and Contractor.

END OF SECTION

DRAFT

AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

for the following PROJECT:
(Name and location or address)

Kokomo Bus Maintenance Facility
919 Millbrook Lane
Kokomo, IN 46901

THE OWNER:
(Name, legal status and address)

City of Kokomo
100 S Union Street
Kokomo, IN 46901

THE ARCHITECT:
(Name, legal status and address)

RQAW/DCCM Corporation
8770 North Street
Fishers, IN 46038

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ADDITIONS AND DELETIONS: The author of this document has added information needed for its completion. The author may also have revised the text of the original AIA standard form. An *Additions and Deletions Report* that notes added information as well as revisions to the standard form text is available from the author and should be reviewed.

This document has important legal consequences. Consultation with an attorney is encouraged with respect to its completion or modification.

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14 TERMINATION OR SUSPENSION OF THE CONTRACT

15 CLAIMS AND DISPUTES

DRAFT

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ARTICLE 1 GENERAL PROVISIONS

§ 1.1 Basic Definitions

§ 1.1.1 The Contract Documents

The Contract Documents are enumerated in the Agreement between the Owner and Contractor (hereinafter the Agreement) and consist of the Agreement, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, Addenda issued prior to execution of the Contract, other documents listed in the Agreement, and Modifications issued after execution of the Contract. A Modification is (1) a written amendment to the Contract signed by both parties, (2) a Change Order, (3) a Construction Change Directive, or (4) a written order for a minor change in the Work issued by the Architect. Unless specifically enumerated in the Agreement, the Contract Documents do not include the advertisement or invitation to bid, Instructions to Bidders, sample forms, other information furnished by the Owner in anticipation of receiving bids or proposals, the Contractor's bid or proposal, or portions of Addenda relating to bidding or proposal requirements.

§ 1.1.2 The Contract

The Contract Documents form the Contract for Construction. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. The Contract may be amended or modified only by a Modification. The Contract Documents shall not be construed to create a contractual relationship of any kind (1) between the Contractor and the Architect or the Architect's consultants, (2) between the Owner and a Subcontractor or a Sub-subcontractor, (3) between the Owner and the Architect or the Architect's consultants, or (4) between any persons or entities other than the Owner and the Contractor. The Architect shall, however, be entitled to performance and enforcement of obligations under the Contract intended to facilitate performance of the Architect's duties.

§ 1.1.3 The Work

The term "Work" means the construction and services required by the Contract Documents, whether completed or partially completed, and includes all other labor, materials, equipment, and services provided or to be provided by the Contractor to fulfill the Contractor's obligations. The Work may constitute the whole or a part of the Project.

§ 1.1.4 The Project

The Project is the total construction of which the Work performed under the Contract Documents may be the whole or a part and which may include construction by the Owner and by Separate Contractors.

§ 1.1.5 The Drawings

The Drawings are the graphic and pictorial portions of the Contract Documents showing the design, location and dimensions of the Work, generally including plans, elevations, sections, details, schedules, and diagrams.

§ 1.1.6 The Specifications

The Specifications are that portion of the Contract Documents consisting of the written requirements for materials, equipment, systems, standards and workmanship for the Work, and performance of related services.

§ 1.1.7 Instruments of Service

Instruments of Service are representations, in any medium of expression now known or later developed, of the tangible and intangible creative work performed by the Architect and the Architect's consultants under their respective professional services agreements. Instruments of Service may include, without limitation, studies, surveys, models, sketches, drawings, specifications, and other similar materials.

§ 1.1.8 Initial Decision Maker

The Initial Decision Maker is the person identified in the Agreement to render initial decisions on Claims in accordance with Section 15.2. The Initial Decision Maker shall not show partiality to the Owner or Contractor and shall not be liable for results of interpretations or decisions rendered in good faith.

§ 1.2 Correlation and Intent of the Contract Documents

§ 1.2.1 The intent of the Contract Documents is to include all items necessary for the proper execution and completion of the Work by the Contractor. The Contract Documents are complementary, and what is required by one shall be as binding as if required by all; performance by the Contractor shall be required only to the extent consistent with the Contract Documents and reasonably inferable from them as being necessary to produce the indicated results.

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§ 1.2.1.1 The invalidity of any provision of the Contract Documents shall not invalidate the Contract or its remaining provisions. If it is determined that any provision of the Contract Documents violates any law, or is otherwise invalid or unenforceable, then that provision shall be revised to the extent necessary to make that provision legal and enforceable. In such case the Contract Documents shall be construed, to the fullest extent permitted by law, to give effect to the parties' intentions and purposes in executing the Contract.

§ 1.2.2 Organization of the Specifications into divisions, sections and articles, and arrangement of Drawings shall not control the Contractor in dividing the Work among Subcontractors or in establishing the extent of Work to be performed by any trade.

§ 1.2.3 Unless otherwise stated in the Contract Documents, words that have well-known technical or construction industry meanings are used in the Contract Documents in accordance with such recognized meanings.

§ 1.3 Capitalization

Terms capitalized in these General Conditions include those that are (1) specifically defined, (2) the titles of numbered articles, or (3) the titles of other documents published by the American Institute of Architects.

§ 1.4 Interpretation

In the interest of brevity the Contract Documents frequently omit modifying words such as "all" and "any" and articles such as "the" and "an," but the fact that a modifier or an article is absent from one statement and appears in another is not intended to affect the interpretation of either statement.

§ 1.5 Ownership and Use of Drawings, Specifications, and Other Instruments of Service

§ 1.5.1 The Architect and the Architect's consultants shall be deemed the authors and owners of their respective Instruments of Service, including the Drawings and Specifications, and retain all common law, statutory, and other reserved rights in their Instruments of Service, including copyrights. The Contractor, Subcontractors, Sub-subcontractors, and suppliers shall not own or claim a copyright in the Instruments of Service. Submittal or distribution to meet official regulatory requirements or for other purposes in connection with the Project is not to be construed as publication in derogation of the Architect's or Architect's consultants' reserved rights.

§ 1.5.2 The Contractor, Subcontractors, Sub-subcontractors, and suppliers are authorized to use and reproduce the Instruments of Service provided to them, subject to any protocols established pursuant to Sections 1.7 and 1.8, solely and exclusively for execution of the Work. All copies made under this authorization shall bear the copyright notice, if any, shown on the Instruments of Service. The Contractor, Subcontractors, Sub-subcontractors, and suppliers may not use the Instruments of Service on other projects or for additions to the Project outside the scope of the Work without the specific written consent of the Owner, Architect, and the Architect's consultants.

§ 1.6 Notice

§ 1.6.1 Except as otherwise provided in Section 1.6.2, where the Contract Documents require one party to notify or give notice to the other party, such notice shall be provided in writing to the designated representative of the party to whom the notice is addressed and shall be deemed to have been duly served if delivered in person, by mail, by courier, or by electronic transmission if a method for electronic transmission is set forth in the Agreement.

§ 1.6.2 Notice of Claims as provided in Section 15.1.3 shall be provided in writing and shall be deemed to have been duly served only if delivered to the designated representative of the party to whom the notice is addressed by certified or registered mail, or by courier providing proof of delivery.

§ 1.7 Digital Data Use and Transmission

The parties shall agree upon protocols governing the transmission and use of Instruments of Service or any other information or documentation in digital form. The parties will use AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, to establish the protocols for the development, use, transmission, and exchange of digital data.

§ 1.8 Building Information Models Use and Reliance

Any use of, or reliance on, all or a portion of a building information model without agreement to protocols governing the use of, and reliance on, the information contained in the model and without having those protocols set forth in AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, and the requisite AIA Document G202™–2013, Project Building Information Modeling Protocol Form, shall be at the using or

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relying party's sole risk and without liability to the other party and its contractors or consultants, the authors of, or contributors to, the building information model, and each of their agents and employees.

ARTICLE 2 OWNER

§ 2.1 General

§ 2.1.1 The Owner is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Owner shall designate in writing a representative who shall have express authority to bind the Owner with respect to all matters requiring the Owner's approval or authorization. Except as otherwise provided in Section 4.2.1, the Architect does not have such authority. The term "Owner" means the Owner or the Owner's authorized representative.

§ 2.1.2 The Owner shall furnish to the Contractor, within fifteen days after receipt of a written request, information necessary and relevant for the Contractor to evaluate, give notice of, or enforce mechanic's lien rights. Such information shall include a correct statement of the record legal title to the property on which the Project is located, usually referred to as the site, and the Owner's interest therein.

§ 2.2 Evidence of the Owner's Financial Arrangements

§ 2.2.1 Prior to commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract. The Contractor shall have no obligation to commence the Work until the Owner provides such evidence. If commencement of the Work is delayed under this Section 2.2.1, the Contract Time shall be extended appropriately.

§ 2.2.2 Following commencement of the Work and upon written request by the Contractor, the Owner shall furnish to the Contractor reasonable evidence that the Owner has made financial arrangements to fulfill the Owner's obligations under the Contract only if (1) the Owner fails to make payments to the Contractor as the Contract Documents require; (2) the Contractor identifies in writing a reasonable concern regarding the Owner's ability to make payment when due; or (3) a change in the Work materially changes the Contract Sum. If the Owner fails to provide such evidence, as required, within fourteen days of the Contractor's request, the Contractor may immediately stop the Work and, in that event, shall notify the Owner that the Work has stopped. However, if the request is made because a change in the Work materially changes the Contract Sum under (3) above, the Contractor may immediately stop only that portion of the Work affected by the change until reasonable evidence is provided. If the Work is stopped under this Section 2.2.2, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided in the Contract Documents.

§ 2.2.3 After the Owner furnishes evidence of financial arrangements under this Section 2.2, the Owner shall not materially vary such financial arrangements without prior notice to the Contractor.

§ 2.2.4 Where the Owner has designated information furnished under this Section 2.2 as "confidential," the Contractor shall keep the information confidential and shall not disclose it to any other person. However, the Contractor may disclose "confidential" information, after seven (7) days' notice to the Owner, where disclosure is required by law, including a subpoena or other form of compulsory legal process issued by a court or governmental entity, or by court or arbitrator(s) order. The Contractor may also disclose "confidential" information to its employees, consultants, sureties, Subcontractors and their employees, Sub-subcontractors, and others who need to know the content of such information solely and exclusively for the Project and who agree to maintain the confidentiality of such information.

§ 2.3 Information and Services Required of the Owner

§ 2.3.1 Except for permits and fees that are the responsibility of the Contractor under the Contract Documents, including those required under Section 3.7.1, the Owner shall secure and pay for necessary approvals, easements, assessments and charges required for construction, use or occupancy of permanent structures or for permanent changes in existing facilities.

§ 2.3.2 The Owner shall retain an architect lawfully licensed to practice architecture, or an entity lawfully practicing architecture, in the jurisdiction where the Project is located. That person or entity is identified as the Architect in the Agreement and is referred to throughout the Contract Documents as if singular in number.

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§ 2.3.3 If the employment of the Architect terminates, the Owner shall employ a successor to whom the Contractor has no reasonable objection and whose status under the Contract Documents shall be that of the Architect.

§ 2.3.4 The Owner shall furnish surveys describing physical characteristics, legal limitations and utility locations for the site of the Project, and a legal description of the site. The Contractor shall be entitled to rely on the accuracy of information furnished by the Owner but shall exercise proper precautions relating to the safe performance of the Work.

§ 2.3.5 The Owner shall furnish information or services required of the Owner by the Contract Documents with reasonable promptness. The Owner shall also furnish any other information or services under the Owner's control and relevant to the Contractor's performance of the Work with reasonable promptness after receiving the Contractor's written request for such information or services.

§ 2.3.6 Unless otherwise provided in the Contract Documents, the Owner shall furnish to the Contractor one copy of the Contract Documents for purposes of making reproductions pursuant to Section 1.5.2.

§ 2.4 Owner's Right to Stop the Work

If the Contractor fails to correct Work that is not in accordance with the requirements of the Contract Documents as required by Section 12.2 or repeatedly fails to carry out Work in accordance with the Contract Documents, the Owner may issue a written order to the Contractor to stop the Work, or any portion thereof, until the cause for such order has been eliminated; however, the right of the Owner to stop the Work shall not give rise to a duty on the part of the Owner to exercise this right for the benefit of the Contractor or any other person or entity, except to the extent required by Section 6.1.3.

§ 2.5 Owner's Right to Carry Out the Work

If the Contractor defaults or neglects to carry out the Work in accordance with the Contract Documents and fails within a ten-day period after receipt of notice from the Owner to commence and continue correction of such default or neglect with diligence and promptness, the Owner may, without prejudice to other remedies the Owner may have, correct such default or neglect. Such action by the Owner and amounts charged to the Contractor are both subject to prior approval of the Architect and the Architect may, pursuant to Section 9.5.1, withhold or nullify a Certificate for Payment in whole or in part, to the extent reasonably necessary to reimburse the Owner for the reasonable cost of correcting such deficiencies, including Owner's expenses and compensation for the Architect's additional services made necessary by such default, neglect, or failure. If current and future payments are not sufficient to cover such amounts, the Contractor shall pay the difference to the Owner. If the Contractor disagrees with the actions of the Owner or the Architect, or the amounts claimed as costs to the Owner, the Contractor may file a Claim pursuant to Article 15.

ARTICLE 3 CONTRACTOR

§ 3.1 General

§ 3.1.1 The Contractor is the person or entity identified as such in the Agreement and is referred to throughout the Contract Documents as if singular in number. The Contractor shall be lawfully licensed, if required in the jurisdiction where the Project is located. The Contractor shall designate in writing a representative who shall have express authority to bind the Contractor with respect to all matters under this Contract. The term "Contractor" means the Contractor or the Contractor's authorized representative.

§ 3.1.2 The Contractor shall perform the Work in accordance with the Contract Documents.

§ 3.1.3 The Contractor shall not be relieved of its obligations to perform the Work in accordance with the Contract Documents either by activities or duties of the Architect in the Architect's administration of the Contract, or by tests, inspections or approvals required or performed by persons or entities other than the Contractor.

§ 3.2 Review of Contract Documents and Field Conditions by Contractor

§ 3.2.1 Execution of the Contract by the Contractor is a representation that the Contractor has visited the site, become generally familiar with local conditions under which the Work is to be performed, and correlated personal observations with requirements of the Contract Documents.

§ 3.2.2 Because the Contract Documents are complementary, the Contractor shall, before starting each portion of the Work, carefully study and compare the various Contract Documents relative to that portion of the Work, as well as

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the information furnished by the Owner pursuant to Section 2.3.4, shall take field measurements of any existing conditions related to that portion of the Work, and shall observe any conditions at the site affecting it. These obligations are for the purpose of facilitating coordination and construction by the Contractor and are not for the purpose of discovering errors, omissions, or inconsistencies in the Contract Documents; however, the Contractor shall promptly report to the Architect any errors, inconsistencies or omissions discovered by or made known to the Contractor as a request for information in such form as the Architect may require. It is recognized that the Contractor's review is made in the Contractor's capacity as a contractor and not as a licensed design professional, unless otherwise specifically provided in the Contract Documents.

§ 3.2.3 The Contractor is not required to ascertain that the Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, but the Contractor shall promptly report to the Architect any nonconformity discovered by or made known to the Contractor as a request for information in such form as the Architect may require.

§ 3.2.4 If the Contractor believes that additional cost or time is involved because of clarifications or instructions the Architect issues in response to the Contractor's notices or requests for information pursuant to Sections 3.2.2 or 3.2.3, the Contractor shall submit Claims as provided in Article 15. If the Contractor fails to perform the obligations of Sections 3.2.2 or 3.2.3, the Contractor shall pay such costs and damages to the Owner, subject to Section 15.1.7, as would have been avoided if the Contractor had performed such obligations. If the Contractor performs those obligations, the Contractor shall not be liable to the Owner or Architect for damages resulting from errors, inconsistencies or omissions in the Contract Documents, for differences between field measurements or conditions and the Contract Documents, or for nonconformities of the Contract Documents to applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities.

§ 3.3 Supervision and Construction Procedures

§ 3.3.1 The Contractor shall supervise and direct the Work, using the Contractor's best skill and attention. The Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences, and procedures, and for coordinating all portions of the Work under the Contract. If the Contract Documents give specific instructions concerning construction means, methods, techniques, sequences, or procedures, the Contractor shall evaluate the jobsite safety thereof and shall be solely responsible for the jobsite safety of such means, methods, techniques, sequences, or procedures. If the Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely notice to the Owner and Architect, and shall propose alternative means, methods, techniques, sequences, or procedures. The Architect shall evaluate the proposed alternative solely for conformance with the design intent for the completed construction. Unless the Architect objects to the Contractor's proposed alternative, the Contractor shall perform the Work using its alternative means, methods, techniques, sequences, or procedures.

§ 3.3.2 The Contractor shall be responsible to the Owner for acts and omissions of the Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of the Work for, or on behalf of, the Contractor or any of its Subcontractors.

§ 3.3.3 The Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work.

§ 3.4 Labor and Materials

§ 3.4.1 Unless otherwise provided in the Contract Documents, the Contractor shall provide and pay for labor, materials, equipment, tools, construction equipment and machinery, water, heat, utilities, transportation, and other facilities and services necessary for proper execution and completion of the Work, whether temporary or permanent and whether or not incorporated or to be incorporated in the Work.

§ 3.4.2 Except in the case of minor changes in the Work approved by the Architect in accordance with Section 3.12.8 or ordered by the Architect in accordance with Section 7.4, the Contractor may make substitutions only with the consent of the Owner, after evaluation by the Architect and in accordance with a Change Order or Construction Change Directive.

§ 3.4.3 The Contractor shall enforce strict discipline and good order among the Contractor's employees and other persons carrying out the Work. The Contractor shall not permit employment of unfit persons or persons not properly skilled in tasks assigned to them.

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§ 3.5 Warranty

§ 3.5.1 The Contractor warrants to the Owner and Architect that materials and equipment furnished under the Contract will be of good quality and new unless the Contract Documents require or permit otherwise. The Contractor further warrants that the Work will conform to the requirements of the Contract Documents and will be free from defects, except for those inherent in the quality of the Work the Contract Documents require or permit. Work, materials, or equipment not conforming to these requirements may be considered defective. The Contractor's warranty excludes remedy for damage or defect caused by abuse, alterations to the Work not executed by the Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear and normal usage. If required by the Architect, the Contractor shall furnish satisfactory evidence as to the kind and quality of materials and equipment.

§ 3.5.2 All material, equipment, or other special warranties required by the Contract Documents shall be issued in the name of the Owner, or shall be transferable to the Owner, and shall commence in accordance with Section 9.8.4.

§ 3.6 Taxes

The Contractor shall pay sales, consumer, use and similar taxes for the Work provided by the Contractor that are legally enacted when bids are received or negotiations concluded, whether or not yet effective or merely scheduled to go into effect.

§ 3.7 Permits, Fees, Notices and Compliance with Laws

§ 3.7.1 Unless otherwise provided in the Contract Documents, the Contractor shall secure and pay for the building permit as well as for other permits, fees, licenses, and inspections by government agencies necessary for proper execution and completion of the Work that are customarily secured after execution of the Contract and legally required at the time bids are received or negotiations concluded.

§ 3.7.2 The Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of the Work.

§ 3.7.3 If the Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction.

§ 3.7.4 Concealed or Unknown Conditions

If the Contractor encounters conditions at the site that are (1) subsurface or otherwise concealed physical conditions that differ materially from those indicated in the Contract Documents or (2) unknown physical conditions of an unusual nature that differ materially from those ordinarily found to exist and generally recognized as inherent in construction activities of the character provided for in the Contract Documents, the Contractor shall promptly provide notice to the Owner and the Architect before conditions are disturbed and in no event later than 14 days after first observance of the conditions. The Architect will promptly investigate such conditions and, if the Architect determines that they differ materially and cause an increase or decrease in the Contractor's cost of, or time required for, performance of any part of the Work, will recommend that an equitable adjustment be made in the Contract Sum or Contract Time, or both. If the Architect determines that the conditions at the site are not materially different from those indicated in the Contract Documents and that no change in the terms of the Contract is justified, the Architect shall promptly notify the Owner and Contractor, stating the reasons. If either party disputes the Architect's determination or recommendation, that party may submit a Claim as provided in Article 15.

§ 3.7.5 If, in the course of the Work, the Contractor encounters human remains or recognizes the existence of burial markers, archaeological sites or wetlands not indicated in the Contract Documents, the Contractor shall immediately suspend any operations that would affect them and shall notify the Owner and Architect. Upon receipt of such notice, the Owner shall promptly take any action necessary to obtain governmental authorization required to resume the operations. The Contractor shall continue to suspend such operations until otherwise instructed by the Owner but shall continue with all other operations that do not affect those remains or features. Requests for adjustments in the Contract Sum and Contract Time arising from the existence of such remains or features may be made as provided in Article 15.

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§ 3.8 Allowances

§ 3.8.1 The Contractor shall include in the Contract Sum all allowances stated in the Contract Documents. Items covered by allowances shall be supplied for such amounts and by such persons or entities as the Owner may direct, but the Contractor shall not be required to employ persons or entities to whom the Contractor has reasonable objection.

§ 3.8.2 Unless otherwise provided in the Contract Documents,

- **.1** allowances shall cover the cost to the Contractor of materials and equipment delivered at the site and all required taxes, less applicable trade discounts;
- **.2** Contractor's costs for unloading and handling at the site, labor, installation costs, overhead, profit, and other expenses contemplated for stated allowance amounts shall be included in the Contract Sum but not in the allowances; and
- **.3** whenever costs are more than or less than allowances, the Contract Sum shall be adjusted accordingly by Change Order. The amount of the Change Order shall reflect (1) the difference between actual costs and the allowances under Section 3.8.2.1 and (2) changes in Contractor's costs under Section 3.8.2.2.

§ 3.8.3 Materials and equipment under an allowance shall be selected by the Owner with reasonable promptness.

§ 3.9 Superintendent

§ 3.9.1 The Contractor shall employ a competent superintendent and necessary assistants who shall be in attendance at the Project site during performance of the Work. The superintendent shall represent the Contractor, and communications given to the superintendent shall be as binding as if given to the Contractor.

§ 3.9.2 The Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the name and qualifications of a proposed superintendent. Within 14 days of receipt of the information, the Architect may notify the Contractor, stating whether the Owner or the Architect (1) has reasonable objection to the proposed superintendent or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 3.9.3 The Contractor shall not employ a proposed superintendent to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not change the superintendent without the Owner's consent, which shall not unreasonably be withheld or delayed.

§ 3.10 Contractor's Construction and Submittal Schedules

§ 3.10.1 The Contractor, promptly after being awarded the Contract, shall submit for the Owner's and Architect's information a Contractor's construction schedule for the Work. The schedule shall contain detail appropriate for the Project, including (1) the date of commencement of the Work, interim schedule milestone dates, and the date of Substantial Completion; (2) an apportionment of the Work by construction activity; and (3) the time required for completion of each portion of the Work. The schedule shall provide for the orderly progression of the Work to completion and shall not exceed time limits current under the Contract Documents. The schedule shall be revised at appropriate intervals as required by the conditions of the Work and Project.

§ 3.10.2 The Contractor, promptly after being awarded the Contract and thereafter as necessary to maintain a current submittal schedule, shall submit a submittal schedule for the Architect's approval. The Architect's approval shall not be unreasonably delayed or withheld. The submittal schedule shall (1) be coordinated with the Contractor's construction schedule, and (2) allow the Architect reasonable time to review submittals. If the Contractor fails to submit a submittal schedule, or fails to provide submittals in accordance with the approved submittal schedule, the Contractor shall not be entitled to any increase in Contract Sum or extension of Contract Time based on the time required for review of submittals.

§ 3.10.3 The Contractor shall perform the Work in general accordance with the most recent schedules submitted to the Owner and Architect.

§ 3.11 Documents and Samples at the Site

The Contractor shall make available, at the Project site, the Contract Documents, including Change Orders, Construction Change Directives, and other Modifications, in good order and marked currently to indicate field changes and selections made during construction, and the approved Shop Drawings, Product Data, Samples, and

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similar required submittals. These shall be in electronic form or paper copy, available to the Architect and Owner, and delivered to the Architect for submittal to the Owner upon completion of the Work as a record of the Work as constructed.

§ 3.12 Shop Drawings, Product Data and Samples

§ 3.12.1 Shop Drawings are drawings, diagrams, schedules, and other data specially prepared for the Work by the Contractor or a Subcontractor, Sub-subcontractor, manufacturer, supplier, or distributor to illustrate some portion of the Work.

§ 3.12.2 Product Data are illustrations, standard schedules, performance charts, instructions, brochures, diagrams, and other information furnished by the Contractor to illustrate materials or equipment for some portion of the Work.

§ 3.12.3 Samples are physical examples that illustrate materials, equipment, or workmanship, and establish standards by which the Work will be judged.

§ 3.12.4 Shop Drawings, Product Data, Samples, and similar submittals are not Contract Documents. Their purpose is to demonstrate how the Contractor proposes to conform to the information given and the design concept expressed in the Contract Documents for those portions of the Work for which the Contract Documents require submittals. Review by the Architect is subject to the limitations of Section 4.2.7. Informational submittals upon which the Architect is not expected to take responsive action may be so identified in the Contract Documents. Submittals that are not required by the Contract Documents may be returned by the Architect without action.

§ 3.12.5 The Contractor shall review for compliance with the Contract Documents, approve, and submit to the Architect, Shop Drawings, Product Data, Samples, and similar submittals required by the Contract Documents, in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in the Work or in the activities of the Owner or of Separate Contractors.

§ 3.12.6 By submitting Shop Drawings, Product Data, Samples, and similar submittals, the Contractor represents to the Owner and Architect that the Contractor has (1) reviewed and approved them, (2) determined and verified materials, field measurements and field construction criteria related thereto, or will do so, and (3) checked and coordinated the information contained within such submittals with the requirements of the Work and of the Contract Documents.

§ 3.12.7 The Contractor shall perform no portion of the Work for which the Contract Documents require submittal and review of Shop Drawings, Product Data, Samples, or similar submittals, until the respective submittal has been approved by the Architect.

§ 3.12.8 The Work shall be in accordance with approved submittals except that the Contractor shall not be relieved of responsibility for deviations from the requirements of the Contract Documents by the Architect's approval of Shop Drawings, Product Data, Samples, or similar submittals, unless the Contractor has specifically notified the Architect of such deviation at the time of submittal and (1) the Architect has given written approval to the specific deviation as a minor change in the Work, or (2) a Change Order or Construction Change Directive has been issued authorizing the deviation. The Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples, or similar submittals, by the Architect's approval thereof.

§ 3.12.9 The Contractor shall direct specific attention, in writing or on resubmitted Shop Drawings, Product Data, Samples, or similar submittals, to revisions other than those requested by the Architect on previous submittals. In the absence of such notice, the Architect's approval of a resubmission shall not apply to such revisions.

§ 3.12.10 The Contractor shall not be required to provide professional services that constitute the practice of architecture or engineering unless such services are specifically required by the Contract Documents for a portion of the Work or unless the Contractor needs to provide such services in order to carry out the Contractor's responsibilities for construction means, methods, techniques, sequences, and procedures. The Contractor shall not be required to provide professional services in violation of applicable law.

§ 3.12.10.1 If professional design services or certifications by a design professional related to systems, materials, or equipment are specifically required of the Contractor by the Contract Documents, the Owner and the Architect will

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specify all performance and design criteria that such services must satisfy. The Contractor shall be entitled to rely upon the adequacy and accuracy of the performance and design criteria provided in the Contract Documents. The Contractor shall cause such services or certifications to be provided by an appropriately licensed design professional, whose signature and seal shall appear on all drawings, calculations, specifications, certifications, Shop Drawings, and other submittals prepared by such professional. Shop Drawings, and other submittals related to the Work, designed or certified by such professional, if prepared by others, shall bear such professional's written approval when submitted to the Architect. The Owner and the Architect shall be entitled to rely upon the adequacy and accuracy of the services, certifications, and approvals performed or provided by such design professionals, provided the Owner and Architect have specified to the Contractor the performance and design criteria that such services must satisfy. Pursuant to this Section 3.12.10, the Architect will review and approve or take other appropriate action on submittals only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents.

§ 3.12.10.2 If the Contract Documents require the Contractor's design professional to certify that the Work has been performed in accordance with the design criteria, the Contractor shall furnish such certifications to the Architect at the time and in the form specified by the Architect.

§ 3.13 Use of Site

The Contractor shall confine operations at the site to areas permitted by applicable laws, statutes, ordinances, codes, rules and regulations, lawful orders of public authorities, and the Contract Documents and shall not unreasonably encumber the site with materials or equipment.

§ 3.14 Cutting and Patching

§ 3.14.1 The Contractor shall be responsible for cutting, fitting, or patching required to complete the Work or to make its parts fit together properly. All areas requiring cutting, fitting, or patching shall be restored to the condition existing prior to the cutting, fitting, or patching, unless otherwise required by the Contract Documents.

§ 3.14.2 The Contractor shall not damage or endanger a portion of the Work or fully or partially completed construction of the Owner or Separate Contractors by cutting, patching, or otherwise altering such construction, or by excavation. The Contractor shall not cut or otherwise alter construction by the Owner or a Separate Contractor except with written consent of the Owner and of the Separate Contractor. Consent shall not be unreasonably withheld. The Contractor shall not unreasonably withhold, from the Owner or a Separate Contractor, its consent to cutting or otherwise altering the Work.

§ 3.15 Cleaning Up

§ 3.15.1 The Contractor shall keep the premises and surrounding area free from accumulation of waste materials and rubbish caused by operations under the Contract. At completion of the Work, the Contractor shall remove waste materials, rubbish, the Contractor's tools, construction equipment, machinery, and surplus materials from and about the Project.

§ 3.15.2 If the Contractor fails to clean up as provided in the Contract Documents, the Owner may do so and the Owner shall be entitled to reimbursement from the Contractor.

§ 3.16 Access to Work

The Contractor shall provide the Owner and Architect with access to the Work in preparation and progress wherever located.

§ 3.17 Royalties, Patents and Copyrights

The Contractor shall pay all royalties and license fees. The Contractor shall defend suits or claims for infringement of copyrights and patent rights and shall hold the Owner and Architect harmless from loss on account thereof, but shall not be responsible for defense or loss when a particular design, process, or product of a particular manufacturer or manufacturers is required by the Contract Documents, or where the copyright violations are contained in Drawings, Specifications, or other documents prepared by the Owner or Architect. However, if an infringement of a copyright or patent is discovered by, or made known to, the Contractor, the Contractor shall be responsible for the loss unless the information is promptly furnished to the Architect.

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§ 3.18 Indemnification

§ 3.18.1 To the fullest extent permitted by law, the Contractor shall indemnify and hold harmless the Owner, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), but only to the extent caused by the negligent acts or omissions of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, regardless of whether or not such claim, damage, loss, or expense is caused in part by a party indemnified hereunder. Such obligation shall not be construed to negate, abridge, or reduce other rights or obligations of indemnity that would otherwise exist as to a party or person described in this Section 3.18.

§ 3.18.2 In claims against any person or entity indemnified under this Section 3.18 by an employee of the Contractor, a Subcontractor, anyone directly or indirectly employed by them, or anyone for whose acts they may be liable, the indemnification obligation under Section 3.18.1 shall not be limited by a limitation on amount or type of damages, compensation, or benefits payable by or for the Contractor or a Subcontractor under workers' compensation acts, disability benefit acts, or other employee benefit acts.

ARTICLE 4 ARCHITECT

§ 4.1 General

§ 4.1.1 The Architect is the person or entity retained by the Owner pursuant to Section 2.3.2 and identified as such in the Agreement.

§ 4.1.2 Duties, responsibilities, and limitations of authority of the Architect as set forth in the Contract Documents shall not be restricted, modified, or extended without written consent of the Owner, Contractor, and Architect. Consent shall not be unreasonably withheld.

§ 4.2 Administration of the Contract

§ 4.2.1 The Architect will provide administration of the Contract as described in the Contract Documents and will be an Owner's representative during construction until the date the Architect issues the final Certificate for Payment. The Architect will have authority to act on behalf of the Owner only to the extent provided in the Contract Documents.

§ 4.2.2 The Architect will visit the site at intervals appropriate to the stage of construction, or as otherwise agreed with the Owner, to become generally familiar with the progress and quality of the portion of the Work completed, and to determine in general if the Work observed is being performed in a manner indicating that the Work, when fully completed, will be in accordance with the Contract Documents. However, the Architect will not be required to make exhaustive or continuous on-site inspections to check the quality or quantity of the Work. The Architect will not have control over, charge of, or responsibility for the construction means, methods, techniques, sequences or procedures, or for the safety precautions and programs in connection with the Work, since these are solely the Contractor's rights and responsibilities under the Contract Documents.

§ 4.2.3 On the basis of the site visits, the Architect will keep the Owner reasonably informed about the progress and quality of the portion of the Work completed, and promptly report to the Owner (1) known deviations from the Contract Documents, (2) known deviations from the most recent construction schedule submitted by the Contractor, and (3) defects and deficiencies observed in the Work. The Architect will not be responsible for the Contractor's failure to perform the Work in accordance with the requirements of the Contract Documents. The Architect will not have control over or charge of, and will not be responsible for acts or omissions of, the Contractor, Subcontractors, or their agents or employees, or any other persons or entities performing portions of the Work.

§ 4.2.4 Communications

The Owner and Contractor shall include the Architect in all communications that relate to or affect the Architect's services or professional responsibilities. The Owner shall promptly notify the Architect of the substance of any direct communications between the Owner and the Contractor otherwise relating to the Project. Communications by and with the Architect's consultants shall be through the Architect. Communications by and with Subcontractors and suppliers shall be through the Contractor. Communications by and with Separate Contractors shall be through the Owner. The Contract Documents may specify other communication protocols.

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§ 4.2.5 Based on the Architect's evaluations of the Contractor's Applications for Payment, the Architect will review and certify the amounts due the Contractor and will issue Certificates for Payment in such amounts.

§ 4.2.6 The Architect has authority to reject Work that does not conform to the Contract Documents. Whenever the Architect considers it necessary or advisable, the Architect will have authority to require inspection or testing of the Work in accordance with Sections 13.4.2 and 13.4.3, whether or not the Work is fabricated, installed or completed. However, neither this authority of the Architect nor a decision made in good faith either to exercise or not to exercise such authority shall give rise to a duty or responsibility of the Architect to the Contractor, Subcontractors, suppliers, their agents or employees, or other persons or entities performing portions of the Work.

§ 4.2.7 The Architect will review and approve, or take other appropriate action upon, the Contractor's submittals such as Shop Drawings, Product Data, and Samples, but only for the limited purpose of checking for conformance with information given and the design concept expressed in the Contract Documents. The Architect's action will be taken in accordance with the submittal schedule approved by the Architect or, in the absence of an approved submittal schedule, with reasonable promptness while allowing sufficient time in the Architect's professional judgment to permit adequate review. Review of such submittals is not conducted for the purpose of determining the accuracy and completeness of other details such as dimensions and quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain the responsibility of the Contractor as required by the Contract Documents. The Architect's review of the Contractor's submittals shall not relieve the Contractor of the obligations under Sections 3.3, 3.5, and 3.12. The Architect's review shall not constitute approval of safety precautions or of any construction means, methods, techniques, sequences, or procedures. The Architect's approval of a specific item shall not indicate approval of an assembly of which the item is a component.

§ 4.2.8 The Architect will prepare Change Orders and Construction Change Directives, and may order minor changes in the Work as provided in Section 7.4. The Architect will investigate and make determinations and recommendations regarding concealed and unknown conditions as provided in Section 3.7.4.

§ 4.2.9 The Architect will conduct inspections to determine the date or dates of Substantial Completion and the date of final completion; issue Certificates of Substantial Completion pursuant to Section 9.8; receive and forward to the Owner, for the Owner's review and records, written warranties and related documents required by the Contract and assembled by the Contractor pursuant to Section 9.10; and issue a final Certificate for Payment pursuant to Section 9.10.

§ 4.2.10 If the Owner and Architect agree, the Architect will provide one or more Project representatives to assist in carrying out the Architect's responsibilities at the site. The Owner shall notify the Contractor of any change in the duties, responsibilities and limitations of authority of the Project representatives.

§ 4.2.11 The Architect will interpret and decide matters concerning performance under, and requirements of, the Contract Documents on written request of either the Owner or Contractor. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness.

§ 4.2.12 Interpretations and decisions of the Architect will be consistent with the intent of, and reasonably inferable from, the Contract Documents and will be in writing or in the form of drawings. When making such interpretations and decisions, the Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either, and will not be liable for results of interpretations or decisions rendered in good faith.

§ 4.2.13 The Architect's decisions on matters relating to aesthetic effect will be final if consistent with the intent expressed in the Contract Documents.

§ 4.2.14 The Architect will review and respond to requests for information about the Contract Documents. The Architect's response to such requests will be made in writing within any time limits agreed upon or otherwise with reasonable promptness. If appropriate, the Architect will prepare and issue supplemental Drawings and Specifications in response to the requests for information.

ARTICLE 5 SUBCONTRACTORS

§ 5.1 Definitions

§ 5.1.1 A Subcontractor is a person or entity who has a direct contract with the Contractor to perform a portion of the Work at the site. The term "Subcontractor" is referred to throughout the Contract Documents as if singular in

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number and means a Subcontractor or an authorized representative of the Subcontractor. The term "Subcontractor" does not include a Separate Contractor or the subcontractors of a Separate Contractor.

§ 5.1.2 A Sub-subcontractor is a person or entity who has a direct or indirect contract with a Subcontractor to perform a portion of the Work at the site. The term "Sub-subcontractor" is referred to throughout the Contract Documents as if singular in number and means a Sub-subcontractor or an authorized representative of the Sub-subcontractor.

§ 5.2 Award of Subcontracts and Other Contracts for Portions of the Work

§ 5.2.1 Unless otherwise stated in the Contract Documents, the Contractor, as soon as practicable after award of the Contract, shall notify the Owner and Architect of the persons or entities proposed for each principal portion of the Work, including those who are to furnish materials or equipment fabricated to a special design. Within 14 days of receipt of the information, the Architect may notify the Contractor whether the Owner or the Architect (1) has reasonable objection to any such proposed person or entity or (2) requires additional time for review. Failure of the Architect to provide notice within the 14-day period shall constitute notice of no reasonable objection.

§ 5.2.2 The Contractor shall not contract with a proposed person or entity to whom the Owner or Architect has made reasonable and timely objection. The Contractor shall not be required to contract with anyone to whom the Contractor has made reasonable objection.

§ 5.2.3 If the Owner or Architect has reasonable objection to a person or entity proposed by the Contractor, the Contractor shall propose another to whom the Owner or Architect has no reasonable objection. If the proposed but rejected Subcontractor was reasonably capable of performing the Work, the Contract Sum and Contract Time shall be increased or decreased by the difference, if any, occasioned by such change, and an appropriate Change Order shall be issued before commencement of the substitute Subcontractor's Work. However, no increase in the Contract Sum or Contract Time shall be allowed for such change unless the Contractor has acted promptly and responsively in submitting names as required.

§ 5.2.4 The Contractor shall not substitute a Subcontractor, person, or entity for one previously selected if the Owner or Architect makes reasonable objection to such substitution.

§ 5.3 Subcontractual Relations

By appropriate written agreement, the Contractor shall require each Subcontractor, to the extent of the Work to be performed by the Subcontractor, to be bound to the Contractor by terms of the Contract Documents, and to assume toward the Contractor all the obligations and responsibilities, including the responsibility for safety of the Subcontractor's Work that the Contractor, by these Contract Documents, assumes toward the Owner and Architect. Each subcontract agreement shall preserve and protect the rights of the Owner and Architect under the Contract Documents with respect to the Work to be performed by the Subcontractor so that subcontracting thereof will not prejudice such rights, and shall allow to the Subcontractor, unless specifically provided otherwise in the subcontract agreement, the benefit of all rights, remedies, and redress against the Contractor that the Contractor, by the Contract Documents, has against the Owner. Where appropriate, the Contractor shall require each Subcontractor to enter into similar agreements with Sub-subcontractors. The Contractor shall make available to each proposed Subcontractor, prior to the execution of the subcontract agreement, copies of the Contract Documents to which the Subcontractor will be bound, and, upon written request of the Subcontractor, identify to the Subcontractor terms and conditions of the proposed subcontract agreement that may be at variance with the Contract Documents. Subcontractors will similarly make copies of applicable portions of such documents available to their respective proposed Sub-subcontractors.

§ 5.4 Contingent Assignment of Subcontracts

§ 5.4.1 Each subcontract agreement for a portion of the Work is assigned by the Contractor to the Owner, provided that

- **.1** assignment is effective only after termination of the Contract by the Owner for cause pursuant to Section 14.2 and only for those subcontract agreements that the Owner accepts by notifying the Subcontractor and Contractor; and
- **.2** assignment is subject to the prior rights of the surety, if any, obligated under bond relating to the Contract.

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When the Owner accepts the assignment of a subcontract agreement, the Owner assumes the Contractor's rights and obligations under the subcontract.

§ 5.4.2 Upon such assignment, if the Work has been suspended for more than 30 days, the Subcontractor's compensation shall be equitably adjusted for increases in cost resulting from the suspension.

§ 5.4.3 Upon assignment to the Owner under this Section 5.4, the Owner may further assign the subcontract to a successor contractor or other entity. If the Owner assigns the subcontract to a successor contractor or other entity, the Owner shall nevertheless remain legally responsible for all of the successor contractor's obligations under the subcontract.

ARTICLE 6 CONSTRUCTION BY OWNER OR BY SEPARATE CONTRACTORS

§ 6.1 Owner's Right to Perform Construction and to Award Separate Contracts

§ 6.1.1 The term "Separate Contractor(s)" shall mean other contractors retained by the Owner under separate agreements. The Owner reserves the right to perform construction or operations related to the Project with the Owner's own forces, and with Separate Contractors retained under Conditions of the Contract substantially similar to those of this Contract, including those provisions of the Conditions of the Contract related to insurance and waiver of subrogation.

§ 6.1.2 When separate contracts are awarded for different portions of the Project or other construction or operations on the site, the term "Contractor" in the Contract Documents in each case shall mean the Contractor who executes each separate Owner-Contractor Agreement.

§ 6.1.3 The Owner shall provide for coordination of the activities of the Owner's own forces and of each Separate Contractor with the Work of the Contractor, who shall cooperate with them. The Contractor shall participate with any Separate Contractors and the Owner in reviewing their construction schedules. The Contractor shall make any revisions to its construction schedule deemed necessary after a joint review and mutual agreement. The construction schedules shall then constitute the schedules to be used by the Contractor, Separate Contractors, and the Owner until subsequently revised.

§ 6.1.4 Unless otherwise provided in the Contract Documents, when the Owner performs construction or operations related to the Project with the Owner's own forces or with Separate Contractors, the Owner or its Separate Contractors shall have the same obligations and rights that the Contractor has under the Conditions of the Contract, including, without excluding others, those stated in Article 3, this Article 6, and Articles 10, 11, and 12.

§ 6.2 Mutual Responsibility

§ 6.2.1 The Contractor shall afford the Owner and Separate Contractors reasonable opportunity for introduction and storage of their materials and equipment and performance of their activities, and shall connect and coordinate the Contractor's construction and operations with theirs as required by the Contract Documents.

§ 6.2.2 If part of the Contractor's Work depends for proper execution or results upon construction or operations by the Owner or a Separate Contractor, the Contractor shall, prior to proceeding with that portion of the Work, promptly notify the Architect of apparent discrepancies or defects in the construction or operations by the Owner or Separate Contractor that would render it unsuitable for proper execution and results of the Contractor's Work. Failure of the Contractor to notify the Architect of apparent discrepancies or defects prior to proceeding with the Work shall constitute an acknowledgment that the Owner's or Separate Contractor's completed or partially completed construction is fit and proper to receive the Contractor's Work. The Contractor shall not be responsible for discrepancies or defects in the construction or operations by the Owner or Separate Contractor that are not apparent.

§ 6.2.3 The Contractor shall reimburse the Owner for costs the Owner incurs that are payable to a Separate Contractor because of the Contractor's delays, improperly timed activities or defective construction. The Owner shall be responsible to the Contractor for costs the Contractor incurs because of a Separate Contractor's delays, improperly timed activities, damage to the Work or defective construction.

§ 6.2.4 The Contractor shall promptly remedy damage that the Contractor wrongfully causes to completed or partially completed construction or to property of the Owner or Separate Contractor as provided in Section 10.2.5.

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§ 6.2.5 The Owner and each Separate Contractor shall have the same responsibilities for cutting and patching as are described for the Contractor in Section 3.14.

§ 6.3 Owner's Right to Clean Up

If a dispute arises among the Contractor, Separate Contractors, and the Owner as to the responsibility under their respective contracts for maintaining the premises and surrounding area free from waste materials and rubbish, the Owner may clean up and the Architect will allocate the cost among those responsible.

ARTICLE 7 CHANGES IN THE WORK

§ 7.1 General

§ 7.1.1 Changes in the Work may be accomplished after execution of the Contract, and without invalidating the Contract, by Change Order, Construction Change Directive or order for a minor change in the Work, subject to the limitations stated in this Article 7 and elsewhere in the Contract Documents.

§ 7.1.2 A Change Order shall be based upon agreement among the Owner, Contractor, and Architect. A Construction Change Directive requires agreement by the Owner and Architect and may or may not be agreed to by the Contractor. An order for a minor change in the Work may be issued by the Architect alone.

§ 7.1.3 Changes in the Work shall be performed under applicable provisions of the Contract Documents. The Contractor shall proceed promptly with changes in the Work, unless otherwise provided in the Change Order, Construction Change Directive, or order for a minor change in the Work.

§ 7.2 Change Orders

§ 7.2.1 A Change Order is a written instrument prepared by the Architect and signed by the Owner, Contractor, and Architect stating their agreement upon all of the following:

- **.1** The change in the Work;
- **.2** The amount of the adjustment, if any, in the Contract Sum; and
- **.3** The extent of the adjustment, if any, in the Contract Time.

§ 7.3 Construction Change Directives

§ 7.3.1 A Construction Change Directive is a written order prepared by the Architect and signed by the Owner and Architect, directing a change in the Work prior to agreement on adjustment, if any, in the Contract Sum or Contract Time, or both. The Owner may by Construction Change Directive, without invalidating the Contract, order changes in the Work within the general scope of the Contract consisting of additions, deletions, or other revisions, the Contract Sum and Contract Time being adjusted accordingly.

§ 7.3.2 A Construction Change Directive shall be used in the absence of total agreement on the terms of a Change Order.

§ 7.3.3 If the Construction Change Directive provides for an adjustment to the Contract Sum, the adjustment shall be based on one of the following methods:

- **.1** Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation;
- **.2** Unit prices stated in the Contract Documents or subsequently agreed upon;
- **.3** Cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee; or
- **.4** As provided in Section 7.3.4.

§ 7.3.4 If the Contractor does not respond promptly or disagrees with the method for adjustment in the Contract Sum, the Architect shall determine the adjustment on the basis of reasonable expenditures and savings of those performing the Work attributable to the change, including, in case of an increase in the Contract Sum, an amount for overhead and profit as set forth in the Agreement, or if no such amount is set forth in the Agreement, a reasonable amount. In such case, and also under Section 7.3.3.3, the Contractor shall keep and present, in such form as the Architect may prescribe, an itemized accounting together with appropriate supporting data. Unless otherwise provided in the Contract Documents, costs for the purposes of this Section 7.3.4 shall be limited to the following:

- **.1** Costs of labor, including applicable payroll taxes, fringe benefits required by agreement or custom, workers' compensation insurance, and other employee costs approved by the Architect;

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.2 Costs of materials, supplies, and equipment, including cost of transportation, whether incorporated or consumed;

.3 Rental costs of machinery and equipment, exclusive of hand tools, whether rented from the Contractor or others;

.4 Costs of premiums for all bonds and insurance, permit fees, and sales, use, or similar taxes, directly related to the change; and

.5 Costs of supervision and field office personnel directly attributable to the change.

§ 7.3.5 If the Contractor disagrees with the adjustment in the Contract Time, the Contractor may make a Claim in accordance with applicable provisions of Article 15.

§ 7.3.6 Upon receipt of a Construction Change Directive, the Contractor shall promptly proceed with the change in the Work involved and advise the Architect of the Contractor's agreement or disagreement with the method, if any, provided in the Construction Change Directive for determining the proposed adjustment in the Contract Sum or Contract Time.

§ 7.3.7 A Construction Change Directive signed by the Contractor indicates the Contractor's agreement therewith, including adjustment in Contract Sum and Contract Time or the method for determining them. Such agreement shall be effective immediately and shall be recorded as a Change Order.

§ 7.3.8 The amount of credit to be allowed by the Contractor to the Owner for a deletion or change that results in a net decrease in the Contract Sum shall be actual net cost as confirmed by the Architect. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.

§ 7.3.9 Pending final determination of the total cost of a Construction Change Directive to the Owner, the Contractor may request payment for Work completed under the Construction Change Directive in Applications for Payment. The Architect will make an interim determination for purposes of monthly certification for payment for those costs and certify for payment the amount that the Architect determines, in the Architect's professional judgment, to be reasonably justified. The Architect's interim determination of cost shall adjust the Contract Sum on the same basis as a Change Order, subject to the right of either party to disagree and assert a Claim in accordance with Article 15.

§ 7.3.10 When the Owner and Contractor agree with a determination made by the Architect concerning the adjustments in the Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and the Architect will prepare a Change Order. Change Orders may be issued for all or any part of a Construction Change Directive.

§ 7.4 Minor Changes in the Work

The Architect may order minor changes in the Work that are consistent with the intent of the Contract Documents and do not involve an adjustment in the Contract Sum or an extension of the Contract Time. The Architect's order for minor changes shall be in writing. If the Contractor believes that the proposed minor change in the Work will affect the Contract Sum or Contract Time, the Contractor shall notify the Architect and shall not proceed to implement the change in the Work. If the Contractor performs the Work set forth in the Architect's order for a minor change without prior notice to the Architect that such change will affect the Contract Sum or Contract Time, the Contractor waives any adjustment to the Contract Sum or extension of the Contract Time.

ARTICLE 8 TIME

§ 8.1 Definitions

§ 8.1.1 Unless otherwise provided, Contract Time is the period of time, including authorized adjustments, allotted in the Contract Documents for Substantial Completion of the Work.

§ 8.1.2 The date of commencement of the Work is the date established in the Agreement.

§ 8.1.3 The date of Substantial Completion is the date certified by the Architect in accordance with Section 9.8.

§ 8.1.4 The term "day" as used in the Contract Documents shall mean calendar day unless otherwise specifically defined.

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§ 8.2 Progress and Completion

§ 8.2.1 Time limits stated in the Contract Documents are of the essence of the Contract. By executing the Agreement, the Contractor confirms that the Contract Time is a reasonable period for performing the Work.

§ 8.2.2 The Contractor shall not knowingly, except by agreement or instruction of the Owner in writing, commence the Work prior to the effective date of insurance required to be furnished by the Contractor and Owner.

§ 8.2.3 The Contractor shall proceed expeditiously with adequate forces and shall achieve Substantial Completion within the Contract Time.

§ 8.3 Delays and Extensions of Time

§ 8.3.1 If the Contractor is delayed at any time in the commencement or progress of the Work by (1) an act or neglect of the Owner or Architect, of an employee of either, or of a Separate Contractor; (2) by changes ordered in the Work; (3) by labor disputes, fire, unusual delay in deliveries, unavoidable casualties, adverse weather conditions documented in accordance with Section 15.1.6.2, or other causes beyond the Contractor's control; (4) by delay authorized by the Owner pending mediation and binding dispute resolution; or (5) by other causes that the Contractor asserts, and the Architect determines, justify delay, then the Contract Time shall be extended for such reasonable time as the Architect may determine.

§ 8.3.2 Claims relating to time shall be made in accordance with applicable provisions of Article 15.

§ 8.3.3 This Section 8.3 does not preclude recovery of damages for delay by either party under other provisions of the Contract Documents.

ARTICLE 9 PAYMENTS AND COMPLETION

§ 9.1 Contract Sum

§ 9.1.1 The Contract Sum is stated in the Agreement and, including authorized adjustments, is the total amount payable by the Owner to the Contractor for performance of the Work under the Contract Documents.

§ 9.1.2 If unit prices are stated in the Contract Documents or subsequently agreed upon, and if quantities originally contemplated are materially changed so that application of such unit prices to the actual quantities causes substantial inequity to the Owner or Contractor, the applicable unit prices shall be equitably adjusted.

§ 9.2 Schedule of Values

Where the Contract is based on a stipulated sum or Guaranteed Maximum Price, the Contractor shall submit a schedule of values to the Architect before the first Application for Payment, allocating the entire Contract Sum to the various portions of the Work. The schedule of values shall be prepared in the form, and supported by the data to substantiate its accuracy, required by the Architect. This schedule, unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's Applications for Payment. Any changes to the schedule of values shall be submitted to the Architect and supported by such data to substantiate its accuracy as the Architect may require, and unless objected to by the Architect, shall be used as a basis for reviewing the Contractor's subsequent Applications for Payment.

§ 9.3 Applications for Payment

§ 9.3.1 At least ten days before the date established for each progress payment, the Contractor shall submit to the Architect an itemized Application for Payment prepared in accordance with the schedule of values, if required under Section 9.2, for completed portions of the Work. The application shall be notarized, if required, and supported by all data substantiating the Contractor's right to payment that the Owner or Architect require, such as copies of requisitions, and releases and waivers of liens from Subcontractors and suppliers, and shall reflect retainage if provided for in the Contract Documents.

§ 9.3.1.1 As provided in Section 7.3.9, such applications may include requests for payment on account of changes in the Work that have been properly authorized by Construction Change Directives, or by interim determinations of the Architect, but not yet included in Change Orders.

§ 9.3.1.2 Applications for Payment shall not include requests for payment for portions of the Work for which the Contractor does not intend to pay a Subcontractor or supplier, unless such Work has been performed by others whom the Contractor intends to pay.

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§ 9.3.2 Unless otherwise provided in the Contract Documents, payments shall be made on account of materials and equipment delivered and suitably stored at the site for subsequent incorporation in the Work. If approved in advance by the Owner, payment may similarly be made for materials and equipment suitably stored off the site at a location agreed upon in writing. Payment for materials and equipment stored on or off the site shall be conditioned upon compliance by the Contractor with procedures satisfactory to the Owner to establish the Owner's title to such materials and equipment or otherwise protect the Owner's interest, and shall include the costs of applicable insurance, storage, and transportation to the site, for such materials and equipment stored off the site.

§ 9.3.3 The Contractor warrants that title to all Work covered by an Application for Payment will pass to the Owner no later than the time of payment. The Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from the Owner shall, to the best of the Contractor's knowledge, information, and belief, be free and clear of liens, claims, security interests, or encumbrances, in favor of the Contractor, Subcontractors, suppliers, or other persons or entities that provided labor, materials, and equipment relating to the Work.

§ 9.4 Certificates for Payment

§ 9.4.1 The Architect will, within seven days after receipt of the Contractor's Application for Payment, either (1) issue to the Owner a Certificate for Payment in the full amount of the Application for Payment, with a copy to the Contractor; or (2) issue to the Owner a Certificate for Payment for such amount as the Architect determines is properly due, and notify the Contractor and Owner of the Architect's reasons for withholding certification in part as provided in Section 9.5.1; or (3) withhold certification of the entire Application for Payment, and notify the Contractor and Owner of the Architect's reason for withholding certification in whole as provided in Section 9.5.1.

§ 9.4.2 The issuance of a Certificate for Payment will constitute a representation by the Architect to the Owner, based on the Architect's evaluation of the Work and the data in the Application for Payment, that, to the best of the Architect's knowledge, information, and belief, the Work has progressed to the point indicated, the quality of the Work is in accordance with the Contract Documents, and that the Contractor is entitled to payment in the amount certified. The foregoing representations are subject to an evaluation of the Work for conformance with the Contract Documents upon Substantial Completion, to results of subsequent tests and inspections, to correction of minor deviations from the Contract Documents prior to completion, and to specific qualifications expressed by the Architect. However, the issuance of a Certificate for Payment will not be a representation that the Architect has (1) made exhaustive or continuous on-site inspections to check the quality or quantity of the Work; (2) reviewed construction means, methods, techniques, sequences, or procedures; (3) reviewed copies of requisitions received from Subcontractors and suppliers and other data requested by the Owner to substantiate the Contractor's right to payment; or (4) made examination to ascertain how or for what purpose the Contractor has used money previously paid on account of the Contract Sum.

§ 9.5 Decisions to Withhold Certification

§ 9.5.1 The Architect may withhold a Certificate for Payment in whole or in part, to the extent reasonably necessary to protect the Owner, if in the Architect's opinion the representations to the Owner required by Section 9.4.2 cannot be made. If the Architect is unable to certify payment in the amount of the Application, the Architect will notify the Contractor and Owner as provided in Section 9.4.1. If the Contractor and Architect cannot agree on a revised amount, the Architect will promptly issue a Certificate for Payment for the amount for which the Architect is able to make such representations to the Owner. The Architect may also withhold a Certificate for Payment or, because of subsequently discovered evidence, may nullify the whole or a part of a Certificate for Payment previously issued, to such extent as may be necessary in the Architect's opinion to protect the Owner from loss for which the Contractor is responsible, including loss resulting from acts and omissions described in Section 3.3.2, because of

- **.1** defective Work not remedied;
- **.2** third party claims filed or reasonable evidence indicating probable filing of such claims, unless security acceptable to the Owner is provided by the Contractor;
- **.3** failure of the Contractor to make payments properly to Subcontractors or suppliers for labor, materials or equipment;
- **.4** reasonable evidence that the Work cannot be completed for the unpaid balance of the Contract Sum;
- **.5** damage to the Owner or a Separate Contractor;
- **.6** reasonable evidence that the Work will not be completed within the Contract Time, and that the unpaid balance would not be adequate to cover actual or liquidated damages for the anticipated delay; or

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.7 repeated failure to carry out the Work in accordance with the Contract Documents.

§ 9.5.2 When either party disputes the Architect's decision regarding a Certificate for Payment under Section 9.5.1, in whole or in part, that party may submit a Claim in accordance with Article 15.

§ 9.5.3 When the reasons for withholding certification are removed, certification will be made for amounts previously withheld.

§ 9.5.4 If the Architect withholds certification for payment under Section 9.5.1.3, the Owner may, at its sole option, issue joint checks to the Contractor and to any Subcontractor or supplier to whom the Contractor failed to make payment for Work properly performed or material or equipment suitably delivered. If the Owner makes payments by joint check, the Owner shall notify the Architect and the Contractor shall reflect such payment on its next Application for Payment.

§ 9.6 Progress Payments

§ 9.6.1 After the Architect has issued a Certificate for Payment, the Owner shall make payment in the manner and within the time provided in the Contract Documents, and shall so notify the Architect.

§ 9.6.2 The Contractor shall pay each Subcontractor, no later than seven days after receipt of payment from the Owner, the amount to which the Subcontractor is entitled, reflecting percentages actually retained from payments to the Contractor on account of the Subcontractor's portion of the Work. The Contractor shall, by appropriate agreement with each Subcontractor, require each Subcontractor to make payments to Sub-subcontractors in a similar manner.

§ 9.6.3 The Architect will, on request, furnish to a Subcontractor, if practicable, information regarding percentages of completion or amounts applied for by the Contractor and action taken thereon by the Architect and Owner on account of portions of the Work done by such Subcontractor.

§ 9.6.4 The Owner has the right to request written evidence from the Contractor that the Contractor has properly paid Subcontractors and suppliers amounts paid by the Owner to the Contractor for subcontracted Work. If the Contractor fails to furnish such evidence within seven days, the Owner shall have the right to contact Subcontractors and suppliers to ascertain whether they have been properly paid. Neither the Owner nor Architect shall have an obligation to pay, or to see to the payment of money to, a Subcontractor or supplier, except as may otherwise be required by law.

§ 9.6.5 The Contractor's payments to suppliers shall be treated in a manner similar to that provided in Sections 9.6.2, 9.6.3 and 9.6.4.

§ 9.6.6 A Certificate for Payment, a progress payment, or partial or entire use or occupancy of the Project by the Owner shall not constitute acceptance of Work not in accordance with the Contract Documents.

§ 9.6.7 Unless the Contractor provides the Owner with a payment bond in the full penal sum of the Contract Sum, payments received by the Contractor for Work properly performed by Subcontractors or provided by suppliers shall be held by the Contractor for those Subcontractors or suppliers who performed Work or furnished materials, or both, under contract with the Contractor for which payment was made by the Owner. Nothing contained herein shall require money to be placed in a separate account and not commingled with money of the Contractor, create any fiduciary liability or tort liability on the part of the Contractor for breach of trust, or entitle any person or entity to an award of punitive damages against the Contractor for breach of the requirements of this provision.

§ 9.6.8 Provided the Owner has fulfilled its payment obligations under the Contract Documents, the Contractor shall defend and indemnify the Owner from all loss, liability, damage or expense, including reasonable attorney's fees and litigation expenses, arising out of any lien claim or other claim for payment by any Subcontractor or supplier of any tier. Upon receipt of notice of a lien claim or other claim for payment, the Owner shall notify the Contractor. If approved by the applicable court, when required, the Contractor may substitute a surety bond for the property against which the lien or other claim for payment has been asserted.

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§ 9.7 Failure of Payment

If the Architect does not issue a Certificate for Payment, through no fault of the Contractor, within seven days after receipt of the Contractor's Application for Payment, or if the Owner does not pay the Contractor within seven days after the date established in the Contract Documents, the amount certified by the Architect or awarded by binding dispute resolution, then the Contractor may, upon seven additional days' notice to the Owner and Architect, stop the Work until payment of the amount owing has been received. The Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable costs of shutdown, delay and start-up, plus interest as provided for in the Contract Documents.

§ 9.8 Substantial Completion

§ 9.8.1 Substantial Completion is the stage in the progress of the Work when the Work or designated portion thereof is sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work for its intended use.

§ 9.8.2 When the Contractor considers that the Work, or a portion thereof which the Owner agrees to accept separately, is substantially complete, the Contractor shall prepare and submit to the Architect a comprehensive list of items to be completed or corrected prior to final payment. Failure to include an item on such list does not alter the responsibility of the Contractor to complete all Work in accordance with the Contract Documents.

§ 9.8.3 Upon receipt of the Contractor's list, the Architect will make an inspection to determine whether the Work or designated portion thereof is substantially complete. If the Architect's inspection discloses any item, whether or not included on the Contractor's list, which is not sufficiently complete in accordance with the Contract Documents so that the Owner can occupy or utilize the Work or designated portion thereof for its intended use, the Contractor shall, before issuance of the Certificate of Substantial Completion, complete or correct such item upon notification by the Architect. In such case, the Contractor shall then submit a request for another inspection by the Architect to determine Substantial Completion.

§ 9.8.4 When the Work or designated portion thereof is substantially complete, the Architect will prepare a Certificate of Substantial Completion that shall establish the date of Substantial Completion; establish responsibilities of the Owner and Contractor for security, maintenance, heat, utilities, damage to the Work and insurance; and fix the time within which the Contractor shall finish all items on the list accompanying the Certificate. Warranties required by the Contract Documents shall commence on the date of Substantial Completion of the Work or designated portion thereof unless otherwise provided in the Certificate of Substantial Completion.

§ 9.8.5 The Certificate of Substantial Completion shall be submitted to the Owner and Contractor for their written acceptance of responsibilities assigned to them in the Certificate. Upon such acceptance, and consent of surety if any, the Owner shall make payment of retainage applying to the Work or designated portion thereof. Such payment shall be adjusted for Work that is incomplete or not in accordance with the requirements of the Contract Documents.

§ 9.9 Partial Occupancy or Use

§ 9.9.1 The Owner may occupy or use any completed or partially completed portion of the Work at any stage when such portion is designated by separate agreement with the Contractor, provided such occupancy or use is consented to by the insurer and authorized by public authorities having jurisdiction over the Project. Such partial occupancy or use may commence whether or not the portion is substantially complete, provided the Owner and Contractor have accepted in writing the responsibilities assigned to each of them for payments, retainage, if any, security, maintenance, heat, utilities, damage to the Work and insurance, and have agreed in writing concerning the period for correction of the Work and commencement of warranties required by the Contract Documents. When the Contractor considers a portion substantially complete, the Contractor shall prepare and submit a list to the Architect as provided under Section 9.8.2. Consent of the Contractor to partial occupancy or use shall not be unreasonably withheld. The stage of the progress of the Work shall be determined by written agreement between the Owner and Contractor or, if no agreement is reached, by decision of the Architect.

§ 9.9.2 Immediately prior to such partial occupancy or use, the Owner, Contractor, and Architect shall jointly inspect the area to be occupied or portion of the Work to be used in order to determine and record the condition of the Work.

§ 9.9.3 Unless otherwise agreed upon, partial occupancy or use of a portion or portions of the Work shall not constitute acceptance of Work not complying with the requirements of the Contract Documents.

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§ 9.10 Final Completion and Final Payment

§ 9.10.1 Upon receipt of the Contractor's notice that the Work is ready for final inspection and acceptance and upon receipt of a final Application for Payment, the Architect will promptly make such inspection. When the Architect finds the Work acceptable under the Contract Documents and the Contract fully performed, the Architect will promptly issue a final Certificate for Payment stating that to the best of the Architect's knowledge, information and belief, and on the basis of the Architect's on-site visits and inspections, the Work has been completed in accordance with the Contract Documents and that the entire balance found to be due the Contractor and noted in the final Certificate is due and payable. The Architect's final Certificate for Payment will constitute a further representation that conditions listed in Section 9.10.2 as precedent to the Contractor's being entitled to final payment have been fulfilled.

§ 9.10.2 Neither final payment nor any remaining retained percentage shall become due until the Contractor submits to the Architect (1) an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with the Work for which the Owner or the Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied, (2) a certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect, (3) a written statement that the Contractor knows of no reason that the insurance will not be renewable to cover the period required by the Contract Documents, (4) consent of surety, if any, to final payment, (5) documentation of any special warranties, such as manufacturers' warranties or specific Subcontractor warranties, and (6) if required by the Owner, other data establishing payment or satisfaction of obligations, such as receipts and releases and waivers of liens, claims, security interests, or encumbrances arising out of the Contract, to the extent and in such form as may be designated by the Owner. If a Subcontractor refuses to furnish a release or waiver required by the Owner, the Contractor may furnish a bond satisfactory to the Owner to indemnify the Owner against such lien, claim, security interest, or encumbrance. If a lien, claim, security interest, or encumbrance remains unsatisfied after payments are made, the Contractor shall refund to the Owner all money that the Owner may be compelled to pay in discharging the lien, claim, security interest, or encumbrance, including all costs and reasonable attorneys' fees.

§ 9.10.3 If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor or by issuance of Change Orders affecting final completion, and the Architect so confirms, the Owner shall, upon application by the Contractor and certification by the Architect, and without terminating the Contract, make payment of the balance due for that portion of the Work fully completed, corrected, and accepted. If the remaining balance for Work not fully completed or corrected is less than retainage stipulated in the Contract Documents, and if bonds have been furnished, the written consent of the surety to payment of the balance due for that portion of the Work fully completed and accepted shall be submitted by the Contractor to the Architect prior to certification of such payment. Such payment shall be made under terms and conditions governing final payment, except that it shall not constitute a waiver of Claims.

§ 9.10.4 The making of final payment shall constitute a waiver of Claims by the Owner except those arising from

- **.1** liens, Claims, security interests, or encumbrances arising out of the Contract and unsettled;
- **.2** failure of the Work to comply with the requirements of the Contract Documents;
- **.3** terms of special warranties required by the Contract Documents; or
- **.4** audits performed by the Owner, if permitted by the Contract Documents, after final payment.

§ 9.10.5 Acceptance of final payment by the Contractor, a Subcontractor, or a supplier, shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at the time of final Application for Payment.

ARTICLE 10 PROTECTION OF PERSONS AND PROPERTY

§ 10.1 Safety Precautions and Programs

The Contractor shall be responsible for initiating, maintaining, and supervising all safety precautions and programs in connection with the performance of the Contract.

§ 10.2 Safety of Persons and Property

§ 10.2.1 The Contractor shall take reasonable precautions for safety of, and shall provide reasonable protection to prevent damage, injury, or loss to

- **.1** employees on the Work and other persons who may be affected thereby;

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.2 the Work and materials and equipment to be incorporated therein, whether in storage on or off the site, under care, custody, or control of the Contractor, a Subcontractor, or a Sub-subcontractor; and

.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.

§ 10.2.2 The Contractor shall comply with, and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities, bearing on safety of persons or property or their protection from damage, injury, or loss.

§ 10.2.3 The Contractor shall implement, erect, and maintain, as required by existing conditions and performance of the Contract, reasonable safeguards for safety and protection, including posting danger signs and other warnings against hazards; promulgating safety regulations; and notifying the owners and users of adjacent sites and utilities of the safeguards.

§ 10.2.4 When use or storage of explosives or other hazardous materials or equipment, or unusual methods are necessary for execution of the Work, the Contractor shall exercise utmost care and carry on such activities under supervision of properly qualified personnel.

§ 10.2.5 The Contractor shall promptly remedy damage and loss (other than damage or loss insured under property insurance required by the Contract Documents) to property referred to in Sections 10.2.1.2 and 10.2.1.3 caused in whole or in part by the Contractor, a Subcontractor, a Sub-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 under Sections 10.2.1.2 and 10.2.1.3. The Contractor may make a Claim for the cost to remedy the damage or loss to the extent such damage or loss is attributable to acts or omissions of the Owner or Architect or anyone directly or indirectly employed by either of them, or by anyone for whose acts either of them may be liable, and not attributable to the fault or negligence of the Contractor. The foregoing obligations of the Contractor are in addition to the Contractor's obligations under Section 3.18.

§ 10.2.6 The Contractor shall designate a responsible member of the Contractor's organization at the site whose duty shall be the prevention of accidents. This person shall be the Contractor's superintendent unless otherwise designated by the Contractor in writing to the Owner and Architect.

§ 10.2.7 The Contractor shall not permit any part of the construction or site to be loaded so as to cause damage or create an unsafe condition.

§ 10.2.8 Injury or Damage to Person or Property

If either party suffers injury or damage to person or property because of an act or omission of the other party, or of others for whose acts such party is legally responsible, notice of the injury or damage, whether or not insured, shall be given to the other party within a reasonable time not exceeding 21 days after discovery. The notice shall provide sufficient detail to enable the other party to investigate the matter.

§ 10.3 Hazardous Materials and Substances

§ 10.3.1 The Contractor is responsible for compliance with any requirements included in the Contract Documents regarding hazardous materials or substances. If the Contractor encounters a hazardous material or substance not addressed in the Contract Documents and if reasonable precautions will be inadequate to prevent foreseeable bodily injury or death to persons resulting from a material or substance, including but not limited to asbestos or polychlorinated biphenyl (PCB), encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and notify the Owner and Architect of the condition.

§ 10.3.2 Upon receipt of the Contractor's notice, the Owner shall obtain the services of a licensed laboratory to verify the presence or absence of the material or substance reported by the Contractor and, in the event such material or substance is found to be present, to cause it to be rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and Architect the names and qualifications of persons or entities who are to perform tests verifying the presence or absence of the material or substance or who are to perform the task of removal or safe containment of the material or substance. The Contractor and the Architect will promptly reply to the Owner in writing stating whether or not either has reasonable objection to the persons or entities proposed by the Owner. If either the Contractor or Architect has an objection to a person or entity proposed

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by the Owner, the Owner shall propose another to whom the Contractor and the Architect have no reasonable objection. When the material or substance has been rendered harmless, Work in the affected area shall resume upon written agreement of the Owner and Contractor. By Change Order, the Contract Time shall be extended appropriately and the Contract Sum shall be increased by the amount of the Contractor's reasonable additional costs of shutdown, delay, and start-up.

§ 10.3.3 To the fullest extent permitted by law, the Owner shall indemnify and hold harmless the Contractor, Subcontractors, Architect, Architect's consultants, and agents and employees of any of them from and against claims, damages, losses, and expenses, including but not limited to attorneys' fees, arising out of or resulting from performance of the Work in the affected area if in fact the material or substance presents the risk of bodily injury or death as described in Section 10.3.1 and has not been rendered harmless, provided that such claim, damage, loss, or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property (other than the Work itself), except to the extent that such damage, loss, or expense is due to the fault or negligence of the party seeking indemnity.

§ 10.3.4 The Owner shall not be responsible under this Section 10.3 for hazardous materials or substances the Contractor brings to the site unless such materials or substances are required by the Contract Documents. The Owner shall be responsible for hazardous materials or substances required by the Contract Documents, except to the extent of the Contractor's fault or negligence in the use and handling of such materials or substances.

§ 10.3.5 The Contractor shall reimburse the Owner for the cost and expense the Owner incurs (1) for remediation of hazardous materials or substances the Contractor brings to the site and negligently handles, or (2) where the Contractor fails to perform its obligations under Section 10.3.1, except to the extent that the cost and expense are due to the Owner's fault or negligence.

§ 10.3.6 If, without negligence on the part of the Contractor, the Contractor is held liable by a government agency for the cost of remediation of a hazardous material or substance solely by reason of performing Work as required by the Contract Documents, the Owner shall reimburse the Contractor for all cost and expense thereby incurred.

§ 10.4 Emergencies

In an emergency affecting safety of persons or property, the Contractor shall act, at the Contractor's discretion, to prevent threatened damage, injury, or loss. Additional compensation or extension of time claimed by the Contractor on account of an emergency shall be determined as provided in Article 15 and Article 7.

ARTICLE 11 INSURANCE AND BONDS

§ 11.1 Contractor's Insurance and Bonds

§ 11.1.1 The Contractor shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Contractor shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Owner, Architect, and Architect's consultants shall be named as additional insureds under the Contractor's commercial general liability policy or as otherwise described in the Contract Documents.

§ 11.1.2 The Contractor shall provide surety bonds of the types, for such penal sums, and subject to such terms and conditions as required by the Contract Documents. The Contractor shall purchase and maintain the required bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 11.1.3 Upon the request of any person or entity appearing to be a potential beneficiary of bonds covering payment of obligations arising under the Contract, the Contractor shall promptly furnish a copy of the bonds or shall authorize a copy to be furnished.

§ 11.1.4 Notice of Cancellation or Expiration of Contractor's Required Insurance. Within three (3) business days of the date the Contractor becomes aware of an impending or actual cancellation or expiration of any insurance required by the Contract Documents, the Contractor shall provide notice to the Owner of such impending or actual cancellation or expiration. Upon receipt of notice from the Contractor, the Owner shall, unless the lapse in coverage arises from an act or omission of the Owner, have the right to stop the Work until the lapse in coverage has been cured by the

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procurement of replacement coverage by the Contractor. The furnishing of notice by the Contractor shall not relieve the Contractor of any contractual obligation to provide any required coverage.

§ 11.2 Owner's Insurance

§ 11.2.1 The Owner shall purchase and maintain insurance of the types and limits of liability, containing the endorsements, and subject to the terms and conditions, as described in the Agreement or elsewhere in the Contract Documents. The Owner shall purchase and maintain the required insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located.

§ 11.2.2 Failure to Purchase Required Property Insurance. If the Owner fails to purchase and maintain the required property insurance, with all of the coverages and in the amounts described in the Agreement or elsewhere in the Contract Documents, the Owner shall inform the Contractor in writing prior to commencement of the Work. Upon receipt of notice from the Owner, the Contractor may delay commencement of the Work and may obtain insurance that will protect the interests of the Contractor, Subcontractors, and Sub-Subcontractors in the Work. When the failure to provide coverage has been cured or resolved, the Contract Sum and Contract Time shall be equitably adjusted. In the event the Owner fails to procure coverage, the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent the loss to the Owner would have been covered by the insurance to have been procured by the Owner. The cost of the insurance shall be charged to the Owner by a Change Order. If the Owner does not provide written notice, and the Contractor is damaged by the failure or neglect of the Owner to purchase or maintain the required insurance, the Owner shall reimburse the Contractor for all reasonable costs and damages attributable thereto.

§ 11.2.3 Notice of Cancellation or Expiration of Owner's Required Property Insurance. Within three (3) business days of the date the Owner becomes aware of an impending or actual cancellation or expiration of any property insurance required by the Contract Documents, the Owner shall provide notice to the Contractor of such impending or actual cancellation or expiration. Unless the lapse in coverage arises from an act or omission of the Contractor: (1) the Contractor, upon receipt of notice from the Owner, shall have the right to stop the Work until the lapse in coverage has been cured by the procurement of replacement coverage by either the Owner or the Contractor; (2) the Contract Time and Contract Sum shall be equitably adjusted; and (3) the Owner waives all rights against the Contractor, Subcontractors, and Sub-subcontractors to the extent any loss to the Owner would have been covered by the insurance had it not expired or been cancelled. If the Contractor purchases replacement coverage, the cost of the insurance shall be charged to the Owner by an appropriate Change Order. The furnishing of notice by the Owner shall not relieve the Owner of any contractual obligation to provide required insurance.

§ 11.3 Waivers of Subrogation

§ 11.3.1 The Owner and Contractor waive all rights against (1) each other and any of their subcontractors, sub-subcontractors, agents, and employees, each of the other; (2) the Architect and Architect's consultants; and (3) Separate Contractors, if any, and any of their subcontractors, sub-subcontractors, agents, and employees, for damages caused by fire, or other causes of loss, to the extent those losses are covered by property insurance required by the Agreement or other property insurance applicable to the Project, except such rights as they have to proceeds of such insurance. The Owner or Contractor, as appropriate, shall require similar written waivers in favor of the individuals and entities identified above from the Architect, Architect's consultants, Separate Contractors, subcontractors, and sub-subcontractors. The policies of insurance purchased and maintained by each person or entity agreeing to waive claims pursuant to this section 11.3.1 shall not prohibit this waiver of subrogation. This waiver of subrogation shall be effective as to a person or entity (1) even though that person or entity would otherwise have a duty of indemnification, contractual or otherwise, (2) even though that person or entity did not pay the insurance premium directly or indirectly, or (3) whether or not the person or entity had an insurable interest in the damaged property.

§ 11.3.2 If during the Project construction period the Owner insures properties, real or personal or both, at or adjacent to the site by property insurance under policies separate from those insuring the Project, or if after final payment property insurance is to be provided on the completed Project through a policy or policies other than those insuring the Project during the construction period, to the extent permissible by such policies, the Owner waives all rights in accordance with the terms of Section 11.3.1 for damages caused by fire or other causes of loss covered by this separate property insurance.

§ 11.4 Loss of Use, Business Interruption, and Delay in Completion Insurance

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The Owner, at the Owner's option, may purchase and maintain insurance that will protect the Owner against loss of use of the Owner's property, or the inability to conduct normal operations, due to fire or other causes of loss. The Owner waives all rights of action against the Contractor and Architect for loss of use of the Owner's property, due to fire or other hazards however caused.

§11.5 Adjustment and Settlement of Insured Loss

§ 11.5.1 A loss insured under the property insurance required by the Agreement shall be adjusted by the Owner as fiduciary and made payable to the Owner as fiduciary for the insureds, as their interests may appear, subject to requirements of any applicable mortgagee clause and of Section 11.5.2. The Owner shall pay the Architect and Contractor their just shares of insurance proceeds received by the Owner, and by appropriate agreements the Architect and Contractor shall make payments to their consultants and Subcontractors in similar manner.

§ 11.5.2 Prior to settlement of an insured loss, the Owner shall notify the Contractor of the terms of the proposed settlement as well as the proposed allocation of the insurance proceeds. The Contractor shall have 14 days from receipt of notice to object to the proposed settlement or allocation of the proceeds. If the Contractor does not object, the Owner shall settle the loss and the Contractor shall be bound by the settlement and allocation. Upon receipt, the Owner shall deposit the insurance proceeds in a separate account and make the appropriate distributions. Thereafter, if no other agreement is made or the Owner does not terminate the Contract for convenience, the Owner and Contractor shall execute a Change Order for reconstruction of the damaged or destroyed Work in the amount allocated for that purpose. If the Contractor timely objects to either the terms of the proposed settlement or the allocation of the proceeds, the Owner may proceed to settle the insured loss, and any dispute between the Owner and Contractor arising out of the settlement or allocation of the proceeds shall be resolved pursuant to Article 15. Pending resolution of any dispute, the Owner may issue a Construction Change Directive for the reconstruction of the damaged or destroyed Work.

ARTICLE 12 UNCOVERING AND CORRECTION OF WORK

§ 12.1 Uncovering of Work

§ 12.1.1 If a portion of the Work is covered contrary to the Architect's request or to requirements specifically expressed in the Contract Documents, it must, if requested in writing by the Architect, be uncovered for the Architect's examination and be replaced at the Contractor's expense without change in the Contract Time.

§ 12.1.2 If a portion of the Work has been covered that the Architect has not specifically requested to examine prior to its being covered, the Architect may request to see such Work and it shall be uncovered by the Contractor. If such Work is in accordance with the Contract Documents, the Contractor shall be entitled to an equitable adjustment to the Contract Sum and Contract Time as may be appropriate. If such Work is not in accordance with the Contract Documents, the costs of uncovering the Work, and the cost of correction, shall be at the Contractor's expense.

§ 12.2 Correction of Work

§ 12.2.1 Before Substantial Completion

The Contractor shall promptly correct Work rejected by the Architect or failing to conform to the requirements of the Contract Documents, discovered before Substantial Completion and whether or not fabricated, installed or completed. Costs of correcting such rejected Work, including additional testing and inspections, the cost of uncovering and replacement, and compensation for the Architect's services and expenses made necessary thereby, shall be at the Contractor's expense.

§ 12.2.2 After Substantial Completion

§ 12.2.2.1 In addition to the Contractor's obligations under Section 3.5, if, within one year after the date of Substantial Completion of the Work or designated portion thereof or after the date for commencement of warranties established under Section 9.9.1, or by terms of any applicable special warranty required by the Contract Documents, any of the Work is found to be not in accordance with the requirements of the Contract Documents, the Contractor shall correct it promptly after receipt of notice from the Owner to do so, unless the Owner has previously given the Contractor a written acceptance of such condition. The Owner shall give such notice promptly after discovery of the condition. During the one-year period for correction of Work, if the Owner fails to notify the Contractor and give the Contractor an opportunity to make the correction, the Owner waives the rights to require correction by the Contractor and to make a claim for breach of warranty. If the Contractor fails to correct nonconforming Work within a reasonable time during that period after receipt of notice from the Owner or Architect, the Owner may correct it in accordance with Section 2.5.

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§ 12.2.2.2 The one-year period for correction of Work shall be extended with respect to portions of Work first performed after Substantial Completion by the period of time between Substantial Completion and the actual completion of that portion of the Work.

§ 12.2.2.3 The one-year period for correction of Work shall not be extended by corrective Work performed by the Contractor pursuant to this Section 12.2.

§ 12.2.3 The Contractor shall remove from the site portions of the Work that are not in accordance with the requirements of the Contract Documents and are neither corrected by the Contractor nor accepted by the Owner.

§ 12.2.4 The Contractor shall bear the cost of correcting destroyed or damaged construction of the Owner or Separate Contractors, whether completed or partially completed, caused by the Contractor's correction or removal of Work that is not in accordance with the requirements of the Contract Documents.

§ 12.2.5 Nothing contained in this Section 12.2 shall be construed to establish a period of limitation with respect to other obligations the Contractor has under the Contract Documents. Establishment of the one-year period for correction of Work as described in Section 12.2.2 relates only to the specific obligation of the Contractor to correct the Work, and has no relationship to the time within which the obligation to comply with the Contract Documents may be sought to be enforced, nor to the time within which proceedings may be commenced to establish the Contractor's liability with respect to the Contractor's obligations other than specifically to correct the Work.

§ 12.3 Acceptance of Nonconforming Work

If the Owner prefers to accept Work that is not in accordance with the requirements of the Contract Documents, the Owner may do so instead of requiring its removal and correction, in which case the Contract Sum will be reduced as appropriate and equitable. Such adjustment shall be effected whether or not final payment has been made.

ARTICLE 13 MISCELLANEOUS PROVISIONS

§ 13.1 Governing Law

The Contract shall be governed by the law of the place where the Project is located, excluding that jurisdiction's choice of law rules. If the parties have selected arbitration as the method of binding dispute resolution, the Federal Arbitration Act shall govern Section 15.4.

§ 13.2 Successors and Assigns

§ 13.2.1 The Owner and Contractor respectively bind themselves, their partners, successors, assigns, and legal representatives to covenants, agreements, and obligations contained in the Contract Documents. Except as provided in Section 13.2.2, neither party to the Contract shall assign the Contract as a whole without written consent of the other. If either party attempts to make an assignment without such consent, that party shall nevertheless remain legally responsible for all obligations under the Contract.

§ 13.2.2 The Owner may, without consent of the Contractor, assign the Contract to a lender providing construction financing for the Project, if the lender assumes the Owner's rights and obligations under the Contract Documents. The Contractor shall execute all consents reasonably required to facilitate the assignment.

§ 13.3 Rights and Remedies

§ 13.3.1 Duties and obligations imposed by the Contract Documents and rights and remedies available thereunder shall be in addition to and not a limitation of duties, obligations, rights, and remedies otherwise imposed or available by law.

§ 13.3.2 No action or failure to act by the Owner, Architect, or Contractor shall constitute a waiver of a right or duty afforded them under the Contract, nor shall such action or failure to act constitute approval of or acquiescence in a breach thereunder, except as may be specifically agreed upon in writing.

§ 13.4 Tests and Inspections

§ 13.4.1 Tests, inspections, and approvals of portions of the Work shall be made as required by the Contract Documents and by applicable laws, statutes, ordinances, codes, rules, and regulations or lawful orders of public authorities. Unless otherwise provided, the Contractor shall make arrangements for such tests, inspections, and approvals with an independent testing laboratory or entity acceptable to the Owner, or with the appropriate public authority, and shall bear all related costs of tests, inspections, and approvals. The Contractor shall give the Architect

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timely notice of when and where tests and inspections are to be made so that the Architect may be present for such procedures. The Owner shall bear costs of tests, inspections, or approvals that do not become requirements until after bids are received or negotiations concluded. The Owner shall directly arrange and pay for tests, inspections, or approvals where building codes or applicable laws or regulations so require.

§ 13.4.2 If the Architect, Owner, or public authorities having jurisdiction determine that portions of the Work require additional testing, inspection, or approval not included under Section 13.4.1, the Architect will, upon written authorization from the Owner, instruct the Contractor to make arrangements for such additional testing, inspection, or approval, by an entity acceptable to the Owner, and the Contractor shall give timely notice to the Architect of when and where tests and inspections are to be made so that the Architect may be present for such procedures. Such costs, except as provided in Section 13.4.3, shall be at the Owner's expense.

§ 13.4.3 If procedures for testing, inspection, or approval under Sections 13.4.1 and 13.4.2 reveal failure of the portions of the Work to comply with requirements established by the Contract Documents, all costs made necessary by such failure, including those of repeated procedures and compensation for the Architect's services and expenses, shall be at the Contractor's expense.

§ 13.4.4 Required certificates of testing, inspection, or approval shall, unless otherwise required by the Contract Documents, be secured by the Contractor and promptly delivered to the Architect.

§ 13.4.5 If the Architect is to observe tests, inspections, or approvals required by the Contract Documents, the Architect will do so promptly and, where practicable, at the normal place of testing.

§ 13.4.6 Tests or inspections conducted pursuant to the Contract Documents shall be made promptly to avoid unreasonable delay in the Work.

§ 13.5 Interest

Payments due and unpaid under the Contract Documents shall bear interest from the date payment is due at the rate the parties agree upon in writing or, in the absence thereof, at the legal rate prevailing from time to time at the place where the Project is located.

ARTICLE 14 TERMINATION OR SUSPENSION OF THE CONTRACT

§ 14.1 Termination by the Contractor

§ 14.1.1 The Contractor may terminate the Contract if the Work is stopped for a period of 30 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, for any of the following reasons:

- **.1** Issuance of an order of a court or other public authority having jurisdiction that requires all Work to be stopped;
- **.2** An act of government, such as a declaration of national emergency, that requires all Work to be stopped;
- **.3** Because the Architect has not issued a Certificate for Payment and has not notified the Contractor of the reason for withholding certification as provided in Section 9.4.1, or because the Owner has not made payment on a Certificate for Payment within the time stated in the Contract Documents; or
- **.4** The Owner has failed to furnish to the Contractor reasonable evidence as required by Section 2.2.

§ 14.1.2 The Contractor may terminate the Contract if, through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, their agents or employees, or any other persons or entities performing portions of the Work, repeated suspensions, delays, or interruptions of the entire Work by the Owner as described in Section 14.3, constitute in the aggregate more than 100 percent of the total number of days scheduled for completion, or 120 days in any 365-day period, whichever is less.

§ 14.1.3 If one of the reasons described in Section 14.1.1 or 14.1.2 exists, the Contractor may, upon seven days' notice to the Owner and Architect, terminate the Contract and recover from the Owner payment for Work executed, as well as reasonable overhead and profit on Work not executed, and costs incurred by reason of such termination.

§ 14.1.4 If the Work is stopped for a period of 60 consecutive days through no act or fault of the Contractor, a Subcontractor, a Sub-subcontractor, or their agents or employees or any other persons or entities performing portions of the Work because the Owner has repeatedly failed to fulfill the Owner's obligations under the Contract

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Documents with respect to matters important to the progress of the Work, the Contractor may, upon seven additional days' notice to the Owner and the Architect, terminate the Contract and recover from the Owner as provided in Section 14.1.3.

§ 14.2 Termination by the Owner for Cause

§ 14.2.1 The Owner may terminate the Contract if the Contractor

- **.1** repeatedly refuses or fails to supply enough properly skilled workers or proper materials;
- **.2** fails to make payment to Subcontractors or suppliers in accordance with the respective agreements between the Contractor and the Subcontractors or suppliers;
- **.3** repeatedly disregards applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of a public authority; or
- **.4** otherwise is guilty of substantial breach of a provision of the Contract Documents.

§ 14.2.2 When any of the reasons described in Section 14.2.1 exist, and upon certification by the Architect that sufficient cause exists to justify such action, the Owner may, without prejudice to any other rights or remedies of the Owner and after giving the Contractor and the Contractor's surety, if any, seven days' notice, terminate employment of the Contractor and may, subject to any prior rights of the surety:

- **.1** Exclude the Contractor from the site and take possession of all materials, equipment, tools, and construction equipment and machinery thereon owned by the Contractor;
- **.2** Accept assignment of subcontracts pursuant to Section 5.4; and
- **.3** Finish the Work by whatever reasonable method the Owner may deem expedient. Upon written request of the Contractor, the Owner shall furnish to the Contractor a detailed accounting of the costs incurred by the Owner in finishing the Work.

§ 14.2.3 When the Owner terminates the Contract for one of the reasons stated in Section 14.2.1, the Contractor shall not be entitled to receive further payment until the Work is finished.

§ 14.2.4 If the unpaid balance of the Contract Sum exceeds costs of finishing the Work, including compensation for the Architect's services and expenses made necessary thereby, and other damages incurred by the Owner and not expressly waived, such excess shall be paid to the Contractor. If such costs and damages exceed the unpaid balance, the Contractor shall pay the difference to the Owner. The amount to be paid to the Contractor or Owner, as the case may be, shall be certified by the Initial Decision Maker, upon application, and this obligation for payment shall survive termination of the Contract.

§ 14.3 Suspension by the Owner for Convenience

§ 14.3.1 The Owner may, without cause, order the Contractor in writing to suspend, delay or interrupt the Work, in whole or in part for such period of time as the Owner may determine.

§ 14.3.2 The Contract Sum and Contract Time shall be adjusted for increases in the cost and time caused by suspension, delay, or interruption under Section 14.3.1. Adjustment of the Contract Sum shall include profit. No adjustment shall be made to the extent

- **.1** that performance is, was, or would have been, so suspended, delayed, or interrupted, by another cause for which the Contractor is responsible; or
- **.2** that an equitable adjustment is made or denied under another provision of the Contract.

§ 14.4 Termination by the Owner for Convenience

§ 14.4.1 The Owner may, at any time, terminate the Contract for the Owner's convenience and without cause.

§ 14.4.2 Upon receipt of notice from the Owner of such termination for the Owner's convenience, the Contractor shall

- **.1** cease operations as directed by the Owner in the notice;
- **.2** take actions necessary, or that the Owner may direct, for the protection and preservation of the Work; and
- **.3** except for Work directed to be performed prior to the effective date of termination stated in the notice, terminate all existing subcontracts and purchase orders and enter into no further subcontracts and purchase orders.

§ 14.4.3 In case of such termination for the Owner's convenience, the Owner shall pay the Contractor for Work

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properly executed; costs incurred by reason of the termination, including costs attributable to termination of Subcontracts; and the termination fee, if any, set forth in the Agreement.

ARTICLE 15 CLAIMS AND DISPUTES

§ 15.1 Claims

§ 15.1.1 Definition

A Claim is a demand or assertion by one of the parties seeking, as a matter of right, payment of money, a change in the Contract Time, or other relief with respect to the terms of the Contract. The term "Claim" also includes other disputes and matters in question between the Owner and Contractor arising out of or relating to the Contract. The responsibility to substantiate Claims shall rest with the party making the Claim. This Section 15.1.1 does not require the Owner to file a Claim in order to impose liquidated damages in accordance with the Contract Documents.

§ 15.1.2 Time Limits on Claims

The Owner and Contractor shall commence all Claims and causes of action against the other and arising out of or related to the Contract, whether in contract, tort, breach of warranty or otherwise, in accordance with the requirements of the binding dispute resolution method selected in the Agreement and within the period specified by applicable law, but in any case not more than 10 years after the date of Substantial Completion of the Work. The Owner and Contractor waive all Claims and causes of action not commenced in accordance with this Section 15.1.2.

§ 15.1.3 Notice of Claims

§ 15.1.3.1 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered prior to expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party and to the Initial Decision Maker with a copy sent to the Architect, if the Architect is not serving as the Initial Decision Maker. Claims by either party under this Section 15.1.3.1 shall be initiated within 21 days after occurrence of the event giving rise to such Claim or within 21 days after the claimant first recognizes the condition giving rise to the Claim, whichever is later.

§ 15.1.3.2 Claims by either the Owner or Contractor, where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2, shall be initiated by notice to the other party. In such event, no decision by the Initial Decision Maker is required.

§ 15.1.4 Continuing Contract Performance

§ 15.1.4.1 Pending final resolution of a Claim, except as otherwise agreed in writing or as provided in Section 9.7 and Article 14, the Contractor shall proceed diligently with performance of the Contract and the Owner shall continue to make payments in accordance with the Contract Documents.

§ 15.1.4.2 The Contract Sum and Contract Time shall be adjusted in accordance with the Initial Decision Maker's decision, subject to the right of either party to proceed in accordance with this Article 15. The Architect will issue Certificates for Payment in accordance with the decision of the Initial Decision Maker.

§ 15.1.5 Claims for Additional Cost

If the Contractor wishes to make a Claim for an increase in the Contract Sum, notice as provided in Section 15.1.3 shall be given before proceeding to execute the portion of the Work that is the subject of the Claim. Prior notice is not required for Claims relating to an emergency endangering life or property arising under Section 10.4.

§ 15.1.6 Claims for Additional Time

§ 15.1.6.1 If the Contractor wishes to make a Claim for an increase in the Contract Time, notice as provided in Section 15.1.3 shall be given. The Contractor's Claim shall include an estimate of cost and of probable effect of delay on progress of the Work. In the case of a continuing delay, only one Claim is necessary.

§ 15.1.6.2 If adverse weather conditions are the basis for a Claim for additional time, such Claim shall be documented by data substantiating that weather conditions were abnormal for the period of time, could not have been reasonably anticipated, and had an adverse effect on the scheduled construction.

§ 15.1.7 Waiver of Claims for Consequential Damages

The Contractor and Owner waive Claims against each other for consequential damages arising out of or relating to this Contract. This mutual waiver includes

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.1 damages incurred by the Owner for rental expenses, for losses of use, income, profit, financing, business and reputation, and for loss of management or employee productivity or of the services of such persons; and

.2 damages incurred by the Contractor for principal office expenses including the compensation of personnel stationed there, for losses of financing, business and reputation, and for loss of profit, except anticipated profit arising directly from the Work.

This mutual waiver is applicable, without limitation, to all consequential damages due to either party's termination in accordance with Article 14. Nothing contained in this Section 15.1.7 shall be deemed to preclude assessment of liquidated damages, when applicable, in accordance with the requirements of the Contract Documents.

§ 15.2 Initial Decision

§ 15.2.1 Claims, excluding those where the condition giving rise to the Claim is first discovered after expiration of the period for correction of the Work set forth in Section 12.2.2 or arising under Sections 10.3, 10.4, and 11.5, shall be referred to the Initial Decision Maker for initial decision. The Architect will serve as the Initial Decision Maker, unless otherwise indicated in the Agreement. Except for those Claims excluded by this Section 15.2.1, an initial decision shall be required as a condition precedent to mediation of any Claim. If an initial decision has not been rendered within 30 days after the Claim has been referred to the Initial Decision Maker, the party asserting the Claim may demand mediation and binding dispute resolution without a decision having been rendered. Unless the Initial Decision Maker and all affected parties agree, the Initial Decision Maker will not decide disputes between the Contractor and persons or entities other than the Owner.

§ 15.2.2 The Initial Decision Maker will review Claims and within ten days of the receipt of a Claim take one or more of the following actions: (1) request additional supporting data from the claimant or a response with supporting data from the other party, (2) reject the Claim in whole or in part, (3) approve the Claim, (4) suggest a compromise, or (5) advise the parties that the Initial Decision Maker is unable to resolve the Claim if the Initial Decision Maker lacks sufficient information to evaluate the merits of the Claim or if the Initial Decision Maker concludes that, in the Initial Decision Maker's sole discretion, it would be inappropriate for the Initial Decision Maker to resolve the Claim.

§ 15.2.3 In evaluating Claims, the Initial Decision Maker may, but shall not be obligated to, consult with or seek information from either party or from persons with special knowledge or expertise who may assist the Initial Decision Maker in rendering a decision. The Initial Decision Maker may request the Owner to authorize retention of such persons at the Owner's expense.

§ 15.2.4 If the Initial Decision Maker requests a party to provide a response to a Claim or to furnish additional supporting data, such party shall respond, within ten days after receipt of the request, and shall either (1) provide a response on the requested supporting data, (2) advise the Initial Decision Maker when the response or supporting data will be furnished, or (3) advise the Initial Decision Maker that no supporting data will be furnished. Upon receipt of the response or supporting data, if any, the Initial Decision Maker will either reject or approve the Claim in whole or in part.

§ 15.2.5 The Initial Decision Maker will render an initial decision approving or rejecting the Claim, or indicating that the Initial Decision Maker is unable to resolve the Claim. This initial decision shall (1) be in writing; (2) state the reasons therefor; and (3) notify the parties and the Architect, if the Architect is not serving as the Initial Decision Maker, of any change in the Contract Sum or Contract Time or both. The initial decision shall be final and binding on the parties but subject to mediation and, if the parties fail to resolve their dispute through mediation, to binding dispute resolution.

§ 15.2.6 Either party may file for mediation of an initial decision at any time, subject to the terms of Section 15.2.6.1.

§ 15.2.6.1 Either party may, within 30 days from the date of receipt of an initial decision, demand in writing that the other party file for mediation. If such a demand is made and the party receiving the demand fails to file for mediation within 30 days after receipt thereof, then both parties waive their rights to mediate or pursue binding dispute resolution proceedings with respect to the initial decision.

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§ 15.2.7 In the event of a Claim against the Contractor, the Owner may, but is not obligated to, notify the surety, if any, of the nature and amount of the Claim. If the Claim relates to a possibility of a Contractor's default, the Owner may, but is not obligated to, notify the surety and request the surety's assistance in resolving the controversy.

§ 15.2.8 If a Claim relates to or is the subject of a mechanic's lien, the party asserting such Claim may proceed in accordance with applicable law to comply with the lien notice or filing deadlines.

§ 15.3 Mediation

§ 15.3.1 Claims, disputes, or other matters in controversy arising out of or related to the Contract, except those waived as provided for in Sections 9.10.4, 9.10.5, and 15.1.7, shall be subject to mediation as a condition precedent to binding dispute resolution.

§ 15.3.2 The parties shall endeavor to resolve their Claims by mediation which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Mediation Procedures in effect on the date of the Agreement. A request for mediation shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the mediation. The request may be made concurrently with the filing of binding dispute resolution proceedings but, in such event, mediation shall proceed in advance of binding dispute resolution proceedings, which shall be stayed pending mediation for a period of 60 days from the date of filing, unless stayed for a longer period by agreement of the parties or court order. If an arbitration is stayed pursuant to this Section 15.3.2, the parties may nonetheless proceed to the selection of the arbitrator(s) and agree upon a schedule for later proceedings.

§ 15.3.3 Either party may, within 30 days from the date that mediation has been concluded without resolution of the dispute or 60 days after mediation has been demanded without resolution of the dispute, demand in writing that the other party file for binding dispute resolution. If such a demand is made and the party receiving the demand fails to file for binding dispute resolution within 60 days after receipt thereof, then both parties waive their rights to binding dispute resolution proceedings with respect to the initial decision.

§ 15.3.4 The parties shall share the mediator's fee and any filing fees equally. The mediation shall be held in the place where the Project is located, unless another location is mutually agreed upon. Agreements reached in mediation shall be enforceable as settlement agreements in any court having jurisdiction thereof.

§ 15.4 Arbitration

§ 15.4.1 If the parties have selected arbitration as the method for binding dispute resolution in the Agreement, any Claim subject to, but not resolved by, mediation shall be subject to arbitration which, unless the parties mutually agree otherwise, shall be administered by the American Arbitration Association in accordance with its Construction Industry Arbitration Rules in effect on the date of the Agreement. The Arbitration shall be conducted in the place where the Project is located, unless another location is mutually agreed upon. A demand for arbitration shall be made in writing, delivered to the other party to the Contract, and filed with the person or entity administering the arbitration. The party filing a notice of demand for arbitration must assert in the demand all Claims then known to that party on which arbitration is permitted to be demanded.

§ 15.4.1.1 A demand for arbitration shall be made no earlier than concurrently with the filing of a request for mediation, but in no event shall it be made after the date when the institution of legal or equitable proceedings based on the Claim would be barred by the applicable statute of limitations. For statute of limitations purposes, receipt of a written demand for arbitration by the person or entity administering the arbitration shall constitute the institution of legal or equitable proceedings based on the Claim.

§ 15.4.2 The award rendered by the arbitrator or arbitrators shall be final, and judgment may be entered upon it in accordance with applicable law in any court having jurisdiction thereof.

§ 15.4.3 The foregoing agreement to arbitrate and other agreements to arbitrate with an additional person or entity duly consented to by parties to the Agreement, shall be specifically enforceable under applicable law in any court having jurisdiction thereof.

§ 15.4.4 Consolidation or Joinder

§ 15.4.4.1 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may consolidate an arbitration conducted under this Agreement with any other arbitration to which it is a party

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provided that (1) the arbitration agreement governing the other arbitration permits consolidation, (2) the arbitrations to be consolidated substantially involve common questions of law or fact, and (3) the arbitrations employ materially similar procedural rules and methods for selecting arbitrator(s).

§ 15.4.4.2 Subject to the rules of the American Arbitration Association or other applicable arbitration rules, either party may include by joinder persons or entities substantially involved in a common question of law or fact whose presence is required if complete relief is to be accorded in arbitration, provided that the party sought to be joined consents in writing to such joinder. Consent to arbitration involving an additional person or entity shall not constitute consent to arbitration of any claim, dispute or other matter in question not described in the written consent.

§ 15.4.4.3 The Owner and Contractor grant to any person or entity made a party to an arbitration conducted under this Section 15.4, whether by joinder or consolidation, the same rights of joinder and consolidation as those of the Owner and Contractor under this Agreement.

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SECTION 00 72 14

GENERAL CONDITIONS - AIA

1.1 SUMMARY

A. Document Includes:
1. General Conditions.

1.2 GENERAL CONDITIONS

A. AIA Document A201-2017, General Conditions of the Contract for Construction, is the General Conditions of the Contract.

1.3 SUPPLEMENTARY CONDITIONS

A. Refer to Document 00 73 13 for modifications to General Conditions.

END OF SECTION

SECTION 00 73 13

SUPPLEMENTARY CONDITIONS - AIA

1.1 SUMMARY

A. Document Includes:
1. Supplementary Conditions.

1.2 SUPPLEMENTARY CONDITIONS

A. These Supplementary Conditions modify the General Conditions of the Contract for Construction, AIA Document A201-2017, and other provisions of the Contract Documents as indicated below. All provisions which are not so modified remain in full force and effect.

B. The terms used in these Supplementary Conditions which are defined in the General Conditions of the Contract for Construction, AIA Document A201-2017, have the meanings assigned to them in the General Conditions.

1.3 SUPPLEMENTARY CONDITIONS DEFINITIONS

A. **Build America, Buy America Act (BABAA)** – Requirements instituted by the Bipartisan Infrastructure Law of 2021 mandating domestic preference that all iron and steel, manufactured products, and construction materials are produced in the United States.

B. **Construction Materials** – Those articles, materials, or supply – other than an item of primarily iron or steel; a manufactured product; cement and cementitious materials; aggregates such as stone, sand, or gravel; or aggregate binding agents or additives – that are or consist primarily of: non-ferrous metals, plastic and polymer-based products, glass, lumber or drywall.

C. **Manufactured Product** – Items assembled out of components, or otherwise made or processed from raw materials into finished products. Manufactured products must be manufactured (assembled) in the United States, and the cost of components that were mined, produced, or manufactured in the United States must be greater than 55 percent of the total cost of all components of the project.

D. **Manufacturer's Certification** - Documentation provided by a Manufacturer, certifying that the items provided by Manufacturer meet the domestic preference requirements of BABAA.

Article 1 - Contract Documents

1. Add the following Subparagraph 1.1.5.1 as follows:

1.1.5.1- In general, mechanical and electrical drawings are diagrammatic and schematic, and cannot indicate every offset, fitting, and accessory required to avoid all conflict with

other trades. Contractor shall check drawings of other trades to verify spaces available and make reasonable modifications, as directed, without extra cost to Owner; maintain headroom and other requirements in all areas; and where such requirements appear inadequate, notify Architect before proceeding.

2. Add new Subparagraphs 1.2.4 through 1.2.10 as follows:

1.2.4 Contractor also represents that he has studied all surveys and investigation reports of subsurface and latent physical conditions referred to in the Contract Documents and has made such additional surveys and investigations necessary for the performance of the Work at the Contract Sum and in accordance with the requirements of the Contract Documents, and results of all such data with the requirements of the Contract Documents, and that the Contractor enters into the Contract on the basis of its own examination, investigation and evaluation of all such matters and risks associated with the Work, and not in reliance upon any opinions, statements or representations of the Owner or Architect or any of their respective officers, agents, servants or employees.

1.2.5 Contractor represents that he has familiarized himself with and assumes full responsibility for having familiarized himself with the type, nature, sources, availability and compatibility of all material, systems, products, and equipment specified or which have been proposed or approved as substitutions prior to the execution of the Contract.

1.2.6 "The specifications are, in part, of the brief or "streamlined" type and include incomplete sentences. Omissions of words or phrases such as "The Contractor shall", "as noted on the drawings", "according to the drawings", "a", "an", "the", and "all" are intentional. Omitted words or phrases shall be supplied by reference in the same manner as they are when "note" occurs on the drawings. Words "shall" or "shall be" shall be supplied by inference where a colon (:) is used within sentences or phrases. Words "as per" shall mean "in accordance with". Words "provide" and "work" shall mean furnish, install and connect up complete, in operative conditions and use, all materials, equipment, apparatus and required appurtenances of the particular item to which it has reference. Whenever words "approved", "satisfactory", "directed", "submitted", "inspected", or similar words or phrases are used, it shall be assumed that the word "Architect" follows the verb as the object of the clause, such as "approved by the Architect" and "submitted to the Architect". Where a manufacturer's name is mentioned, words "as manufactured by" or "as made by" shall be understood.

1.2.7 Contractor shall promptly call to the attention of the Owner and Architect any discrepancy or conflict in figures, Drawings, or Specifications that affect its Work. In the event of conflicts or discrepancies between and among the Contract Documents, the Architect shall determine which takes precedence over the other. However, figure dimensions shall take precedence over scale measurements, large scale details shall take precedence over small scale drawings, and drawings of later date shall take precedence over those of earlier date. Any part of the Work shown on the Drawings but not specifically mentioned in the Specifications, or vice versa, shall be considered as part of the Work, the same as though included in both. In the event of an inconsistency or conflict between Drawings and Specifications, or within either document not clarified by addendum, the better quality or greater quantity of Work shall be provided in accordance

with the Architect' s interpretation.

Likewise, the work to be undertaken by Contractor shall include all incidental work necessary as customarily done for the completion of the Project even though it may not be specifically described in the Specifications or Drawings.

1.2.8 In the event of conflicts or discrepancies among the Contract documents, interpretations will be based on the following priorities.

1. The Agreement.
2. Addenda, with those of later date having precedence over those of earlier date.
3. The Supplementary Conditions.
4. The General Conditions of the Contract for Construction.
5. Drawings and Specifications.

In the case of an inconsistency between Drawings and Specifications or within either Document not clarified by Addendum, the better quality or greater quantity of Work shall be provided in accordance with the Architect's interpretation, in every case the more expensive item or method specified or shown shall be figured over any less expensive one. Written dimensions shall be used rather than determined by scale or rule.

1.2.9 Where reference to codes and standards of technical associations and organizations are made in the Contract Documents, the current edition of such codes and standards shall govern unless specified edition dates are included.

1.2.10 The Drawings, Plans and Specifications for the Work and the Project have been prepared for the Owner by the Architect and, accordingly, the Owner makes any express or implied warranty representing the suitability, adequacy, or accuracy thereof.

Article 2 - Owner

1. Modify Subparagraph 2.4.1 by adding the following sentence to the end thereof:

   2.4.1 Contractor shall have no right of action or claim as against the Owner or Architect for or on account of orders or directives for work stoppage if given in good faith upon reasonable belief that sufficient grounds exist therefor.

Article 3 - Contractor

1. Add a new Subparagraph 3.3.1.1 as follows:

   3.3.1.1 Contractor shall provide and maintain, in full operation at all times during the performance of the Contract, a sufficient crew of laborers, mechanics and foremen to prosecute the Work with dispatch. The Contractor shall provide a full-time superintendent who shall be on the job during all working periods. Additional provisions pertaining to coordination are included in Division 1, General Requirements, of the Specifications.

   All products must meet BABAA requirements. Contractor shall include Manufacturer’s Certification for BABAA requirements with all applicable submittals. If a specific

manufacture is used in the bidding, a statement that Manufacturer will comply with BABAA must be included with the bid submission. Contractor shall comply with BABAA requirements, including coordination with manufacturers, distributors, and suppliers to correct deficiencies in any BABAA documentation. Engineer/Architect approval of shop drawings or samples shall include review of BABAA documentation. Contractor shall certify upon completion that all work and materials have complied with BABAA requirements. For any change orders, Contractor shall provide BABAA documentation for any new products or materials required by the change. Installation of materials or products that are not compliant with BABAA requirements shall be considered defective work. Contractor should ensure that Engineer/Architect has an approved Manufacturer's Certification or waiver prior to items being delivered to the project site.

By submitting an application for payment, based in whole or in part on furnishing equipment or materials, Contractor certifies that such equipment and materials, to contractor's knowledge, are compliant with BABAA requirements.

2. Add new Subparagraphs 3.4.4 through 3.4.9 as follows:

3.4.4 Labor shall be performed in a workmanlike manner, by mechanics skilled in their respective trades. Standards of Work required throughout shall be of such grade as will bring results of good workmanship. Mechanics whose Work is unsatisfactory to the Owner or Architect or are considered by either Owner or Architect to be careless, incompetent, unskilled or otherwise objectionable, shall be dismissed from the Work upon notice from the Architect or Owner. Neither the Owner nor Architect shall be responsible for any increased costs of delays caused by such a dismissal.

3.4.5 The Contractor shall at all times enforce strict discipline at the site and shall remove from the site any persons found by the Owner or Architect to be disorderly, disruptive to the orderly and efficient progress of the Work, or otherwise exhibiting conduct not in compliance with the Contract Documents. Neither the Owner nor Architect shall be responsible for any increased costs or delays caused by such removal.

3.4.6 All labor used throughout the Work and in performance of the Contract shall be acceptable to the Owner and of a standing or affiliation that will permit the Work to be carried on harmoniously and without delay, and that will in no case or under any circumstances cause any disturbance, interference or delay to the progress of the Work. Contractor agrees to proceed with its Work without interruption, regardless of any trade or craft affiliations or the lack thereof on the part of any workmen on the Project. Contractor agrees that where its Work is stopped or delayed or interfered with by strikes, slowdowns or work interruptions resulting from the acts or failures to act of its employees in concert, or by the breach of any of the terms of this provision, then the Owner, at its option, may terminate the Contract and proceed in accordance with the Contractual Documents.

3.4.7 Contractor shall be obligated to perform all work designated by the Owner or Architect as work included within the scope of the Contract Documents notwithstanding a dispute or claim by the Contractor that such work constitutes extra or additional work.

3.4.8 After the Contract has been executed, the Owner and the Architect will consider a formal request of the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 1 of the Specifications). Refer to Section 01631.

3.4.9 By making requests for substitutions based on Subparagraph 3.4.8 above, the Contractor:

1. represents that the Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;
2. represents that the Contractor will provide the same warranty for the substitution that the Contractor would for that specified;
3. certifies that the cost data presented is complete and includes all related costs under his Contract except the Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and
4. will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be completed in all respects.
5. time required by the Architect to review the Contractor's request for substitution shall be compensated by the Contractor through the Owner. Compensation will be on an hourly basis per the Architect's current labor rate schedule for employees involved in the review of the request.

3. Change the third sentence of Paragraph 3.5 to read as follows:

All Work, materials, or equipment not conforming to these requirements, including substitutions not properly approved and authorized, shall be considered defective.

4. Add new Subparagraphs 3.5.3 through 3.5.13 as follows:

3.5.3 For a period of one year from the date of final completion and acceptance of the Work by the Owner, as evidenced by the date of the Architect's Certificate of Completion, the Contractor warrants to the Owner all movable windows, apparatus, machinery, mechanical and electrical equipment. For the same period, the Contractor warrants to Owner to make good, at his own expense, any defects, shrinkages, warpages or other faults in Work required under this Contract arising out of defective materials or workmanship, ordinary wear and tear excepted.

3.5.4 As part of the above warranty, it is expressly understood and agreed that the Contractor warrants that the Contractor's portion of the Work shall be waterproof and weatherproof in every respect.

3.5.5 The Contractor warrants and represents to the Owner that the Drawings and Specifications for the Work are suitable and adapted for said Work, and agrees that it will perform said construction work and complete same to the entire satisfaction of the Owner and Architect.

3.5.6 The commencement and terms for the guarantees and warranties provided and required by the Contract Documents shall not in any manner be affected by any delay in

the commencement, progress or completion of the Work, regardless of the cause therefor.

3.5.7 In addition to all of Contractor's warranties and obligations to correct defective Work provided by law or as set forth in any of the Contract Documents, the Contractor agrees, upon notice from Owner or Architect, immediately to repair, restore, correct and cure, at Contractor's expense, all defects and omissions in workmanship and materials and all failures to comply with the Contract Documents which appear within one (1) year from the date of final completion and acceptance of Work by Owner. Contractor shall pay for, and if requested, correct, repair, restore and cure any damage or injury, whenever the same shall occur or appear, resulting from any defects, omissions or failure in workmanship and materials, and indemnify, hold harmless, and defend Owner against any and all claims, losses, costs, damages and expenses, including attorney's fees, suffered by Owner as a result of such damage or injury, whenever such damage or injury shall occur or appear.

3.5.8 The foregoing guarantees and warranties shall not shorten any longer warranty or liability period provided for by law or in the plans, drawings or specifications or otherwise received from Contractor or any subcontractor, material supplier or manufacturer of Contractor nor supersede the terms of any liability for defective Work, but shall be in addition thereto, and shall be in addition to all manufacturer's and factory warranties.

3.5.9 Notwithstanding anything to the contrary contained herein with respect to warranties, it is understood and agreed that the foregoing warranties and guarantees shall not affect, limit or impair Owner's right against Contractor with regard to latent defects in the Work which do not appear within the applicable warranty period following acceptance of the Work and which could not, by the exercise of reasonable care and due diligence, be ascertained or discovered by Owner within such warranty period. Contractor shall be and remain liable and responsible to correct and cure any such latent defects which are reported to Contractor by Owner in writing within ninety (90) days after such latent defect first appears or could, by the exercise of reasonable care and due diligence, be ascertained or discovered by Owner.

3.5.10 All guarantees or warranties upon any Work, labor, materials, or equipment by any subcontractor or material supplier of Contractor shall be deemed made by Contractor to Owner. All guarantees and warranties shall survive Owner's final acceptance of the Project. Neither the acceptance of any of the Work by Owner, in whole or in part, nor any payment, either partial or final, by Owner to Contractor, shall constitute a waiver by Owner of any claims against Contractor for defects in the Work, whether latent or apparent, and no such payment or acceptance of the Work by Owner shall release or discharge Contractor or Contractor's surety from any such claims for breach of such warranties.

3.5.11 Nothing herein intends or implies that the guarantees or warranties shall apply to Work which has been abused or neglected by the Owner or his successor in interest.

3.5.12 Upon completion of the Work, Contractor shall furnish Owner with copies of all warranties, guarantees, operating manuals relative to equipment installed, and a complete

set of reproducible drawings with all field changes noted on them relating to the improvements constructed under the Contract.

3.5.13 If required by the Owner or the Architect, the Contractor shall deliver to the Owner a signed affidavit stating that, to the best of his knowledge, the Work has been constructed in accordance with the Contract Documents. If such an affidavit is required, the Architect will not recommend final payment or issue a final certificate for payment until such affidavit has been delivered to the Owner.

5. Modify Paragraph 3.6 by adding the following sentence to the end thereon:

The Contract Sum includes the cost of such taxes, and Owner may deduct from the Contractor's account any expense the Owner incurs because of the Contractor's failure to comply with applicable taxing laws, rules or regulations of local, state and federal authorities.

6. Add the following Subparagraph 3.6.1 as follows:

3.6.1 "Materials and properties purchased by Contracts with the Owner that become a permanent part of the structure or constructed facility are not subject to the Indiana Gross Retail Tax (Sales Tax). The Contractor shall obtain a copy of the Owner's Exemption Certificate and then issue copies of this certificate to his suppliers when acquiring materials and products for use in this project. The Contractor shall enforce this exemption clause for all of his purchases and for those of his Subcontractors."

7. Modify Subparagraph 3.7.3 as follows: At the start of this Subparagraph, insert the following:

Contractor represents and warrants that it is familiar with all governmental rules, regulations, laws and ordinances pertaining to the Work.

8. Add the following new Subparagraphs 3.7.6 through 3.7.8 as follows:

3.7.6 The Contractor shall give prior notice to utility companies, make all arrangements and provide all services necessary to discontinue utilities or place same service.

3.7.7 It is the Contractor's responsibility to perform all construction in accordance with appropriate local, state and national laws, statutes, building codes and requirements. All rated construction shall conform to the requirements of similar construction as tested by UL, or another testing organization recognized by the State of Indiana.

3.7.8 The Contractor shall provide the Owner all necessary and required signed statements that the construction is in compliance with local, state and national laws, statutes, building codes and requirements. These statements must be supplied prior to final payment.

9. Add the following Subparagraph 3.9.4 as follows:

3.9.4 The Contractor shall not remove the superintendent from the project under any circumstances prior to substantial completion. Exceptions will be made for major illness, incompetence or termination with cause and even so will require the Owner's concurrence. The superintendent cannot be removed prior to "Final Completion" without the consent of the Architect and written approval of the Owner. The superintendent shall not be allowed vacation or other time off during the last three months before substantial completion.

10. Add the following Subparagraphs 3.10.4 through 3.10.9 as follows:

3.10.4 The Owner, if deems necessary, may direct the Contractor to Work overtime, in addition to any overtime required to meet the approved progress schedule as incorporated in the Contract Documents, and if so directed Contractor shall Work said overtime. Provided that the Contractor is not in default under any of the terms or provisions of the Contract or of any of the other Contract Documents, the Contractor will be reimbursed for such actual additional wages paid, if any, at rates which have been approved by the Architect and the Owner plus taxes imposed by law on such additional wages, plus workmen's compensation insurance and levies on such additional wages if required to be paid by the Contractor.

3.10.5 The following requirements will govern in connection with such additional overtime required under Subparagraph 3.10.4. The Contractor and his Subcontractors shall be required to submit a daily statement of employees by name, trade classification, hourly rate, premium or overtime hours worked, and signed by the Owner to substantiate his premium or overtime charges, all in accordance with the Owner's and standard procedures. These changes shall be submitted weekly for the Owner's records. All such statements shall be submitted in three (3) copy form, including the original statement. The contractor will be reimbursed for the overtime premium and in addition applicable contributions to Federal and State Unemployment Tax and Federal Insurance Contributions Tax. These taxes shall be a percentage factor to be applied to the premium cost. No overhead and profit will be allowed. Each Contractor involved will be required to submit to the Owners, as promptly as possible, an itemized breakdown of the foregoing percentage and shall furnish a photostatic copy of the applicable State unemployment experience rate or a statement from the State Unemployment Security Commission setting forth said experience rate. In addition, in the case of major premium time charge, the union agreements for the trades involved shall be submitted along with the first premium time proposal. Such adjustments shall be subject to an audit by the Architect and the Owner and shall be recorded on the Contractor's books in a manner to facilitate such audit.

3.10.6 If, however, the progress of the Work or of the Project be delayed by any fault or neglect or act or failure to act of the Contractor or any of its officers, agents, servants, or employees, then the Contractor shall, in addition to all of the other obligations imposed by the Contract upon the Contractor in such cases, and at its own cost and expense, Work such overtime as may be necessary to make up for all time lost to avoid delay in the completion of the Work and of the Project. If, after written notice is given, the Contractor refuses to Work overtime required to make up lost time or to avoid delay in the completion of the Work and of the Project, the Owner may hire others to perform the Work and deduct the cost from the Contractor's Contract amount.

3.10.7 Should the progress of the Work or of the Project be delayed by any fault or neglect or act or failure to act of the Contractor or any of its officers, agents, servants or employees so as to cause any additional cost, expense, liability or damage to the Owner or Architect, or any damages or additional costs or expenses for which the owner, or Architect may or shall become liable, the Contractor shall and does hereby agree to compensate the Owner and the Architect and to indemnify them against all such costs, expenses, damages and liability.

3.10.8 If the Owner considers it necessary for the Contractor or Subcontractor to cease Work at a designated point at any time for the orderly progress of the Work, each Contractor or Subcontractor, when directed by the Owner, shall transfer his men to such point or points as directed, and execute such portions of his Work as required to enable others to properly carry on their Work without delay.

3.10.9 Additional provisions pertaining to the progress schedule are included in Division 1, General Requirements.

11. Add new Subparagraphs 3.13.1 and 3.13.2 as follows:

3.13.1 If the Owner requires the Contractor to relocate materials which have been stored on site or within the building, the Contractor shall relocate such materials at no additional cost to the Owner.

3.13.2 The Contractor is responsible for its site access. The Contractor shall keep roads, walks, ramps, etc., on and adjacent to the Project site in good working order and condition and free from obstructions which might present a hazard to or interference with traffic. When construction operations necessitate the closing of traffic lanes, the Contractor shall be responsible for arranging such closings in advance with the authorities having jurisdiction, the Owner, and adjacent property Owners. The Contractor shall provide adequate barricades, signs and other devices for traffic guides and public safety.

12. Add new Subparagraphs 3.14.3, 3.14.4 and 3.14.5 as follows:

3.14.3 Cutting and patching shall be performed by the proper trades or crafts necessary for the material involved, but the cost of same shall be borne by the Contractor requiring the cutting and patching.

3.14.4 Patching shall mean the restoration of a surface or item to its original condition to match the existing adjoining surfaces unless otherwise indicated, noted, detailed or specified.

1. When patching involves painting, special coating, vinyl fabric or other applied finish, the entire surface affected (i.e., wall or ceiling) shall be refinished as a part of this requirement.

3.14.5 Cutting and patching includes cleaning of all surfaces soiled by this work.

13. Add the following to the end of Paragraph 3.16:

    3.16 - The Owner and Architect shall have access to the Work at all times.

Article 7 - Changes in the Work

1. Modify Subparagraph 7.3.4 as follows:

   a. In the last part of the second sentence, delete the words "a reasonable allowance for overhead and profit" and substitute "an allowance for overhead and profit in accordance with the schedule set forth in Subparagraph 7.3.4 as amended." This cost must include cost of supervision and project management, on or off site, Contractor's off-site expense.

   b. In the second sentence, change the word "Architect" to "Owner and Architect".

2. Add new Subparagraph 7.3.4.6 and 7.3.4.7 as follows:

   7.3.4.6 In Subparagraph 7.3.3.3 and 7.3.3.4 the allowance for overhead and profit combined, included in the total cost to the Owner, shall be based on the following schedule:

   a. For the Contractor, the work performed by the Contractor's own forces, ten percent (10%) of the cost.

   b. For the Contractor, for work performed by his Subcontractor, ten percent (10%) of the amount due the Subcontractor.

   c. For each Subcontractor or Sub-Subcontractor involved, for work performed by his own forces, ten percent (10%) of the cost.

   d. For each Subcontractor, for work performed by his Sub-Subcontractors, ten percent (10%) of the amount due the Sub-Subcontractor.

   e. Cost to which overhead and profit is to be applied shall be determined in accordance with Subparagraph 7.1.4.

   f. In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs showing quantities, with unit price of labor and materials for each quantity, including those items furnished by Subcontractors. Where major cost items are subcontracts, they shall be itemized also and a copy of their quotations, itemized as indicated above, shall be included in the proposal. In no case will a change involving over $500.00 be approved without such itemization.

   g. "Cost" is to include supervision cost.

   7.3.4.7 No action, conduct, omission, prior failure or course of dealing by the Owner shall act to waive, modify, change or alter the requirements that change orders must be in

writing and signed by the Owner and Contractor, and that such written change orders are the exclusive method of effecting any change to the Contract Sum or Contract Time.

The Contractor acknowledges that the Contract Sum and Contract Time cannot be changed by implication, oral agreements, actions, inactions, course of conduct, or constructive change order.

Article 8 - Time

1. Add a new Subparagraph 8.2.3.1 as follows:

   8.2.3.1 Inasmuch as the completion of the Project within the prescribed time is dependent upon the close and active cooperation of all those engaged therein, it is, therefore, required that the Contractor shall lay out and install his Work at such time or times and in such manner as consistent with the schedule to permit the carrying forward of the work of other contractors.

2. Add new Subparagraphs 8.2.4 through 8.2.6 as follows:

   8.2.4 - Except as otherwise provided herein, substantial completion of work shall be within the number of calendar days stated by the Contractor in Proposal Form (Form 96) and shall become a contract obligation. The time for completion of the Work shall be extended for the period of any excusable delay, which term shall include only those delays directly caused by any of the reasons enumerated in the following Sub-Paragraphs 8.3.2 and 8.3.3.

   8.2.5 - Completion shall be understood to be substantial completion for the Owner's beneficial occupancy, with only minor "punch list" items yet to be completed and items such as balancing of heating system, etc., which cannot be completed due to climatic conditions.

   8.2.6 Whenever it may be useful or necessary for the Owner to do so, before final inspection and acceptance of the Project, the Owner may take possession of the Project or parts thereof at any time that it is determined by the Architect that the construction has been completed to a point where the Owner can occupy or use said Project, or parts thereof, without impairment to Contractor's Work. The Owner may at such time install furnishings and equipment as he sees fit or may at his discretion award separate Contracts for this purpose. It is recognized that some of the Contractor's Work may not be complete at such time and the Contractor shall make all reasonable efforts to complete the Work as quickly as possible. Such use or occupation shall not relieve the Contractor of his guarantee of said Work and materials nor of his obligation to make good at his own expense any defective materials or workmanship which may occur or develop prior to Contractor's release from responsibility to the Owner.

   However, the Contractor shall not be responsible for the maintenance of such portion of the Work as may be used or occupied by the Owner, nor for any damage thereto that is due to or caused by the negligence of the Owner during such period of use or occupancy.

3. Modify Subparagraphs 8.3.1 through 8.3.3 by deleting them in their entirety and replacing them with the following:

8.3.1 If the Contractor is delayed at any time in the progress, performance or completion of any portion or portions of the whole of the Work contemplated by its Contract with Owner as the result of flood, cyclone, hurricane, tornado, earthquake or other similar catastrophe, or as the result of Acts of God, the public enemy, Acts of the Government, or fires, epidemics, quarantine restrictions, strikes or labor disputes, freight embargoes or unusual delay in transportation, unavoidable casualties, or on account of any acts or omissions of the Owner, Architect, or others engaged by them (except as herein provided), or by their employees, agents or representatives, or by changes ordered in the Work by the Owner which are not required to correct problems or discrepancies in the Contractor's Work, or by any other causes which the Contractor could not reasonably control or circumvent, and which are not due to any fault, neglect, act or omission on Contractor's part, and the risks of which are not otherwise assumed by Contractor pursuant to the provisions of the Contract Documents, then the Contract Time for completion of the portion or portions of the Work directly affected by such delay, shall upon timely request of the Contractor, be extended by a period equivalent to the time lost by reason of any and all of the aforesaid causes. Said period shall be as approved and certified by the Architect and the Owner.

8.3.2 No extension of time shall be granted for delays on account of, or resulting from, weather conditions or other natural phenomenon of normal intensity for the locality or other weather conditions except for the catastrophic weather conditions mentioned in the preceding Subparagraph 8.3.1, unsuitable ground conditions, inadequate construction forces, the failure of the Contractor to place orders for equipment or materials sufficiently in advance to insure their delivery when needed, or delays resulting from interruptions to or suspensions of Contractor's Work so as to enable other contractors to perform their Work.

8.3.3 Any claim for an extension in the Contract Time shall be based on written notice delivered to Owner and Architect within seventy-two (72) hours of the commencement of the event or occurrence giving rise to the claim. Such notice must set forth (a) the cause of the delay, (b) a description of the portion or portions of the Work affected thereby, and (c) all details pertinent thereto. Notice of the extent of the claim with supporting data, including application for the specific number of days extension of time requested shall be delivered to Owner and Architect within twenty (20) days of such occurrence unless Owner allows an additional period of time to ascertain more accurate data.

8.3.4 It is a condition precedent to the consideration or prosecution of claims relating to any delays, suspension, hindrance or causes which justify an extension of the Contract Time, that such claims be made and furnished in strict accordance with all applicable time limits provided in this Article. Otherwise, if the Contractor fails to comply, such claims shall be waived, invalid and unenforceable as against the Owner and Architect.

8.3.5 The Contractor agrees that, whether or not any delay shall be the basis for an extension of time, he shall have no claim against the Owner for an increase in the Contract Price, nor a claim against the Owner or Architect for a payment or allowance of any kind for damage, loss or expense resulting from delays nor shall Contractor have any

claim for damage, loss or expense resulting from interruptions to, or suspension of his Work to enable other Contractors to perform their Work. As between the Contractor and Owner, except for delays caused by acts constituting intentional interference by the Owner with the Contractor's performance of its Work when such acts continue after the Contractor's written notice to the Owner of such interference, the Contractor shall assume the risk of all suspensions of, delays in or hindrances to the performance of the Work, regardless of the length thereof, arising from any and all causes whatsoever, including without limitation, those due to any acts or omissions of the Owner, other contractors or subcontractors, except only to the extent that an extension of time may be due to the Contractor as expressly provided for in this Article for such suspension, delay or hindrance. The Contractor shall bear all costs, expenses and liabilities which he may incur in connection with such suspensions, delays or hindrances, and all such suspensions, delays or hindrances, costs, expenses and liabilities of any nature, whatsoever, whether or not provided for in this Contract, shall conclusively be deemed to have been within the contemplation of the parties. The only remedy available to the Contractor shall be an extension of time.

8.3.5.1 The Owner's exercise of any of its rights under the Contract Documents, including but not limited to, its rights regarding changes in the Work, regardless of the extent or number of such changes, performance of separate work or carrying out the Contractor's Work by the Owner directing overtime or changes in the sequence of the Work, withholding payment or otherwise exercising its rights under the provisions of Articles 9 and 14 hereof, or exercising any of its remedies of suspension of the Work or requirements of correction or re-execution of any defective work shall not, under any circumstances, be construed as intentional interference with the Contractor's performance of the Work.

8.3.6 In the event of a dispute between the Contractor and Owner concerning the period of such time extension, the matter shall be referred to the Architect whose decision thereon shall be final and binding upon the parties. Such extension or extensions of time as determined by the Owner or the Architect shall release and discharge the Owner and the Architect of and from any and all claims of whatever character by the Contractor on account of the aforesaid or any other causes of delay.

8.3.7 Notwithstanding any provision of this Contract, whether or not relating to the Contract Time, the Owner makes no representation or guarantee as to the date or time that the Project site or any portion thereof will be made available to the Contractor for the performance of the Work, or as to weather conditions at the Project site will be such as to permit the Work to be performed thereon without interruption or by any particular sequence or method or as to whether the performance of the Work can be completed by the time required under this Contract or by any other time.

8.3.8 Whenever in connection with this Contract it is required, expressly or otherwise, that the Owner shall perform any act relating to the Contract, including making available or furnishing any real property, materials, or other things, no guarantee is made by the Owner as to the time of such performance, and delay of the Owner in fulfilling such requirements shall not result in liability of any kind on the part of the Owner except only

to the extent that an extension of time may be due as expressly provided for in this Article.

Article 9 – Payments and Completion

2. Add the following to the end of Paragraph 9.2:

   The Schedule of Values so prepared by the Contractor, reviewed by the Architect, and concurred by the Surety, shall constitute the basis of progress payments to the Contractor, and payments made pursuant to regards the Architect, the Contractor and the Surety on any bonds be deemed properly made at the request of the Contractor and the Surety.

2. Add a new Subparagraph 9.2.2 as follows:

   9.2.2 The Schedule of Values shall be prepared in a manner that shows each major portion of the Work as a separate line item. The Contractor shall identify those line items of Work that will be accomplished by Subcontractors.

3. Add a new Subparagraph 9.2.3 as follows:

   9.2.3 Contractor shall obtain written concurrence in such schedule of values from the Surety furnishing any Performance Bond and Labor and Materials Payment Bond. Copy of written concurrence by the Surety shall be submitted by the time of written submission.

4. Add a new Subparagraph 9.2.4 as follows:

   9.2.4 Said schedule shall include a value of two (2) percent closeout cost associated with each subcontractor and is to be clearly itemized on the schedule.

5. Modify Subparagraph 9.3.1 by adding the following:

   Progress payment requests shall be clearly itemized on the schedule, submitted on a notarized AIA Document G702, Application and Certificate for Payment, supported by AIA G703, Continuation Sheet. These requests shall detail the value of the various materials stored on the site and the value of the various types of labor performed during the period of time since the previous payment request. The Contractor shall attach to each payment request a statement certifying that all payments due the Contractor from previously issued Certificates for Payment have been paid. Contractor shall furnish such additional supporting data substantiating the Contractor's right to payment as the Owner or Architect may require.

   Payment will be recommended by Architect, and approved by the Owner, based on ninety percent (90%) of the estimated value of labor performed and materials incorporated in the Work, plus ninety percent (90%) of the value of non-perishable materials suitably stored at the site. Stored materials shall not be removed from the site without permission of the Owner.

6. Add the following Subparagraphs 9.3.1.3 through 9.3.1.6 as follows:

9.3.1.3 – Until the Work is 50 percent complete, the Owner shall pay 90 percent of the amount due the Contractor on account of progress payments. At the time Work is 50 percent complete and thereafter, the Architect will authorize remaining partial payments to be paid in full.

9.3.1.4 Until his Subcontract is fifty percent (50%) complete, a Subcontractor shall be paid ninety percent (90%) of the earned sum by the Contractor. At the time his Subcontract is fifty percent (50%) complete, if the manner of completion of his Subcontract and its progress are and remain satisfactory to the Contractor and the Architect, and in the absence of other good and sufficient reasons, he shall be paid in full on the remaining progress payments.

9.3.1.5 The full contract retainage may be reinstated if the manner of completion of the work and its progress do not remain satisfactory to the Architect, or the Owner, or for other good and sufficient reasons.

9.3.1.6 The Owner, Contractor, and the Architect shall cooperate to the end that retentions shall be paid promptly when all conditions of the Contract have been met.

7. Add Subparagraph 9.3.2.1 as follows:

9.3.2.1 Payment for Stored Material and Equipment will be made if the Contractor includes with each monthly request the following two paragraphs to certify that all material and equipment for which payment is requested is in fact paid for the Contractor and becomes the property of the Owner. The Architect reserves the right to observe building materials, stored off-site, for which the Contractor is requesting payment. If building materials are stored more than five miles from the project site or the Architect's office, the Contractor shall compensate the Architect both for time and expense in making this review.

1. "The Contractor certifies that all stored materials included in this Application for Payment are free and clear of all liens, claims, security interests and encumbrances and that no work, materials, or equipment covered hereby is subject to any retained interest by any other person."

2. "Title to all work materials and equipment covered by this Application for Payment which has not hereto before passed to the Owner is hereby conveyed and transferred to the Owner effective upon payment of this Application for Payment."

8. Add new Subparagraphs 9.5.5 and 9.5.6 as follows:

9.5.5 In the event Owner withholds any payment, partial or final, from the Contractor by virtue of Contractor's failure to make payments properly to subcontractors, laborers, and material suppliers for labor, materials, and/or equipment furnished to the Project, Owner may, but shall not be obligated or required to, make direct payment on behalf of Contractor of any part or all of such sums due and owing to said subcontractors, material suppliers and/or laborers for their labor, materials or equipment furnished to the Project, not to exceed the Contract Sum remaining due and owing to Contractor, and charging all

such direct payments against the Contract Sum under the Contract. Before making any such direct payments for labor, materials or equipment, Owner first shall give Contractor three (3) days' written notice stating Owner's intention to make such payment and setting forth the names of the subcontractors, material suppliers and/or laborers which Owner intends to pay directly, the amounts to be paid them, and the reason therefor. If Contractor does not pay or otherwise satisfy such bills, statements and/or claims of the parties so identified within two (2) days after receipt of such notice or give Owner satisfactory assurances that the same will be paid or otherwise satisfied, Owner may proceed with such payment; provided, however, nothing contained in this paragraph shall create any personal liability on the part of the Owner to any subcontractor, material supplier or laborer, or any direct contractual relationship between Owner and them.

9.5.6 If any claim or lien is made or filed with or against the Owner, the Project, real estate, or contract proceeds by any person claiming that Contractor or any subcontractor or other person for whom Contractor is liable has failed to make payment for labor, services, materials, equipment, taxes or other items or obligations furnished or incurred for or in connection with the Work, or if at any time there shall be evidence of such non-payment or of any claim or lien which is chargeable to Contractor, or if Contractor or any subcontractor or other person for whom Contractor is liable causes damage to the Work or to any other Work on the Project, or if Contractor fails to perform or is otherwise in default under any of the terms or provisions of the Contract Documents, Owner shall have the right to retain from any payment then due or thereafter to become due an amount which it deems sufficient to (1) satisfy, discharge and/or defend against such claim or lien or any action which may be brought or judgment which may be recovered thereon, (2) make good any such non-payment, damage, failure or default, and (3) compensate the Owner and Architect for and indemnify them against any and all losses, liability, damages, costs, expenses including legal fees and disbursements which may be sustained or incurred by either or both of them in connection therewith. Owner shall have the right to apply and charge against Contractor so much of the amount retained as may be required for the foregoing purposes. If the amount retained is insufficient therefor, Contractor shall be liable for the difference and shall pay the same to the Owner.

9. Add the following Subparagraph 9.6.9:

9.6.9. Upon commencement of the Work, an escrow account shall be established in a financial institution chosen by the Contractor and approved by the Owner.

1. The escrow agreement shall provide that the financial institution will act as escrow agent, will pay interest on funds deposited in such account in accordance with the provisions of the escrow agreement and will disburse funds from the account upon the direction of the Owner as set forth below. Compensation to the escrow agent for establishing and maintaining the escrow account shall be paid from interest accrued in the escrow account.

2. As each progress payment is made, the retainage with respect to that payment shall be deposited by the Owner in the escrow account.

3. Interest earned on retainage will be maintained proportionally to the amount of retainage which is maintained, and any retainage which is released to the

contractor will also be released with the appropriate amount of interest earned at the time that the retainage is released to the Contractor.

4. When the Contractor has fulfilled all of the requirements of the Contract providing for reduction of retained funds, the escrow agent shall release to the Contractor one-half of the accrued funds but none of the interest thereon. When the work has been fully completed in a satisfactory manner and the Architect has issued a final Certificate for Payment, the escrow agent shall pay to the Contractor the full amount of funds remaining in the account, including net balance of the interest paid to the account, but less any interest that may have accrued for the benefit of the Owner, which shall be paid for the Owner.

5. If, after Substantial Completion of the Work, final completion thereof is materially delayed through no fault of the Contractor, the escrow agent shall make payment to the Contractor as provided in Subparagraph 9.10.3

10. Add new Subparagraph 9.10.6 as follows:

9.10.6 – Final Payment, including all escrowed principal and escrowed income shall be due within sixty-one (61) days following the Date of Substantial Completion, as defined above. If at that time there are any remaining uncompleted minor items, an amount equal to two hundred percent (200%) of the value of each item as determined by the Architect shall be withheld until all such items are complete. The cost of the review estimate and other efforts necessary to establish the value of the incomplete work will be deducted from the remaining funds owed to the Contractor.

11. Add Paragraph 9.11 and Subparagraph 9.11.1 as follows:

Article 10 – Protection of Persons and Property

2. Modify Subparagraph 10.2.2 by adding the following sentence to the end thereof:

The Contract Sum includes the cost of such notices and compliance, and Owner may deduct from the Contractor's account any expense the Owner incurs because of the Contractor's failure to comply with such laws, ordinances, rules, regulations and lawful orders.

2. Add a new Subparagraph 10.2.2.1 as follows:

10.2.2.1The Contractor shall comply with all applicable safety recommendations of the Associated General Contractors of America, American National Standards Institute and National Fire Protection Association, the Occupational Safety and Health Act, and all special safety and security requirements of the Owner. If any inconsistency exists between the provisions of this Subparagraph 10.2.2.1 and Subparagraph 10.2.2, Subparagraph 10.2.2 shall take precedence.

3. Add a new Subparagraph 10.2.4.1 as follows:

10.2.4.1 When use or storage of explosives and other hazardous materials or equipment,

or unusual methods are necessary, the Contractor shall give the Owner reasonable advance notice.

4. Add new Subparagraphs 10.2.9 and 10.2.10 as follows:

10.2.9 All damage, injury or loss to any property referred to in Subparagraph 10.2.1 caused, directly or indirectly, in whole or in part, by Contractor, any subcontractor or anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable, shall be remedied by Contractor. Contractor's duties and responsibilities for the safety and protection of the Work shall continue until such time as all the Work is completed and accepted by Owner.

10.2.10 Contractor shall indemnify, save harmless and defend Owner from any liability, including any and all claims, damages, losses, costs, attorneys' fees and other professional fees, resulting from any violation of all such applicable laws, ordinances, rules, regulations, lawful orders and safety requirements referred to in Subparagraph 10.2.2.

Article 11 – Insurance

2. Add Subparagraph 11.1.1 through 11.1.3 as follows:

11.1.1 The Contractor shall not commence the Work until he has obtained all insurance required under this section and has submitted a Certificate of Insurance form to the Owner. Certificates shall be furnished on AIA Document G705 or the Accord Form and submitted to the Architect, in duplicate, at least five (5) days prior to starting Work. The Certificate shall provide for thirty (30) days prior written notice to the Owner and Architect of policy cancellation. If requested, a certified copy of the policies shall be submitted to the Architect for his review.

11.1.2 In the event the Contractor engages Subcontractors for all or a portion of the Work required by its Contract, the Contractor will require any and all Subcontractors to also assume all of the duties, obligations and requirements in this Article. The Contractor shall require such Subcontractors to provide Certificates of Insurance evidencing the insurance, and naming the Contractor, Architect, and Owner as additional insureds, with primary non-contributory status, except as respects worker's compensation insurance, and that the insurance carried and maintained by the Subcontractor meets all of the requirements of this Article. The Contractor shall not permit any Subcontractor to commence Work until a Certificate of such insurance has been submitted and on file with the Contractor.

11.1.3 The Contractor's Commercial General Liability Insurance shall include premises – operations (including explosion, collapse and underground coverage) elevators, independent contractors, products liability, completed operations, and blanket contractual liability on all written contracts, all including broad form property damage coverage.

2. Add Subparagraphs 11.1.2.1 and 11.1.2.2 as follows:

11.1.2.1 The Contractor shall deliver the required bonds to the Owner not later

than three (3) days following the date the Agreement is entered into, or if the Work is to be commenced prior thereto in response to a letter of intent, the Contractor shall, prior to the commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished.

11.1.2.2 The Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

Article 12 – Uncovering and Correction of Work

2. Add a new Subparagraph 12.2.6 as follows:

12.2.6 Contractor shall return to project up to 24 months from date of substantial completion to repair all masonry cracks inside or out, and establish new control joints as required.

Article 13 – Miscellaneous Provisions

1. Modify Subparagraph 13.2.1 by adding the following to the end thereof:

13.2.1 Neither this Contract nor any monies due or to become due hereunder shall be assignable without the prior written consent of the Owner, neither shall the whole or any part of this Contract be sublet without such prior written consent. Any such assignment or subletting without prior written consent by the Owner shall be void and of no effect and shall vest no right of action in the assignee or subcontractor as against the Owner or Architect. Owner's consent to any subletting shall not be deemed to create any contractual relationship between the Owner and any subcontractor to whom the work or any portion thereof is sublet and shall not vest any right or right of action in such subcontractor against Owner.

2. Add new Subparagraphs 13.4.7 through 13.4.11 as follows:

13.4.7 Where materials are specified to conform to the standard specifications of the American Society for Testing and Materials, American Concrete Institute, American Institute of Steel Construction, other recognized technical organizations with the Federal Government, but testing is not required in connection therewith, the Contractor shall furnish certificates to the Architect and Owner's Representative as evidence that the proposed products meet requirements of standard specifications cited.

13.4.8 Notices required by this Paragraph shall be delivered in writing to the Architect no less than three (3) days prior to inspection, test or approval date. Notices shall specify the location and time that inspection, test or approval will be made.

13.4.9 If any portion of the Work to be inspected, tested or approved under the observation of the Architect or Owner is not ready for such inspections, tests or approvals at the time designed in the Contractor's notice to the Architect, the Contractor shall bear all costs for Architect's additional services made necessary by such delay.

13.4.10 Certificates of inspection or testing shall indicate if that portion of the Work inspected or tested meets the minimum requirements of the standard or regulation specified. Certificates shall include the name of Contractor, name of Project and location and date inspection or test was conducted.

13.4.11 Additional provisions pertaining to testing are included in Division 1 – General Requirements, and in Sections relating to specific work involved.

3. Delete Subparagraph 13.5 in its entirety and replace it with the following:

13.5 Payments due to the Contractor under the terms of the Contract Documents and unpaid under this Agreement shall bear interest from the date payment is due at the legal rate prevailing at the place of the Project; provided, that such interest shall apply only with respect to liquidated and non-disputed payments, and shall accrue from and after the thirtieth (30th) day following the Owner's receipt of a statement of account by the Contractor, demanding such payment and containing an express statement by the Contractor of its intention to assess such interest upon such claim. In the event the Owner is entitled to withhold payments under the Contract, or elsewhere in the Contract Documents, or in the event of a good faith dispute between the Owner and Contractor, no interest shall accrue.

4. Add a new Subparagraph 13.6 as follows:

13.6 The Contractor shall comply with all federal, state, and municipal and local rules, ordinances, rules, regulations, orders, notices and requirements relating to non-discrimination in employment, fair employment practices, and equal employment opportunity, whether or not provided elsewhere in the Contract Documents without additional charge or expense to the Owner, and shall be responsible for and correct, at its own cost and expense, any violations thereof resulting from or in connection with the performance of the Work. Contractor shall at any time upon demand, furnish such proof as the Owner may require to demonstrate compliance with such requirements and correction of any violations. Contractor agrees to save harmless and indemnify the Owner, the Owner's Representative, and Architect from and against any and all loss, injury, claims, actions, damages, costs and expenses, including legal fees and disbursements, caused or occasioned directly or indirectly by the Contractor's failure to comply with any of said laws, ordinances, rules, regulations, orders, notices or requirements, or to correct violations.

5. Add a new Subparagraph 13.7 as follows:

13.7 Contractor shall maintain policies of employment as follows:

1. Pursuant to the requirements of Indiana Code S22-91-10 and S5.16-6-1, Contractor and his Subcontractors may not discriminate against any employee or applicant for employment to be employed in the performance of such contract, with respect to his hire, tenure, terms, conditions or privileges of employment of any matter directly or indirectly related to employment because of his race, religion, color, sex, handicap, national origin or ancestry. The Contractor and Subcontractor, if any, agrees to comply with all the provisions contained in the

Equal Opportunity Clause quoted in Executive Orders No. 11246 and No. 11375. In addition, the Contractor shall cause this Equal Opportunity Clause to be included in the subcontracts or purchase orders hereunder unless exempted by rules, regulations and orders of the Secretary of Labor

issued pursuant to Section 204 of the executive Orders No. 11246 and No. 11375 as amended. Breach of this covenant may be regarded as a material breach of contract.

2. Contractor and Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them on their behalf, state all qualified applicants will receive consideration for employment without regard to race, religion, color, sex, handicap, national origin or ancestry.

Article 14 - Termination of the Contract

1. Add the following text to Subparagraph 14.2.1 after the end of 4.2.1.4.

   The occurrence of any labor dispute, work stoppage, strike (including sympathetic strike), slow down, picketing, or any other activity directly or indirectly attributable to Contractor's employees, either caused by them or resulting from their employment on the Project which interrupts, interferes with or delays the Work of Contractor or other separate contractors shall constitute a breach of Contract under 14.2.1.4.

2. Add a new Subparagraph 14.2.5 as follows:

   14.2.5 If termination of the Contract is effectuated by Owner for cause resulting from Contractor's failing to substantially perform in accordance with the terms of the Contract, and it is subsequently found or determined in legal proceedings that the Contractor was not in substantial breach of the Contract by failure to perform in accordance with its terms, or that such failure was caused through fault of the Owner, then such termination shall be deemed to be a termination for convenience pursuant to Paragraph 14.4, and the Contractor's remedy and recovery as against the Owner shall, in such case, be limited to the payments provided by such Subparagraph 14.4.3.

3. Delete Subparagraph 14.4.1 in its entirety and replace it with the following.

   14.4.1 The Contract may be terminated by the Owner in whole or in part without cause and for its convenience on three (3) days written notice to the Contractor.

4. Delete Subparagraph 14.4.3 in its entirety and replace it with the following.

   14.4.3 In the event of such termination for the Owner’s convenience, the Contractor shall be compensated for that portion of the contract sum earned to the date of termination, but Owner shall not be liable for any additional or other consequential damages. Such entitlement of Contractor shall constitute Contractor's sole and exclusive remedy and recovery, and in no event shall the Contractor be entitled to recover anticipated profits and overhead on unperformed Work by reason of such termination for convenience.

5. Add Paragraph 14.5 as follows:

14.5 Owner shall have the right to terminate the Contract at any time upon three (3) days' written notice to contractor in the event Owner is unable to obtain or maintain financing for the portion of the Work as yet unfinanced or uncompleted. Owner shall be obligated to pay Contractor that portion of the Contract Sum earned to the date of termination, but Owner shall not be liable for any additional or other consequential damages.

Article 15 – Claims and Disputes

1. Replace Paragraph 15.1.6.2 with the following:

15.1.6.2 The Contractor shall not be allowed an increase in Contract Time due to weather delays if the number of weather delay days is not greater than the number the US Weather Bureau reports as the average number of days per month of Inclement Weather for the nearest reporting station in the county where the Project is located. "Inclement Weather" shall be defined as rain, snow, sleet, hail, or other forms of precipitation that prohibit, halt, or otherwise inhibit the ability of the Contractor to make meaningful progress on the Project. If the Work has progressed to the point that Inclement Weather does not affect the progress of the Contractor, no increase in Contract Time shall be allowed. Historic data for all areas may be obtained from: U.S. Department of Commerce National Climatic Data Center (the "NCDC") at http://www.ncdc.noaa.gov/oa/ncdc.html. It is the Contractor's obligation to provide a copy of NCDC report with any claim filed for an increase in Contract Time for delays caused by unusual Inclement Weather not reasonably expected for the Project location and at the time of year in question. This includes current information as well as the monthly averages available at the time of bidding.

END OF SECTION

SECTION 01 10 00

SUMMARY OF WORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Contract description.

B. Contractor's use of site and premises.

C. Work sequence.

D. Owner occupancy.

E. Specification Conventions.

1.2 PROJECT SCOPE

A. The project involves the construction of a new 1-story municipal bus maintenance facility. The addition will be approximately 7,200 sf and will consist of offices, breakroom, storage, mechanical mezzanine and (2) drive-thru maintenance bays.

1.3 SUMMARY

A. This section includes a summary of the contract, including responsibilities for coordination and temporary facilities and controls.

B. Specific requirements of the contract are also indicated in individual Specification Sections and on Drawings.

C. The General Contractor shall review the Contract Documents for all scopes and familiarize themselves with the requirements and responsibilities to enable all required coordination and supervision to take place in order to unite all efforts toward the completion of the project.

D. The General Contractor shall be responsible for all rock and wet soils removal encountered during the excavation of their respective work. Refer to the Geotechnical Engineering Services Report as included in this Project Manual for information relating to the soils explorations at the site.

E. The General Contractor shall provide adequate storage for their materials stored on site. Materials storage within the construction areas shall be as directed by the Owner’s Representative and shall not impede progress of the job or Owner use of the site.

1.4 CONTRACTOR'S USE OF SITE AND PREMISES

A. Limit use of site and premises to allow:
   1. Owner Occupancy
   2. Work by Others and Work by Owner.

B. Construction Operations: Limited to areas noted on Drawings or as designated by the Owner's Representative.

C. Keep driveways and roadways not included in the scope of the Project serving the adjacent areas clean, clear, safe and available.

D. The Project shall be a smoke, alcohol, drug and weapon free work site.

E. Contractors shall coordinate activities with the Owner's ongoing activities.

1.5 OWNER OCCUPANCY

A. The Owner will occupy the premises during the entire period of construction for the conduct of normal operations. The Owner will vacate the site for construction of the new facility.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

D. During the course of this Project, normal and customary functions and operations must be maintained.

E. The Architect and Owner will not tolerate any visible or audible action initiated or responded to by any employees of Contractors on this Project toward any occupants or staff members at the facility. This includes any obnoxious behavior. Violators shall promptly be removed from the site.

F. The Owner intends to instruct occupants and staff to refrain from communications with Contractor's personnel working on this project. All communication with Owner and staff shall be through the General Contractor Superintendent or the Architect.

G. Contractors must expend their best effort toward protection of the health, safety, and welfare of occupants on the Owner's property during the course of Work on this Project.

H. Contractors and Subcontractors shall be subject to such rules and regulations for the conduct of the Work as the Owner may establish. Employees shall be properly and completely clothed while working. Bare torsos, legs, and feet will not be allowed. Possession or consumption of alcoholic beverages, drugs, or tobacco products is prohibited. Violators shall be promptly removed from the site.

1.6 SPECIFICATION CONVENTIONS

A. These specifications are written in imperative mood and streamlined form. This imperative language is directed to the Contractor, unless specifically noted otherwise. The words "shall be" are included by inference where a colon (:) is used within sentences or phrases.

1.7 COORDINATION

A. General Contractor shall be responsible for coordination between all scopes of work.

1.8 SPECIAL REQUIREMENTS

B. Contractor shall have limited use of premises for construction operations, including use of Project site, during construction periods. Contractors shall coordinate activities with the Owner's ongoing activities.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 20 00

PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Cash Allowances

B. Contingency allowances.

C. Schedule of values.

D. Applications for payment.

E. Change procedures.

1.2 CASH ALLOWANCES

A. Costs Included in Cash Allowances: Cost of product to Contractor or Subcontractor, less applicable trade discounts; delivery to site and applicable taxes.

B. Costs Not Included in Cash Allowances but Included in Contract Sum/Price: Product handling at site, including unloading, uncrating, and storage; protection of products from elements and from damage; and labor for installation and finishing.

C. Architect/Engineer Responsibilities:
   1. Consult with Contractor for consideration and selection of products.
   2. Select products in consultation with Owner and transmit decision to Contractor.
   3. Prepare Change Order.

D. Contractor Responsibilities:
   1. Assist Architect/Engineer in selection of products, suppliers and installers.
   2. Obtain proposals from suppliers and installers and offer recommendations.
   3. On notification of selection by Architect/Engineer, execute purchase agreement with designated supplier and installer.
   4. Arrange for and process shop drawings, product data, and samples. Arrange for delivery.
   5. Promptly inspect products upon delivery for completeness, damage, and defects. Submit claims for transportation damage.

E. Differences in costs will be adjusted by Change Order.

1.3 CONTINGENCY ALLOWANCES

A. Include in the Contract, a stipulated sum/price of 5% of the total construction cost for changes to the Project as directed by the Architect/Engineer and Owner.

B. Contractor's costs for products, delivery, installation, labor, insurance, payroll, taxes, bonding, equipment rental, overhead and profit will be included in Allowance Authorization Bulletin authorizing expenditure of funds from this Contingency Allowance.

C. Funds will be drawn from Contingency Allowance only by Change Allowance Bulletin issued by the Architect.

D. At closeout of Contract, funds remaining in Contingency Allowance will be credited to Owner by Change Order.

1.4 SCHEDULE OF VALUES

A. Submit printed schedule on AIA Form G703 - Continuation Sheet for G702.

B. Submit Schedule of Values in duplicate within 15 days after date of Notice to Proceed.

C. Format: Utilize Table of Contents of this Project Manual. Identify each line item with number and title of major specification section. Identify site mobilization, bonds, and insurance.

D. Include in each line item the amount of Allowances specified in this section. For unit cost Allowances, identify quantities taken from Contract Documents multiplied by unit cost to achieve total for each item.

E. Include within each line item, direct proportional amount of Contractor's overhead and profit.

F. Revise schedule to list approved Change Orders, with each Application for Payment.

1.5 APPLICATIONS FOR PAYMENT

A. Submit five copies of each application on AIA Form G702 - Application and Certificate for Payment and AIA G703 - Continuation Sheet for G702.

B. Content and Format: Utilize Schedule of Values for listing items in Application for Payment.

C. Submit updated construction schedule with each Application for Payment.

D. Payment Period: Submit at intervals stipulated in the Agreement.

E. Submit with transmittal letter as specified for Submittals in Section 01 33 00.

F. Submit waivers required by the Owner.

G. Substantiating Data: When Architect/Engineer requires substantiating information, submit data justifying dollar amounts in question. Include the following with Application for Payment:
   1. Current construction photographs.
   2. Partial release of liens from major subcontractors and vendors.
   3. Affidavits attesting to off-site stored products.
   4. Construction progress schedules, revised and current.

1.6 CHANGE PROCEDURES

A. Submittals: Submit name of individual authorized to receive change documents and be responsible for informing others in Contractor's employ or Subcontractors of changes to the Work.

B. The Architect/Engineer will advise of minor changes in the Work not involving adjustment to Contract Sum/Price or Contract Time by issuing supplemental instructions on AIA Form G710.

C. The Architect/Engineer may issue a Proposal Request including a detailed description of proposed change with supplementary or revised Drawings and specifications, a change in Contract Time for executing the change with stipulation of overtime work required and the period of time during which the requested price will be considered valid. Contractor will prepare and submit estimate within 7 days.

D. Contractor may propose changes by submitting a request for change to Architect/Engineer, describing proposed change and its full effect on the Work. Include a statement describing reason for the change, and effect on Contract Sum/Price and Contract Time with full documentation and a statement describing effect on Work by separate or other Contractors. Document requested substitutions in accordance with Section 01 60 00.

E. Stipulated Sum/Price Change Order: Based on Proposal Request and Contractor's fixed price quotation or Contractor's request for Change Order as approved by Architect/Engineer.

F. Construction Change Directive: Architect/Engineer may issue directive, on AIA Form G714 Construction Change Directive signed by Owner, instructing Contractor to proceed with change in the Work, for subsequent inclusion in a Change Order. Document will describe changes in the Work, and designate method of determining any change in Contract Sum/Price or Contract Time. Promptly execute change.

G. Time and Material Change Order: Submit itemized account and supporting data after completion of change, within time limits indicated in Conditions of the Contract. Architect/Engineer will determine change allowable in Contract Sum/Price and Contract Time as provided in Contract Documents.

H. Maintain detailed records of work done on Time and Material basis. Provide full information required for evaluation of proposed changes, and to substantiate costs for changes in the Work.

I. Document each quotation for change in cost or time with sufficient data to allow evaluation of quotation.

J. Change Order Forms: AIA G701.

K. Execution of Change Orders: Architect/Engineer will issue Change Orders for signatures of parties as provided in Conditions of the Contract.

L. Correlation of Contractor Submittals:
1. Promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as separate line item and adjust Contract Sum/Price.
2. Promptly revise progress schedules to reflect change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
3. Promptly enter changes in Project Record Documents.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 23 00
ALTERNATES

PART 1 GENERAL

1.1 SECTION INCLUDES

1.2 RELATED REQUIREMENTS

A. Document 00 43 23 - Alternates Form: List of Alternates as supplement to Bid Form.

1.3 ACCEPTANCE OF ALTERNATES

A. Alternates quoted on Bid Forms will be reviewed and accepted or rejected at Owner's option. Accepted Alternates will be identified in the Owner-Contractor Agreement.

B. Coordinate related work and modify surrounding work to integrate the Work of each Alternate.

1.4 SCHEDULE OF Alternates

A. ALT-1
   1. Description:
      a. Underside of metal roof ceiling to receive (128) acoustical ceiling panels. Acoustical ceiling panels basis of design not to exclude others:
         1) Manufacturer: Armstrong Ceilings
         2) Model: Tectum Direct-Attach, 24” x 48”
         3) Finish: White (TWH)
            a) Beveled edges, C-20 mounting; install per manufacturer’s specifications.

B. ALT-2
   1. Description:
      a. Structural main frame to be painted color P-5. Structural metal girts, purlins and secondary structural members to be painted P-3. Paint colors P-5 & P-3 basis of design not to exclude others listed below:
         1) Paint color P-5:
            a) Manufacturer: Sherwin Williams
            b) Color: Cityscape SW7067
            c) Sheen: Semi-gloss
         2) Paint color P-3:
            a) Manufacturer: Sherwin Williams
            b) Color: Ceiling Bright White SW7007
            c) Sheen: Flat

C. ALT-3
   1. Description:

a. Maintenance area to receive epoxy flooring finish. Refer to alternate maintenance are flooring finish plan on sheet IN100 for extent of epoxy flooring. Epoxy flooring finish basis of design not to exclude others:
   1) Manufacturer: Sherwin Williams
   2) Specification: Resuflor Gard SL (60 Mils) with Accelera 4850; 80/120 Mesh San / 1 Coat of 3746 Epoxy Topcoat
      a) Finish to include grit that ensure commercial slip-coefficients are met.
   3) Color: Steel Gray

D. ALT-4.1
   1. Description:
      a. Tire changer to be provided by Contractor. Tire changer basis of design not to exclude others:
         1) Manufacturer: Hunter
         2) Model: TCX635PHD

E. ALT-4.2
   1. Description:
      a. Tire balancer to be provided by Contractor. Tire balancer basis of design not to exclude others:
         1) Manufacturer: Hunter
         2) Model: HDE-32

F. ALT-4.3
   1. Description:
      a. Mig, tig and stick welder with cart and mobile fume extraction unit to be provided by Contractor. Welder and mobile fume extraction unit basis of design not to exclude others:
         1) Manufacturer: Miller
         2) Model: Mutlimatic 220 AC/CD with Cart & Filtair130 Mobile Package
            a) Specification: 120V power input

G. ALT-4.4
   1. Description:
      a. Mig, tig and stick welder to be provided by Contractor. Welder basis of design not to exclude others:
         1) Manufacturer: Miller
         2) Model: Multimatic 220 AC/CD
            a) Specification: 120V power input

H. ALT-4.5
   1. Description:
      a. Mobile column lifts to be provided by Contractor. A set of (4) column lifts is required. Column lifts must have a 18,500 lbs. lift capacity. Mobile column lifts basis of design not to exclude others:
         1) Manufacturer: Stertil Koni
         2) Model: ST1085
            a) Specification: Wireless

I. ALT-4.6
   1. Description:

a. Compressor to be provided by Contractor. Compressor must be rated for 125 psig. Compressor basis of design not to exclude others:
   1) Manufacturer: Ingersoll Rand
   2) Model: UP6-7.5STAS-125

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 25 00
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.2 RELATED REQUIREMENTS

A. Section 00 21 13 - Instructions to Bidders: Restrictions on timing of substitution requests.

B. Section 00 43 25 - Substitution Request Form - During Procurement: Required form for substitution requests made prior to award of contract (During procurement).

C. Section 00 63 25 - Substitution Request Form - During Construction: Required form for substitution requests made after award of contract (During construction).

D. Section 01 30 00 - Administrative Requirements: Submittal procedures, coordination.

1.3 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability.
      b. Regulatory changes.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
      a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to provide same or equivalent maintenance service and source of replacement parts, as applicable.

4. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
5. Waives claims for additional costs or time extension that may subsequently become apparent.
6. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.
1. Note explicitly any non-compliant characteristics.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.
1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.

D. Limit each request to a single proposed substitution item.
1. Submit an electronic document, combining the request form with supporting data into single document.

3.2 SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Submittal Time Restrictions:
1. Section 00 21 13 - Instructions to Bidders specifies time restrictions and the documents required for submitting substitution requests during the bidding period.

B. Submittal Form (before award of contract):
1. Submit substitution requests by completing the form in Section 00 43 25; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

3.3 SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):
1. Submit substitution requests by completing the form in Section 00 63 25; see this section for additional information and instructions. Use only this form; other forms of submission are unacceptable.

B. Submit request for Substitution for Cause immediately upon discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

C. Substitutions will not be considered under one or more of the following circumstances:
1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.
2. Without a separate written request.
3. When acceptance will require revisions to Contract Documents.

3.4 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.

3.5 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.6 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

END OF SECTION

SECTION 01 30 00

ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Coordination and project conditions.

B. Field engineering.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Pre-installation meetings.

G. Cutting and patching.

H. Special procedures.

1.2 COORDINATION AND PROJECT CONDITIONS

A. Coordinate scheduling, submittals, and Work of various sections of Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

B. Verify utility locations in the project area and equipment to remain. Coordinate work of various sections having interdependent responsibilities for installing or connecting to operating equipment (flashing curbs, etc.).

C. Identify routing of existing pipes and conduit and coordinate work as required.

D. Coordinate completion and clean-up of Work of separate sections in preparation for Substantial Completion.

E. After Substantial Completion, coordinate access to site for correction of defective Work and Work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.3 PRECONSTRUCTION MEETING

A. Architect/Engineer will schedule meeting after Notice of Award.

B. Attendance Required: Owner, Architect/Engineer, Contractor and Subcontractors.

C. Agenda:
1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of schedule of values and progress schedule.
5. Designation of personnel representing Owner, Architect/Engineer, and Contractor.
6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
7. Use of premises by Owner and Contractor.
8. Owner's requirements.
9. Construction facilities and controls.
10. Temporary utilities.
11. Survey and building layout.
12. Security and housekeeping procedures.
13. Schedules.
14. Application for payment procedures.
15. Procedures for testing.
16. Procedures for maintaining record documents.
17. Requirements for start-up of equipment.
18. Inspection and acceptance of equipment put into service during construction period.

D. The Architect/Engineer will record minutes and distribute copies to participants and those affected by decisions made.

1.4 PROGRESS MEETINGS

A. The Contractor will schedule and administer meetings throughout progress of the Work at maximum biweekly intervals.

B. Contractor will make arrangements for meetings, prepare agenda with copies for participants, and preside at meetings.

C. Attendance Required: Job superintendent, major subcontractors and suppliers, Owner, Architect/Engineer, as appropriate to agenda topics for each meeting.

D. Agenda:
1. Review minutes of previous meetings.
2. Progress to date.
3. Anticipated progress next 30 days.
4. Identification of problems impeding planned progress.
5. Review of submittals schedule and status of submittals.
6. Maintenance of progress schedule.
7. Corrective measures to regain projected schedules.
8. Review of Requests for Information (RFIs).

9. Review of Architect's Supplemental Instructions (ASIs).
10. Review of Proposal Requests (PRs).
11. Review of Change Orders (COs).
12. Review of Pay Applications.
13. Review of submittals schedule and status of submittals.
14. Owner discussions, concerns, and comments.
15. Architect discussions, concerns, and comments.
16. Other business relating to Work.

E. The Contractor will record minutes and distribute copies to participants and those affected by decisions made.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 CUTTING AND PATCHING

A. Employ skilled and experienced installer to perform cutting and patching.

B. Submit written request in advance of cutting or altering elements affecting:
1. Structural integrity of element.
2. Integrity of weather-exposed or moisture-resistant elements.
3. Efficiency, maintenance, or safety of element.
4. Visual qualities of sight exposed elements.
5. Work of Owner or separate contractor.

C. Execute cutting, fitting, and patching, including excavation and fill, to complete Work, and to:
1. Fit the several parts together, to integrate with other Work.
2. Uncover Work to install or correct ill-timed Work.
3. Remove and replace defective and non-conforming Work.
4. Remove samples of installed Work for testing.
5. Provide openings in elements of Work for penetrations of mechanical and electrical Work.

D. Execute work by methods to avoid damage to other Work, and to provide proper surfaces to receive patching and finishing.

E. Cut masonry and concrete materials using masonry saw or core drill.

F. Restore Work with new products in accordance with requirements of Contract Documents.

G. Fit Work tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

H. Maintain integrity of wall, ceiling, or floor construction; completely seal voids.

I. At penetrations of fire-rated walls, partitions, ceiling, or floor construction, completely seal voids with fire-rated material in accordance with Section 07840, to full thickness of penetrated element.

J. Refinish surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection; for assembly, refinish entire unit.

K. Identify hazardous substances or conditions exposed during the Work to Architect/Engineer for decision or remedy.

3.2 SPECIAL PROCEDURES

A. Materials: As specified in product sections; match existing with new products and salvaged products for patching and extending work.

B. Employ skilled and experienced installer to perform alteration work.

C. Cut, move, or remove items as necessary for access to alterations and renovation Work. Replace and restore at completion.

D. Remove unsuitable material not marked for salvage, including rotted wood, corroded metals, and deteriorated masonry and concrete. Replace materials as specified for finished Work.

E. Remove debris and abandoned items from area and from concealed spaces.

F. Prepare surface and remove surface finishes to permit installation of new work and finishes.

G. Close openings in exterior surfaces to protect existing work from weather and extremes of temperature and humidity.

H. Remove, cut, and patch Work in manner to minimize damage and to permit restoring products and finishes to original condition.

I. Refinish existing visible surfaces to remain in renovated rooms and spaces, to renewed condition for each material, with neat transition to adjacent finishes.

J. Where new Work abuts or aligns with existing, provide smooth and even transition. Patch Work to match existing adjacent Work in texture and appearance.

K. When finished surfaces are cut so that smooth transition with new Work is not possible, terminate existing surface along straight line at natural line of division and submit recommendation to Architect/Engineer for review.

L. Where change of plane of ¼ inch more occurs, submit recommendation for providing smooth transition to Architect/Engineer for review.

M. Trim existing doors to clear new floor finish. Refinish trim to original condition.

N. Patch or replace portions of existing surfaces that are damaged, lifted, discolored, or showing other imperfections.

O. Finish surfaces as specified in individual product sections.

END OF SECTION

SECTION 01 32 30

NETWORK ANALYSIS SCHEDULES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. References.

B. Quality assurance.

C. Format.

D. Milestone schedule.

E. Schedules.

F. Submittals.

G. Review and evaluation.

H. Updating schedules.

I. Distribution.

1.2 REFERENCES

A. The Use of CPM in Construction - A Manual for General Contractors and the Construction Industry, Washington, D.C., The Associated General Contractors of America (AGC).

1.3 QUALITY ASSURANCE

A. Scheduler: Contractor's personnel specializing in CPM scheduling with five years minimum experience in scheduling construction work of complexity comparable to this Project and having use of computer facilities capable of delivering detailed graphic printout within 48 hours of request.

B. Contractor's Administrative Personnel: Five years minimum experience in using and monitoring CPM schedules on comparable projects.

1.4 FORMAT

A. Listings: Reading from left to right, in ascending order for each activity. Identify each activity with applicable specification section number.

B. Diagram Sheet Size: 24 inches high x 36 inches wide.

C. Scale and Spacing: To allow for notations and revisions.

1.5 MILESTONE SCHEDULE

A. The Contractor shall comply with the following milestone schedule:

Notice to Proceed:	November 19th, 2025
Start Construction:	November 29th, 2025
Substantial Completion:	Bidder to provide anticipated number of days to complete scope of work as per specification section 00 41 13 – Bid Form – Stipulated Price

1.6 SCHEDULES

A. Prepare network analysis diagrams and supporting mathematical analyses using Critical Path Method, under concepts and methods outlined in AGC's "The Use of CPM in Construction - A Manual for General Contractors and the Construction Industry."

B. Illustrate order and interdependence of activities and sequence of work, how start of given activity depends on completion of preceding activities, and how completion of activity may restrain start of subsequent activities.

C. Illustrate complete sequence of construction by activity, identifying work of separate stages, floors, etc. Indicate dates for submittals and return of submittals; dates for procurement and delivery of critical products; and dates for installation and provision for testing. Include legend for symbols and abbreviations used.

D. Mathematical Analysis: Tabulate each activity of detailed network diagrams, using calendar dates, and identify for each activity:
   1. Preceding and following event numbers.
   2. Activity description.
   3. Estimated duration of activity, in maximum 15-day intervals.
   4. Earliest start date.
   5. Earliest finish date.
   6. Actual start date.
   7. Actual finish date.
   8. Latest start date.
   9. Latest finish date.
   10. Total and free float; accrue float time to Owner and to Owner's benefit.
   11. Monetary value of activity, keyed to Schedule of Values.
   12. Percentage of activity completed.
   13. Responsibility.

E. Analysis Program: Capable of accepting revised completion dates and re-computation of scheduled dates and float.

F. Required Sorts: List activities in sorts or groups:
   1. By preceding work item or event number from lowest to highest.

2. By longest float, then in order of early start.
3. By responsibility in order of earliest possible start date.
4. In order of latest allowable start dates.
5. In order of latest allowable finish dates.
6. Contractor's periodic payment request sorted by Schedule of Values listings.
7. Listing of basic input data generating report.
8. Listing of activities on critical path.

G. Prepare sub-schedules for each stage of Work identified in Section 01 10 00.

H. Coordinate contents with schedule of values in Section 01 20 00.

1.7 SUBMITTALS

A. Within 10 days after date established in Notice to Proceed, submit proposed preliminary network diagram defining planned operations for first 30 days of Work, with general outline for remainder of Work.

B. Participate in review of preliminary and complete network diagrams jointly with Architect/Engineer.

C. Within 20 days after joint review of proposed preliminary network diagram, submit draft of proposed complete network diagram for review. Include written certification that major Subcontractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete network analysis consisting of network diagrams and mathematical analysis.

E. Submit updated network schedules for each Progress Meeting.

1.8 REVIEW AND EVALUATION

A. Participate in joint review and evaluation of network diagrams and analysis with Architect/Engineer at each submittal.

B. Evaluate project status to determine work behind schedule and work ahead of schedule.

C. After review, revise network diagrams and analysis incorporating results of review, and resubmit within 14 days.

1.9 UPDATING SCHEDULES

A. Maintain schedules to record actual start and finish dates of completed activities.

B. Indicate progress of each activity to date of revision, with projected completion date of each activity. Update diagrams to graphically depict current status of Work.

C. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.

D. Indicate changes required to maintain Date of Substantial Completion.

E. Submit sorts required to support recommended changes.

F. Prepare narrative report to define problem areas, anticipated delays, and impact on schedule. Report corrective action taken or proposed and its effect including effects of changes on schedules of separate contractors.

1.10 DISTRIBUTION

A. Following joint review, distribute copies of updated schedules to Contractor's project site file, to Subcontractors, suppliers, Architect/Engineer, Owner, and other concerned parties.

B. Instruct recipients to promptly report, in writing, problems anticipated by projections shown in schedules.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 33 00

SUBMITTAL PROCEDURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Submittal procedures.

B. Product data.

C. Shop drawings.

D. Samples.

E. Test reports.

F. Certificates & BABAA Compliance.

G. Manufacturer's instructions.

H. Manufacturer's field reports.

I. Construction photographs.

1.2 SUBMITTAL PROCEDURES

A. Transmit each submittal with Architect/Engineer accepted form.

B. Sequentially number transmittal forms. Mark revised submittals with original number and sequential alphabetic suffix.

C. Identify Project, Contractor, subcontractor and supplier; pertinent drawing and detail number, and specification section number, appropriate to submittal.

D. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction Work, and coordination of information is in accordance with requirements of the Work and Contract Documents.

E. Schedule submittals to expedite Project and deliver to RQAW / DCCM at 8770 North Street Ste. 110, Fishers, IN 46038 (for physical samples required by individual specifications sections). Paper submittals may be submitted to zisaacs@dccm.com. Coordinate submission of related items.

F. For each submittal for review, allow 15 days excluding delivery time to and from Contractor.

G. Identify variations from Contract Documents and product or system limitations which may be detrimental to successful performance of completed Work.

H. Allow space on submittals for Contractor and Architect/Engineer review stamps.

I. When revised for resubmission, identify changes made since previous submission.

J. Distribute copies of reviewed submittals as appropriate. Instruct parties to promptly report inability to comply with requirements.

K. Submittals not requested will not be recognized or processed.

L. Revit File Drawings may be requested for submittals and there is no cost for each sheet if requested in the Architect's current software edition (Revit 2024). There will be an additional cost of $25.00 per sheet for any other editions or alternate software. Please limit the requested sheets only to those absolutely required. In addition to this, a signed "Waiver of Claims for Use of Electronic Data" for each request for electronic files is required.

1.3 PRODUCT DATA

A. Product Data: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Submit number of copies Contractor requires, plus two copies Architect/Engineer will retain.

C. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

D. Indicate product utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

E. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 70 00.

1.4 SHOP DRAWINGS

A. Shop Drawings: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Indicate special utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. After review, produce copies and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents described in Section 01 70 00.

1.5 SAMPLES

A. Samples: Submit to Architect/Engineer for review for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.

B. Samples for Selection as Specified in Product Sections:
   1. Submit to Architect/Engineer for aesthetic, color, or finish selection.
   2. Submit samples of finishes from full range of manufacturers' standard colors, or in custom colors selected, textures, and patterns for Architect/Engineer selection.

C. Submit samples to illustrate functional and aesthetic characteristics of Products, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

D. Include identification on each sample, with full Project information.

E. Submit number of samples specified in individual specification sections; Architect/Engineer will retain one sample.

F. Reviewed samples which may be used in the Work are indicated in individual specification sections.

G. Samples will not be used for testing purposes unless specifically stated in specification section.

H. After review, produce duplicates and distribute in accordance with SUBMITTAL PROCEDURES article and for record documents purposes described in Section 01 70 00.

1.6 TEST REPORTS

A. Submit for Architect/Engineer's knowledge as contract administrator or for Owner.

B. Submit test reports for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.7 CERTIFICATES & BABAA COMPLIANCE

A. When specified in individual specification sections, submit certification by manufacturer, installation/application subcontractor, or Contractor to Architect/Engineer, in quantities specified for Product Data.

B. Indicate material or product conforms to or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

C. Certificates may be recent or previous test results on material or Product but must be acceptable to Architect/Engineer.

D. Contractor shall include Manufacturer’s Certification for BABAA requirements with all applicable submittals. If a specific manufacturer is used in the bidding, a statement that the Manufacturer will comply with BABAA must be included with the bid submission. Contractor shall comply with BABAA requirements, including coordination with manufacturers, distributors, and suppliers to correct deficiencies in any BABAA documentation.

1.8 MANUFACTURER'S INSTRUCTIONS

A. When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, to Architect/Engineer for delivery to Owner in quantities specified for Product Data.

B. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.9 MANUFACTURER'S FIELD REPORTS

A. Submit reports for Architect/Engineer's benefit as contract administrator or for Owner.

B. Submit report in duplicate within 10 days of observation to Architect/Engineer for information.

C. Submit for information for limited purpose of assessing conformance with information given and design concept expressed in Contract Documents.

1.10 CONSTRUCTION PHOTOGRAPHS

A. Provide photographs of work that is anticipated to be covered up prior to the Architect/Engineer’s next visit.

B. Each month submit photographs of this type with Application for Payment.

C. Photographs may be submitted to zisaacs@dccm.com in PDF or jpeg format.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

WAIVER OF CLAIMS
FOR USE OF ELECTRONIC DATA

CONTRACT/JOB NO.: _____

PROJECT DESCRIPTION: _____

DATA BEING RELEASED: _____
DATE: _____

RQAW / DCCM, makes the above information available to you without payment/with nominal payment on condition that you agree that RQAW / DCCM has developed the information for its own use and for the use of its clients and, therefore, makes no representation, warranties or undertakings of any type concerning the accuracy or completeness of the information or its usefulness in relation to your consulting services. By receipt and use of this data transmitted herewith, you agree to and do indemnify and hold harmless RQAW / DCCM against and from any and all claims, damage, liability, and/or costs, including reasonable attorney's fees, made or asserted by you or by any third party allegedly resulting from your use or transfer to any other party of the data being provided to you herewith by RQAW / DCCM, including but not limited to any claimed inaccuracies or incompleteness of the data and regardless of whether such claims, etc., involve the alleged negligence of RQAW / DCCM in the preparation, recording, or transfer of the data.

RQAW / DCCM

BY: _____

TITLE: _____

No data are to be used unless and until an authorized representative of the recipient shall have properly executed and returned **"WAIVER OF CLAIMS FOR USE OF ELECTRONIC DATA"** form.

ACKNOWLEDGED AND ACCEPTED THIS _____ DAY OF ____, 20____.

COMPANY: _____

BY: _____

TITLE: _____

The electronic data transmitted herewith is for the use of the intended recipient. If you have intercepted or received this transmittal in error, you are not authorized to use or distribute the information contained herein by any means or for any purpose, and RQAW requests that you communicate the unintended receipt to RQAW / DCCM as soon as possible, and RQAW / DCCM will make arrangements to recover the data transmitted herewith.

SECTION 01 40 00

QUALITY REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Quality control and control of installation.

B. Tolerances.

C. References.

D. Mock-up requirements.

E. Testing and inspection services.

F. Manufacturers' field services.

G. Examination.

H. Preparation.

1.2 QUALITY CONTROL AND CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. When manufacturers' instructions conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Perform Work by persons qualified to produce required and specified quality.

F. Verify field measurements are as indicated on Shop Drawings or as instructed by manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, or disfigurement.

1.3 TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. When manufacturers' tolerances conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

1.4 REFERENCES

A. For products or workmanship specified by association, trade, or other consensus standards, comply with requirements of standard, except when more rigid requirements are specified or are required by applicable codes.

B. Conform to reference standard by date of issue current on date for receiving bids, except where specific date is established by code.

C. Obtain copies of standards where required by product specification sections.

D. When specified reference standards conflict with Contract Documents, request clarification from Architect/Engineer before proceeding.

E. Neither contractual relationships, duties, nor responsibilities of parties in Contract nor those of Architect/Engineer shall be altered from Contract Documents by mention or inference otherwise in reference documents.

1.5 MOCK-UP REQUIREMENTS

A. Tests will be performed under provisions identified in this section and identified in respective product specification sections.

B. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

C. Accepted mock-ups shall be comparison standard for remaining Work.

D. Where mock-up has been accepted by Architect/Engineer and is specified in product specification sections to be removed; remove mock-up and clear area when directed to do so by Architect/Engineer.

1.6 TESTING AND INSPECTION SERVICES

A. The Contractor shall employ and pay for services of an independent testing agency or laboratory acceptable to Owner to perform specified testing.
   1. Prior to start of Work, submit testing laboratory name, address, and telephone number, and names of full-time Registered Professional Engineer and responsible officer.

2. Submit copy of report of laboratory facilities inspection made by Materials Reference Laboratory of National Bureau of Standards during most recent inspection, with memorandum of remedies of deficiencies reported by inspection.

B. The independent firm will perform tests, inspections and other services specified in individual specification sections and as required by Architect/Engineer, Owner or Authority having jurisdiction.
1. Laboratory: Authorized to operate at Project location.
2. Laboratory Staff: Maintain full-time registered Professional Engineer on staff to review services.
3. Testing Equipment: Calibrated at reasonable intervals with devices of an accuracy traceable to National Bureau of Standards or accepted values of natural physical constants.

C. Testing, inspections, and source quality control may occur on or off project site. Perform off-site testing as required by Architect/Engineer or Owner.

D. Reports will be submitted by independent firm to Architect/Engineer and Contractor, in duplicate, indicating observations and results of tests and indicating compliance or non-compliance with Contract Documents.

E. Cooperate with independent firm; furnish samples of materials, design mix, equipment, tools, storage, safe access, and assistance by incidental labor as requested.
1. Notify Architect/Engineer and independent firm 24 hours prior to expected time for operations requiring services.
2. Make arrangements with independent firm and pay for additional samples and tests required for Contractor's use.

F. Testing and employment of testing agency or laboratory shall not relieve Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

G. Retesting or re-inspection required because of non-conformance to specified requirements shall be performed by same independent firm on instructions by Architect/Engineer. Payment for retesting or re-inspection will be charged to Contractor by deducting testing charges from Contract Sum/Price.

H. Agency Responsibilities:
1. Test samples of mixes submitted by Contractor.
2. Provide qualified personnel at site. Cooperate with Architect/Engineer and Contractor in performance of services.
3. Perform specified sampling and testing of products in accordance with specified standards.
4. Ascertain compliance of materials and mixes with requirements of Contract Documents.
5. Promptly notify Architect/Engineer and Contractor of observed irregularities or non-conformance of Work or products.
6. Perform additional tests required by Architect/Engineer.
7. Attend preconstruction meetings and progress meetings.

I. Agency Reports: After each test, promptly submit two copies of report to Architect/Engineer and to Contractor. When requested by Architect/Engineer, provide interpretation of test results. Include the following:
   1. Date issued.
   2. Project title and number.
   3. Name of inspector.
   4. Date and time of sampling or inspection.
   5. Identification of product and specifications section.
   6. Location in Project.
   7. Type of inspection or test.
   8. Date of test.
   9. Results of tests.
   10. Conformance with Contract Documents.

J. Limits on Testing Authority:
   1. Agency or laboratory may not release, revoke, alter, or enlarge on requirements of Contract Documents.
   2. Agency or laboratory may not approve or accept any portion of the Work.
   3. Agency or laboratory may not assume duties of Contractor.
   4. Agency or laboratory has no authority to stop the Work.

1.7 MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, and start-up of equipment; to test, adjust and balance equipment as applicable; and to initiate instructions when necessary.

B. Submit qualifications of observer to Architect/Engineer 30 days in advance of required observations. Observer subject to approval of Architect/Engineer and Owner.

C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

D. Refer to Section 01 33 00 - SUBMITTAL PROCEDURES, MANUFACTURERS' FIELD REPORTS article.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent Work. Beginning new Work means acceptance of existing conditions.

B. Verify existing substrate is capable of structural support or attachment of new Work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Verify utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying new material or substance in contact or bond.

END OF SECTION

SECTION 01 50 00

TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Temporary Utilities:
   1. Temporary electricity.
   2. Temporary lighting for construction purposes.
   3. Temporary heating.
   4. Temporary cooling.
   5. Temporary ventilation.
   6. Telephone service.
   7. Facsimile service.
   8. Temporary water service.
   9. Temporary sanitary facilities.

B. Construction Facilities:
   1. Field offices and sheds.
   2. Vehicular access.
   3. Parking.
   4. Progress cleaning and waste removal.
   5. Project identification.
   6. Traffic regulation.

C. Temporary Controls:
   1. Barriers.
   2. Enclosures and fencing.
   3. Security.
   4. Water control.
   5. Dust control.
   6. Erosion and sediment control.
   7. Noise control.
   8. Pest control.
   9. Pollution control.
   10. Rodent control.

D. Removal of utilities, facilities, and controls.

1.2 TEMPORARY ELECTRICITY

A. Existing service will be available for contractor use during construction.

B. Complement existing power service capacity and characteristics as required for construction operations.

C. Provide power outlets, with branch wiring and distribution boxes located as required for construction operations. Provide flexible power cords as required for portable construction tools and equipment.

D. Permanent convenience receptacles may be utilized during construction.

E. Provide distribution equipment, wiring, and outlets to provide single-phase branch circuits for power and lighting.
   1. Provide 20 ampere duplex outlets, single phase circuits for power tools for every 500 sq ft of active work area.
   2. Provide 20 ampere, single phase branch circuits for lighting.

1.3 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain incandescent lighting for construction operations to achieve minimum lighting level of 5 watt/sq ft.

B. Provide and maintain 0.50 watt/sq ft HID lighting to interior work areas after dark for security purposes.

C. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps for specified lighting levels.

D. Maintain lighting and provide routine repairs.

E. Permanent building lighting may be utilized during construction.

1.4 TEMPORARY HEATING

A. Provide and pay for heating devices and heat as needed to maintain specified conditions for construction operations.

B. Enclose building prior to activating temporary heat in accordance with Enclosures article in this section.

C. Prior to operation of permanent equipment for temporary heating purposes, verify installation is approved for operation, equipment is lubricated, and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

D. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in product sections.

1.5 TEMPORARY COOLING

A. Provide and pay for cooling devices and cooling as needed to maintain specified conditions for construction operations.

B. Enclose building prior to activating temporary cooling in accordance with Enclosures article in this section.

C. Prior to operation of permanent equipment for temporary cooling purposes, verify installation is approved for operation, equipment is lubricated, and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.6 TEMPORARY VENTILATION

A. Ventilate enclosed areas to achieve curing of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

B. Utilize existing ventilation equipment. Extend and supplement equipment with temporary fan units as required to maintain clean air for construction operations.

1.7 TEMPORARY WATER SERVICE

A. Provide and pay for suitable quality water service as needed to maintain specified conditions for construction operations.

B. Extend branch piping with outlets located so water is available by hoses with threaded connections. Provide temporary pipe insulation to prevent freezing.

1.8 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Existing facility use is not permitted. Provide facilities at time of project mobilization.

1.9 FIELD OFFICES AND SHEDS

A. Office: Contractor will be permitted to use space within the existing building as a field office.

B. Provide space for Project meetings, with table and chairs to accommodate 12 persons.

C. Construction: Portable or mobile buildings, or buildings constructed with floors raised above ground, securely fixed to foundations with steps and landings at entrance doors.
   1. Construction: Structurally sound, secure, weather tight enclosures for storage spaces. Maintain during progress of Work; remove when no longer needed.
   2. Temperature Transmission Resistance of Floors, Walls, and Ceilings: Compatible with storage requirements.
   3. Fire Extinguishers: Appropriate type fire extinguisher at each office and each storage area.
   4. Interior Materials in Storage Sheds: As required to provide specified conditions for storage of products.

D. Environmental Control:
   1. Storage Spaces: Heating and ventilation as needed to maintain products in accordance with Contract Documents; lighting for maintenance and inspection of products.

E. Storage Areas and Sheds: Size to storage requirements for products of individual Sections, allowing for access and orderly provision for maintenance and for inspection of products to requirements of Section 01 60 00.

F. Maintenance and Cleaning:
   1. Weekly janitorial services for offices; periodic cleaning and maintenance for office and storage areas.
   2. Maintain approach walks free of mud, water, and snow.

G. Removal: At completion of Work remove buildings, foundations, utility services, and debris. Restore areas.

1.10 VEHICULAR ACCESS

A. Location approved by Owner.

B. Provide unimpeded access for emergency vehicles. Maintain 20-foot-wide driveways with turning space between and around combustible materials.

C. Provide and maintain access to fire hydrants and control valves free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

1.11 PARKING

A. Locate as approved by Owner.

B. When site space is not adequate, provide additional off-site parking.

C. Use of existing parking facilities by construction personnel permitted as directed by Owner.

D. Receive approval from Owner for parking of heavy vehicles or construction equipment in parking areas.

E. Maintenance:
   1. Maintain traffic and parking areas in sound condition free of excavated material, construction equipment, products, mud, snow, and ice.
   2. Maintain existing and permanent 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.

F. Removal, Repair:
   1. Remove temporary materials and construction at Substantial Completion.

2. Remove underground work and compacted materials to depth of 2 feet; fill and grade site as specified.
3. Repair permanent facilities damaged by use, to specified condition.

G. Mud from Site Vehicles: Provide means of removing mud from vehicle wheels before entering streets.

1.12 PROGRESS CLEANING AND WASTE REMOVAL

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces prior to enclosing spaces.

C. Broom and vacuum clean interior areas prior to start of surface finishing and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and rubbish from site weekly and dispose off-site.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.13 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to allow for Owner's use of site, and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by authorities having jurisdiction for public rights-of-way and for public access to existing building, if needed.

C. Provide protection for plants designated to remain. Replace damaged plants.

D. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.14 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6-foot-high fence around exterior storage areas if required.

1.15 SECURITY

A. Security Program:
1. Protect Work existing premises and Owner's operations from theft, vandalism, and unauthorized entry.

B. Entry Control:
   1. Restrict entrance of persons and vehicles into Project site and existing facilities.
   2. Allow entrance only to authorized persons with proper identification.
   3. Maintain log of workers and visitors, make available to Owner on request.
   4. Coordinate access of Owner's personnel to site.

C. Personnel Identification:
   1. Maintain list of accredited persons, submit copy to Owner on request.

1.16 WATER CONTROL

A. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

B. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

1.17 DUST CONTROL

A. Execute Work by methods to minimize raising dust from construction operations.

B. Provide positive means to prevent air-borne dust from dispersing into atmosphere.

1.18 EROSION AND SEDIMENT CONTROL

A. Provide temporary measures including berms, dikes, and drains, and other devices to prevent water flow.

B. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.

C. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures, if applicable.

1.19 NOISE CONTROL

A. Provide methods, means, and facilities to minimize any noise produced by construction operations.

1.20 PEST CONTROL

A. Provide methods, means, and facilities to prevent pests and insects from damaging the Work or entering facility.

1.21 POLLUTION CONTROL

A. Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious or toxic substances and pollutants produced by construction operations.

B. Comply with pollution and environmental control requirements of authorities having jurisdiction.

1.22 RODENT CONTROL

A. Provide methods, means, and facilities to prevent rodents from accessing or invading premises.

1.23 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, and materials prior to Substantial Completion inspection.

B. Remove underground installations to minimum depth of 2 feet. Grade site as indicated on Drawings.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing and permanent facilities used during construction to original condition. Restore permanent facilities used during construction to specified condition.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 60 00

PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Products.

B. Product delivery requirements.

C. Product storage and handling requirements.

D. Product options.

E. Product substitution procedures.

F. Equipment electrical characteristics and components.

1.2 PRODUCTS

A. Furnish products of qualified manufacturers suitable for intended use. Furnish products of each type by single manufacturer unless specified otherwise.

B. Do not use materials and equipment removed from existing premises, except as specifically permitted by Contract Documents.

C. Furnish interchangeable components from same manufacturer for components being replaced.

1.3 PRODUCT DELIVERY REQUIREMENTS

A. Transport and handle products in accordance with manufacturer's instructions.

B. Promptly inspect shipments to ensure products comply with requirements, quantities are correct, and products are undamaged.

C. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage.

1.4 PRODUCT STORAGE AND HANDLING REQUIREMENTS

A. Store and protect products in accordance with manufacturers' instructions.

B. Store with seals and labels intact and legible.

C. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.

D. For exterior storage of fabricated products, place on sloped supports above ground.

E. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.

F. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

G. Store loose granular materials on solid flat surfaces in well-drained area. Prevent mixing with foreign matter.

H. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

I. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

1.5 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Products of one of manufacturers named and meeting specifications, no options or substitutions allowed.

1.6 PRODUCT SUBSTITUTION PROCEDURES

A. Instructions to Bidders specify time restrictions for submitting requests for Substitutions during bidding period to requirements specified in this section.

B. Substitutions may be considered when a product becomes unavailable through no fault of Contractor.

C. Document each request with complete data substantiating compliance of proposed Substitution with Contract Documents.

D. A request constitutes a representation that Contractor:
   1. Has investigated proposed product and determined that it meets or exceeds quality level of specified product.
   2. Will provide same warranty for Substitution as for specified product.
   3. Will coordinate installation and make changes to other Work which may be required for the Work to be complete with no additional cost to Owner.
   4. Waives claims for additional costs or time extension which may subsequently become apparent.
   5. Will reimburse Owner and Architect/Engineer for review or redesign services associated with re-approval by authorities having jurisdiction.

E. Substitutions will not be considered when they are indicated or implied on Shop Drawing or Product Data submittals, without separate written request, or when acceptance will require revision to Contract Documents.

F. Substitution Submittal Procedure:
1. Submit three copies of request for Substitution for consideration. Limit each request to one proposed Substitution.
2. Submit Shop Drawings, Product Data, and certified test results attesting to proposed product equivalence. Burden of proof is on proposer.
3. Architect/Engineer will notify Contractor in writing of decision to accept or reject request.

PART 2 PRODUCTS

2.1 EQUIPMENT ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Include lugs for terminal box.

B. Cord and Plug: Furnish minimum 6-foot (2 m) cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 01 70 00

EXECUTION REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Closeout procedures.

B. Final cleaning.

C. Starting of systems.

D. Demonstration and instructions.

E. Protecting installed construction.

F. Project record documents.

G. Operation and maintenance data.

H. Manual for materials and finishes.

I. Manual for equipment and systems.

J. Spare parts and maintenance products.

K. Product warranties and product bonds.

L. Maintenance service.

1.2 CLOSEOUT PROCEDURES

A. Submit written certification that Contract Documents have been reviewed, Work has been inspected, and that Work is complete in accordance with Contract Documents and ready for Architect/Engineer's review.

B. Provide submittals to Architect/Engineer required by authorities having jurisdiction.

C. Submit final Application for Payment identifying total adjusted Contract Sum, previous payments, and sum remaining due.

1.3 FINAL CLEANING

A. Execute final cleaning prior to final project assessment.

B. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

C. Clean equipment and fixtures to sanitary condition with cleaning materials appropriate to surface and material being cleaned.

D. Replace filters of operating equipment.

E. Clean debris from roofs, gutters, downspouts, and drainage systems.

F. Clean site; sweep paved areas, rake clean landscaped surfaces.

G. Remove waste and surplus materials, rubbish, and construction facilities from site.

1.4 STARTING OF SYSTEMS

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect/Engineer and Owner seven days prior to start-up of each item.

C. Verify each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions which may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by equipment or system manufacturer.

E. Verify wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable manufacturer's representative and Contractors' personnel in accordance with manufacturers' instructions.

G. When specified in individual specification sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report in accordance with Section 01 33 00 that equipment or system has been properly installed and is functioning correctly.

1.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate operation and maintenance of products to Owner's personnel two weeks prior to date of Substantial Completion.

B. Demonstrate Project equipment by manufacturer's representative who is knowledgeable about the Project.

C. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Utilize operation and maintenance manuals as basis for instruction. Review contents of manual with Owner's personnel in detail to explain all aspects of operation and maintenance.

E. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shutdown of each item of equipment at scheduled time.

F. Prepare and insert additional data in operations and maintenance manuals when need for additional data becomes apparent during instruction.

G. Required instruction time for each item of equipment and system is specified in individual sections.

1.6 PROTECTING INSTALLED CONSTRUCTION

A. Protect installed Work and provide special protection where specified in individual specification sections.

B. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

C. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

D. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

E. Prohibit traffic or storage upon waterproofed or roofed surfaces. When traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

F. Prohibit traffic from landscaped areas.

1.7 PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:
   1. Drawings.
   2. Specifications.
   3. Addenda.
   4. Change Orders and other modifications to the Contract.
   5. Reviewed Shop Drawings, Product Data, and Samples.
   6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress, not less than weekly.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
   1. Manufacturer's name and product model and number.
   2. Product substitutions or alternates utilized.
   3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
   1. Measured depths of foundations in relation to finish first floor datum.
   2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
   3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
   4. Field changes of dimension and detail.
   5. Details not on original Contract drawings.

G. Submit documents to Architect/Engineer.

1.8 OPERATION AND MAINTENANCE DATA

A. Submit data bound in 8-1/2 x 11 inch) text pages, three D side ring binders with durable plastic covers.

B. Prepare binder cover with printed title "OPERATION AND MAINTENANCE INSTRUCTIONS", title of project, and subject matter of binder when multiple binders are required.

C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.

D. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

E. Contents: Prepare Table of Contents for each volume, with each product or system description identified, typed on white paper, in three parts as follows:
   1. Part 1: Directory listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers.
   2. Part 2: Operation and maintenance instructions arranged by system and subdivided by specification section. For each category, identify names, addresses, and telephone numbers of Subcontractors and suppliers. Identify the following:
      a. Significant design criteria.
      b. List of equipment.
      c. Parts list for each component.
      d. Operating instructions.
      e. Maintenance instructions for equipment and systems.

f. Maintenance instructions for finishes, including recommended cleaning methods and materials, and special precautions identifying detrimental agents.

3. Part 3: Project documents and certificates, including the following:
   a. Shop drawings and product data.
   b. Air and water balance reports.
   c. Certificates.
   d. Originals of warranties and bonds.

1.9 MANUAL FOR MATERIALS AND FINISHES

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy to be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form within 10 days after final inspection.

E. Building Products, Applied Materials, and Finishes: Include product data, with catalog number, size, composition, and color and texture designations. Include information for re-ordering custom-manufactured products.

F. Instructions for Care and Maintenance: Include manufacturer's recommendations for cleaning agents and methods, precautions against detrimental agents and methods, and recommended schedule for cleaning and maintenance.

G. Moisture Protection and Weather Exposed Products: Include product data listing applicable reference standards, chemical composition, and details of installation. Include recommendations for inspections, maintenance, and repair.

H. Additional Requirements: As specified in individual product specification sections.

I. Include listing in Table of Contents for design data, with tabbed fly sheet and space for insertion of data.

1.10 MANUAL FOR EQUIPMENT AND SYSTEMS

A. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect/Engineer will review draft and return one copy with comments.

B. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit documents within ten days after acceptance.

C. Submit one copy of completed volumes 15 days prior to final inspection. Draft copy to be reviewed and returned after final inspection, with Architect/Engineer comments. Revise content of document sets as required prior to final submission.

D. Submit two sets of revised final volumes in final form within 10 days after final inspection.

E. Each Item of Equipment and Each System: Include description of unit or system, and component parts. Identify function, normal operating characteristics, and limiting conditions. Include performance curves, with engineering data and tests, and complete nomenclature and model number of replaceable parts.

F. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

G. Include color coded wiring diagrams as installed.

H. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and special operating instructions.

I. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

J. Include servicing and lubrication schedule, and list of lubricants required.

K. Include manufacturer's printed operation and maintenance instructions.

L. Include sequence of operation by controls manufacturer.

M. Include original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

N. Include control diagrams by controls manufacturer as installed.

O. Include Contractor's coordination drawings, with color coded piping diagrams as installed.

P. Include charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

Q. Include list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.

R. Include test and balancing reports as specified in Section 01 40 00.

S. Additional Requirements: As specified in individual product specification sections.

T. Include listing in Table of Contents for design data, with tabbed dividers and space for insertion of data.

1.11 SPARE PARTS AND MAINTENANCE PRODUCTS

A. Furnish spare parts, maintenance, and extra products in quantities specified in individual specification sections.

B. Deliver to Project site and place in location as directed by Owner; obtain receipt prior to final payment.

1.12 PRODUCT WARRANTIES AND PRODUCT BONDS

A. Obtain warranties and bonds executed in duplicate by responsible subcontractors, suppliers, and manufacturers, within ten days after completion of applicable item of work.

B. Execute and assemble transferable warranty documents and bonds from subcontractors, suppliers, and manufacturers.

C. Verify documents are in proper form, contain full information, and are notarized.

D. Co-execute submittals when required.

E. Include Table of Contents and assemble in three D side ring binder with durable plastic cover.

F. Submit prior to final Application for Payment.

G. Time of Submittals:
1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within ten days after acceptance.
2. Make other submittals within ten days after Date of Substantial Completion, prior to final Application for Payment.
3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within ten days after acceptance, listing date of acceptance as beginning of warranty or bond period.

1.13 MAINTENANCE SERVICE

A. Furnish service and maintenance of components indicated in specification sections.

B. Examine system components at frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

C. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by manufacturer of original component.

D. Do not assign or transfer maintenance service to agent or Subcontractor without prior written consent of Owner.

PART 2 PRODUCTS

Not Used.

PART 3 EXECUTION

Not Used.

END OF SECTION

SECTION 02 01 00
MAINTENANCE OF EXISTING CONDITIONS

PART I - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Protection of existing buildings, facilities, utilities and site improvements to remain.
2. Verification of existing utilities, site improvements and site conditions.

B. Related Sections:

1. Division 00 Section “Geotechnical Data”.
2. Division 02 Section “Selective Site Demolition”.

1.2 SUBMITTALS

A. Shop Drawings: submit drawings showing details of any proposed construction which is necessary to protect existing construction and utilities.

B. Engineering Design:

1. If required by job conditions, Contractor shall retain the services of a licensed Professional Engineer registered in the state in which the project is located to design temporary and permanent installations as required to protect existing improvements and conditions.
2. All information required for the design shall be the Contractor’s responsibility to obtain.
3. Submit design drawings and calculations to the Architect/Engineer for review. Review by the Architect/Engineer shall not relieve Contractor of full responsibility for design or work. The purpose of the Architect/Engineer review shall be only to protect the Owner from inadequate or insufficient protection for existing improvements and conditions. By reviewing the design, the Architect/Engineer assumes no responsibility for the design or adequacy thereof.
4. Underpinning calculations, if required, shall be reviewed by the Geotechnical Engineer.
5. All design drawings and calculations submitted shall be signed and sealed by the Contractor’s Engineer.

1.3 PROJECT CONDITIONS

A. Existing Site Conditions:

1. The Drawings do not propose to show all existing improvements on the site.
2. Information shown on the Drawings was obtained from drawings of previous construction projects and/or a site survey provided by the Owner.

3. Recorded information concerning existing construction is available for examination in the Architect/Engineer office.
4. Existing structures:

    a. Bottom of existing footing elevations are unknown.
    b. Loads on existing footings and foundations are unknown.
    c. Dimensions of existing foundations are unknown.

5. Information regarding existing subsurface conditions is unconfirmed. See Division 00 Section “Geotechnical Data” for available information regarding Geotechnical Data and soils information.
6. Information concerning the approximate locations of known existing underground utilities is shown on the Drawings. Depths and locations of existing utilities are unconfirmed.
7. Utilities include all underground and above ground piping, conduits, cables and related structures and appurtenances. Utilities also include sewers.

B. Contractor is responsible for verifying all existing site conditions.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Contractor may use materials and systems recognized as suitable for protection of existing improvements and conditions.
2. Untreated wood may only be used for temporary protection, bracing, supports, shores, etc.
3. The Owner or Architect/Engineer may prohibit certain materials and systems if they interfere with the Owner’s operations.

PART 3 - EXECUTION

3.1 PREPARATION

A. Pre-Bid Site Inspection:

1. Bidders shall examine the site, inspect existing buildings, review existing plans and become familiar with all conditions under which the contract work will be performed.
2. This shall be completed during the bidding phase in order that bids include all costs for protection of existing improvements and conditions.
3. Contractor shall notify the Architect/Engineer during the bidding phase of any discrepancies in bidding documents, existing conditions documents and field conditions.
4. No later claim for extra compensation will be allowed, unless it is determined by the Owner and Architect/Engineer to be unforeseen conditions.

B. Pre-Construction Verification of Existing Conditions:

1. Contractor shall verify all existing site conditions and improvements prior to construction, which include field verifying locations of existing utilities and all other existing above grade and below grade improvements which may affect proposed construction activities.
2. Contractor shall notify the Architect/Engineer immediately with conflicts or discrepancies from existing field conditions, existing conditions documentation and proposed new construction.
3. These verifications are to be done well in advance of construction activities in order to allow time for revising design if required.

3.2 GENERAL

A. Contractor shall have underground utilities marked prior to beginning any excavation or other underground work around proposed activity.

B. Provide all permanent and temporary construction necessary to protect existing improvements and conditions as required by construction activities.

C. Install all protection in a manner which will not interfere with the Owner's operations or adjacent work.

D. If at any time movement or other failure is observed in existing improvements or conditions, cease operations, provide all additional protection necessary to stabilize and retain said existing installations and notify Owner immediately.

3.3 JOB COMPLETION

A. Upon completion of construction activities, leave the site in a neat and orderly condition.

B. Restore all areas disrupted by construction activities, which were to remain and not be altered, to their original condition at no additional cost to Owner.

SECTION 02 41 00
DEMOLITION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Selective demolition of built site elements.

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 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

D. Section 02 65 00 - Underground Storage Tank Removal.

1.3 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

1.4 QUALITY ASSURANCE

A. Demolition Firm Qualifications: Company specializing in the type of work required.
   1. Minimum of 3 years of documented experience.

PART 3 EXECUTION

2.1 SCOPE

A. Remove paving and curbs as required to accomplish new work.

B. Remove all above ground tanks and associated slabs, conduit, piping, control equipment and structural elements..

C. Fill excavations, open pits, and holes in ground areas generated as result of removals, using specified fill; compact fill as specified in Section 31 22 00.

2.2 GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
   1. Obtain required permits.
   2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.
   3. Provide, erect, and maintain temporary barriers and security devices.
   4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
   5. Do not close or obstruct roadways or sidewalks without permit.
   6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.
   7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.
   1. Provide bracing and shoring.
   2. Prevent movement or settlement of adjacent structures.
   3. Stop work immediately if adjacent structures appear to be in danger.

D. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

E. Underground Storage Tanks: Remove and dispose of as specified in Section 02 65 00.

2.3 EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

D. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

E. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

F. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

2.4 DEBRIS AND WASTE REMOVAL

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.

SECTION 02 41 13
SELECTIVE SITE DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Demolition of existing site improvements made obsolete by this project, as indicated or implied by the contract documents.
2. Removal of demolition items and debris from site.
3. Protection of items to remain.
4. Abandonment of items indicated in contract documents.
5. Removal, storage and protection of items to be salvaged.
6. The removal of asbestos or lead containing products is not included in this scope of work. If such materials are discovered during demolition, notify the Owner immediately.

B. Related Sections:

1. Division 31 Section “Site Clearing”.

1.2 REQUIREMENTS

A. General:

1. Proper access and function of existing facility operations must be maintained at all times.
2. Demolition activities shall not interfere with or interrupt the operations of the facility, employees or the public.
3. A complete and operable utility system must be maintained at all times.
4. Sufficient parking and site access must be maintained at all times.
5. The route for construction traffic and the removal of debris shall be limited to specific areas. See Drawings for further information.
6. Contractor is solely responsible for providing all permanent and temporary means to ensure site access, utility services and other required conditions are maintained at all times.

B. Miscellaneous:

1. On-site burning is not permitted.
2. Blasting or any other use of explosives is not permitted.
3. Use of heavy vibratory or other similar means that cause excessive nuisance to the public or compromise safety of existing facilities is not permitted.
4. Comply with NFPA 241 (latest edition).

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete: If required, shall comply with Division 32 Section “Site Concrete”.

B. Flowable Fill: If required, shall comply with Division 31 Section “Flowable Fill”.

C. All other materials not specifically described but required for proper completion of the work shall be selected by the Contractor subject to approval of the Architect/Engineer and Owner.

PART 3 - EXECUTION

3.1 PREPARATION

A. Refer to Division 02 Section “Maintenance of Existing Conditions” for verification and maintenance of existing site conditions.

B. Coordination:

1. Contact Owner prior to site mobilization to discuss and verify site access and routing requirements. Prepare a schedule if requested by Owner.
2. Before commencing the work of this Section, verify with the Architect/Engineer and Owner all items to be removed, all items to remain and all items to be salvaged.

3.2 GENERAL

A. Protection:

1. Demolition shall be done in such a manner to protect adjacent materials.
2. Use all necessary and appropriate means to prevent the spread of dust during demolition.
3. Protect employees and public from dust, noise, light, vibration, odor and all other types of nuisances and hazards.
4. Protect all existing items to remain. If such items are damaged, they shall be repaired or replaced by the Contractor to the Owner’s satisfaction at no additional cost to Owner.
5. Items to be demolished as indicated in contract documents or made obsolete by field conditions shall be removed and disposed of off the project site. Abandoning such items in place shall not be permitted unless specifically indicated in the contract documents or approved by Architect/Engineer and Owner.
6. Avoid overloading of existing structures by either a build-up of demolished items or by impact loading of demolished items on the existing structure.
7. Bracing and shoring and other similar and appropriate means shall be used where necessary to avoid collapse or other compromising of structures or materials.

B. Demolition:

1. Items indicated in contract documents to be demolished shall be removed, demounted or disconnected in the best possible manner to ensure that no damage will result to other adjacent items or surfaces to remain.

2. Abandoning demolished items in place is not permitted unless specifically indicated in the contract documents or approved by Architect/Engineer and Owner.
3. For items indicated or approved as being abandoned in place, the means of abandonment shall be reviewed and approved by the Architect/Engineer and Owner prior to abandonment.
4. Phase demolition as described in the contract documents, as required per field conditions and per Owner's request.

C. Salvage:

1. Protect items to be salvaged during removal, handling and storage.
2. All reusable items salvaged during demolition operations shall be retained for the Owner's inspection. Only items so inspected and rejected by the Owner shall be disposed. All other such items shall be turned over to the Owner.

D. Cleaning:

1. Areas in which demolition and salvage work are being done shall be cleaned daily.
2. All dirt, dust, debris, unsalvageable and non-reusable items and similar items shall be removed from the project site daily.
3. Under no circumstances shall such refuse be allowed to collect for longer periods.
4. Refuse shall not be allowed to block or otherwise impair circulation in corridors, stairs, sidewalks or other traffic areas at any time.

E. Disposal:

1. Except for items or materials indicated to be reused, salvaged, reinstalled or otherwise indicated to remain Owner's property, remove demolished materials from Project site and legally dispose of them at an EPA-approved landfill.

3.3 JOB COMPLETION

A. At the completion of demolition activities, ensure all demolition debris is removed from site. Restore adjacent areas to original condition and repair any damaged items to Owner's satisfaction at no additional cost to Owner.

SECTION 03 10 00

CONCRETE FORMWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish, install, and remove all formwork for all cast-in-place concrete as shown or implied on the Contract Documents.
2. Design of formwork, shoring and reshoring.

B. Related Sections:

1. Division 03 Section: Concrete Reinforcement
2. Division 03 Section: Cast-in-Place Concrete
3. Division 03 Section: Composite Metal Decking

1.2 QUALITY ASSURANCE

A. Qualifications of Workmen:

1. Provide at least one person who shall be present at all times during execution of this portion of the Work.
2. This workman shall be thoroughly familiar with the type of materials being installed, the referenced standards, and the requirements of this work.
3. This workman shall direct all work performed under this Section.

B. Codes and Standards:

1. In addition to complying with all pertinent codes and regulations, comply with all pertinent recommendations and maintain tolerances contained in "Recommended Practice for Concrete Formwork," publication ACI 347-Latest Edition of the American Concrete Institute.
2. Where provisions of pertinent codes and standards conflict with the requirements of this Section of the Project Manual, the more stringent provisions shall govern.
3. Tolerance limits per ACI 117-Latest Edition.

    a. Form concrete and set screeds or bulkheads so maximum variation in slab elevation in any bay does not exceed 1/2 inch.

C. Design:

1. Design of formwork, shoring and reshoring by a Professional Engineer of the State where the project is located.

1.3 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect formwork materials before, during, and after installation and to protect the installed work and materials of all other trades.
2. Special precautions, as required to protect permanent steel forms and formwork for exposed concrete, shall be utilized after erection.

PART 2 - PRODUCTS

2.1 FORM MATERIALS

A. Form Lumber:

1. All form lumber in contact with exposed concrete shall be new or of sufficient quality to insure an unblemished texture.
2. All form lumber shall be one of the following or a combination thereof.

a. Plywood, board lumber, hardwood, or other material of grade or quality to best suit each particular usage.

B. Steel Forms:

1. Steel is an acceptable material for formwork.
2. Steel forms shall be "like new" producing a clean, smooth, unblemished texture for concrete exposed in the finished structure. Do not use damaged forms

C. Corrugated Steel Permanent Form:

1. Where shown on the Contract Drawings, provide and install galvanized 26 gauge corrugated steel forms.

a. Nominal depth: 1”.
b. Minimum section modulus: 0.075 inch-cubed per 1 foot width.
c. Minimum tensile strength: 80,000 p.s.i.
d. Standard: “Bowman Construction Products” “Strong form SF-2”.

2. This permanent steel form acts only as form, unlike the products defined in Division 05 Section: Composite Metal Decking, which also provide positive moment reinforcement.

D. Fiber Forms:

1. Fiber forms may be utilized to construct round columns/piers.
2. Seamless forms shall be used for concrete exposed in the finished structure.
3. Standard seamed tubes are permissible for non-exposed concrete.

E. Form Release Agent: Provide non-staining and non-emulsifiable form release agent.

1. Standards:

    a. Release agent shall be similar to Magic Kote by Symons Corporation.
    b. Acceptable manufacturer: BASF Construction Chemicals, Sonneborn

F. Bracing/Shoring/Studs:

1. Such supports shall be selected for economy consistent with safety requirements and the quality required in the finished work. The Contractor is responsible for the design, illustration, safety, and serviceability of all formwork.

2.2 TIES/SPREADERS/ACCESSORIES

A. Type:

1. All form ties shall be a type which does not leave an open hole through the concrete and which permits neat and solid patching at every hole.
2. Spreaders shall be commercially manufactured devices compatible with the system.

B. Design:

1. When forms are removed, ties remaining within the concrete shall be not less than 1" from the surface.
2. Utilize ties with removable plastic cones where concrete will be exposed in the finished structure.

C. Wire Ties and Wood Spreaders:

1. Do not use wire ties and wood spreaders.

D. Other Materials:

1. All other materials not specifically described but required for proper completion of concrete formwork, shall be as selected by the Contractor subject to advance acceptance by the Architect/Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to all work of this Section, carefully inspect the installed work of all trades and verify that all such work is complete to the point where form installation may properly commence.
2. Review the Contract Documents, including Addenda and Post Bid Revisions, as applicable, to determine all Contract requirements/details.
3. Verify that forms may be constructed in accordance with all pertinent codes and regulations, the referenced standards, and the original design.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Architect/Engineer.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 CONSTRUCTION OF FORMS

A. General:

1. Construct all required forms to be substantial, sufficiently tight to prevent leakage of mortar.
2. The design and engineering of the formwork shall be the responsibility of the Contractor.
3. Formwork shall be designed for wet concrete and construction loads, lateral pressures, wind loads, and all other loads anticipated during construction.
4. Provide shoring and bracing as required to prevent undue deflection or bulging of concrete.
5. Provide removable sections at the base of forms, where required, to permit removal of debris, water, etc., from the formwork for walls and deep beams.

B. Layout:

1. Form for all required cast-in-place concrete to the shapes, sizes, lines and dimensions indicated on the drawings.
2. Exercise particular care in the layout of forms to ensure the proper finish structure size and shape.
3. Make proper provision for all openings, offsets, recesses, anchorage, blocking, and other features of the Work as shown or required.
4. Carefully examine the Contract Documents and consult with other trades as required to insure proper provisions for openings, reglets, chases, and other items in the forms.
5. Camber forms as required to allow for form deflections, slippage, and settlement of shores during concrete placement.

C. Embedded Items:

1. Set all required steel frames, angles, grilles, bolts, reglets, inserts, pipe, conduit, and other such items required to be anchored in the concrete before the concrete is placed.

D. Bracing and Shoring:

1. Properly brace and tie the forms together so as to maintain position and shape and to ensure safety to personnel.
2. Construct all bracing, supporting members, and centering of ample size and strength to safely carry, without excessive deflection, all dead and live loads to which they may be subjected.
3. Properly space the forms apart and securely tie them together, using metal spreader ties that give positive tying and accurate spreading.
4. All shoring shall extend to adequate foundations.
5. Shores supporting successive stories shall be placed directly over those below or be so designed and placed to prevent overload on the structure below.

6. The Contractor is responsible for both the proper design and installation of all bracing and shoring, to properly insure the safety and serviceability of the structure.

E. Tolerances:

1. Construct all forms straight, true, plumb, and square within the tolerances recommended by ACI 347.
2. Formed surfaces shall be Class A.

a. Abrupt irregularities in formed surfaces exposed to view in final construction shall not exceed 1/8 inch.

3. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

a. Level Alignment: Variance in elevation of top of slab in any structural bay shall not exceed 1/2 inch.

F. Wetting:

1. Keep forms sufficiently wetted to prevent joints opening up before concrete is placed, except as recommended in ACI 306 R-78, "Recommended Practice for Cold Weather Concreting."

G. Construction Joints:

1. Refer to Division 03 Section: Cast-In-Place-Concrete of this Project Manual.

3.3 PLYWOOD FORMS

A. Assembly:

1. Nail the plywood panels directly to studs and apply in a manner to minimize the number of joints.

B. Joints:

1. Make all panel joints tight butt joints with all edges true and square.

3.4 FOOTING FORMS

A. Side Forms:

1. All footing sides shall be formed unless otherwise specifically authorized by the Architect/Engineer.

3.5 REUSE OF FORMS

A. Requirements:

1. Reuse of forms shall in no way delay or change the schedule for placement of concrete from the schedule obtainable if all forms were new.
2. Reuse of forms shall in no way impart less structural stability to the forms, nor less acceptable appearance to finished concrete.

3.6 CLEAN-UP

A. General:

1. Before concrete is placed the forms shall be cleaned of all debris, ice, snow, frost, and standing water.
2. Remove all loose earth materials from the surfaces of earth forms.

3.7 REMOVAL OF FORMS

A. General:

1. Forms shall be removed in such manner to insure complete safety of the structure.
2. Formwork for columns, walls, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations with the following minimums:

    a. Formwork for walls and columns shall remain in place a minimum of two (2) days during which the temperature of the air surrounding the concrete must be above 50°F.
    b. This minimum time period represents a cumulative number of days or fractions thereof.
    c. Such formwork for concrete placed during cold weather with surrounding air temperatures below 50°F shall remain in place one day after the artificial heating and/or freeze protection is discontinued/ removed.

3. Forms and falsework supporting any vertical loads shall remain in place until the members have acquired sufficient strength to safely support their weight and any superimposed loads. Such forming shall remain in place until the concrete has attained its specified 28 day strength as indicated by the test cylinders unless reshores are installed in sufficient quantities to transmit the loads to adequate foundations without over stressing the partially cured structure. The requirements of ACI 305 and 306 must also be met before forms may be removed.
4. Forms for load bearing superstructure concrete shall never be removed earlier than seven (7) days after the concrete is placed.
5. Removal of forms and falsework is the responsibility of the Contractor, and the Contractor shall bear the full responsibility for this operation.
6. Concrete damaged by too early removal of forms or falsework shall be repaired or replaced as directed by the Architect/Engineer.
7. Concrete exposed by form removal during the curing period shall be cured by one of the methods specified in Division 03 Section: Cast-In-Place-Concrete.
8. Note that curing compound is not permitted in certain locations. In these cases, curing is to be by an alternate method. See Cast-in-Place Concrete specification for alternate methods.

9. In no case shall the superimposed load on relatively new concrete exceed 50 pounds per square foot unless proper shoring to suitable foundations is installed as required by the Architect/Engineer.
10. Methods and quantities of reshores shall be subject to the review/acceptance of the Architect/Engineer, but the responsibility for their adequacy shall remain with the Contractor.
11. Reshores shall extend to and bear on suitable foundation in all cases unless the Contractor submits calculations showing the acceptable dispersal of loads with reshores to lower floors that have attained their 28-day strength and the calculations are reviewed and accepted by the Architect/Engineer.

B. Removal

1. Use all means necessary to protect workmen, passers-by, the installed work and materials of other trades, and the complete safety of the structure.
2. Cut nails and similar fasteners off flush and leave all surfaces smooth and clean.
3. Remove metal spreader ties on exposed concrete by removing or snapping off inside the wall surface and pointing up and rubbing the resulting pockets to match the surrounding areas.

END OF SECTION 03 10 00

SECTION 03 20 00

CONCRETE REINFORCEMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish and install all bar supports, inserts, anchor bolts, welded wire fabric, reinforcing bars and all other items to be embedded in the cast-in-place concrete, not specifically indicated to be by others, as shown or implied on the Contract Documents.

B. Related Sections:

1. Division 03 Section: Concrete Formwork
2. Division 03 Section: Cast-in-Place Concrete
3. Division 03 Section: Epoxy Grout

1.2 QUALITY ASSURANCE

A. Qualifications of Workmen:

1. Provide at least one person who shall be present at all times during execution of this portion of the work.
2. This workman shall be thoroughly familiar with the type of materials being installed and the best methods for their installation.
3. This workman shall direct all work performed under this Section.

B. Codes and Standards:

1. In addition to complying with all pertinent codes and regulations, comply with all pertinent recommendations contained in ACI 315 – Manual of Standard Practice for Detailing Reinforced Concrete Structures and ACI 318 - Building Code Requirements for Reinforced Concrete
2. Where provisions of pertinent codes and standards conflict with this Section of the Project Manual, the more stringent provisions shall govern.

1.3 SUBMITTALS

A. Shop Drawings:

1. Submit shop drawings to the Architect/Engineer defining details of concrete reinforcement in accordance with Division 01 Section "Submittal" of this Project Manual.
2. Reinforcing for concrete walls shall be shown on scale elevations of the walls.

3. The Contractor may release shop drawings for fabrication at his discretion; however, the Contractor shall bear all financial responsibility for changes to the shop drawings up to the time they are marked "Furnish as Submitted." Actual field installation shall only be made with shop drawings marked "Furnish as Submitted."
4. Where hooks are indicated on the Contract Drawings, provide standard hooks unless otherwise noted.
5. All accessories necessary for support of reinforcing steel shall be shown in plan. Do not schedule accessories.

B. Certifications:

1. Submit a certification that all material used is in accordance with the requirements of this Section.

1.4 PRODUCT HANDLING

A. Protection:

1. Use all means necessary to protect concrete reinforcement before, during, and after installation and to protect the installed work and materials of all other trades.
2. Store in a manner to prevent excessive rusting and fouling with dirt, grease, and other bond-breaking coatings.

B. Replacements:

1. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the Owner.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Reinforcing Bars and Dowels:

1. Conform to ASTM A615, Grade 60.
2. Reinforcing that is to be welded shall conform to ASTM A615, Grade 40.
3. Epoxy coated bars (required only where noted) shall meet the requirements of ASTM A884.
4. Galvanized bars (required only where noted) shall meet the requirements of ASTM A767.

B. Welded Wire Fabric:

1. Conform to ASTM A185, 6 x 6 x W 2.1x W 2.1, or as indicated on the drawings. Welded wire fabric shall be furnished in the flat sheet form in lieu of roll form.
2. Epoxy coated welded wire fabric (required only where noted) shall meet the requirements of ASTM A884.

C. Other Embedded Items:

1. Provide standard manufactured products as approved by the Architect/Engineer.

D. Bar Supports:

1. Conform to the requirements of the "Manual of Standard Practice," published by the Concrete Reinforcing Steel Institute.
2. Accessories shall be plastic protected Class "C" for all concrete exposed in the finished structure, except as specified below.
3. Accessories shall be Class "A," bright basic, for unexposed concrete.
4. Utilize Class "E," stainless steel bar supports, for exterior concrete to be finished by sand blasting.
5. Do not use continuous high chairs. Use individual high chairs laced with bottom cross bars plus #5 support bars. (Minimum of 2 rows of supports for all reinforcing.)
6. Supports must be capable of supporting construction loads without failing. Contractor to furnish additional supports at no cost to the Owner if in the Architect/Engineer's estimation the supports are not adequate.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to installation of the work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that concrete reinforcement may be installed in strict accordance with all pertinent codes and regulations and original design.

B. Discrepancies:

1. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 PREPARATION

A. General:

1. Remove all dirt, oil, paint, loose rust, and other foreign materials from the concrete reinforcement prior to replacement.

3.3 PLACING

A. Reinforcing Bars:

1. Place reinforcing steel accurately in conformance with shop drawings stamped "Furnish as Submitted" by the Architect/Engineer.

2. Positively secure reinforcing to bar supports and tie or otherwise anchor bars to prevent displacement by construction loads or by the placing of concrete.
3. Splice bars with a minimum lap of 40 bar diameters, unless otherwise indicated. Use mechanical splicers/couplers where quantity of reinforcement restricts placement of concrete if lapped splices are utilized. Install mechanical splice as recommended by manufacturer.
4. Splice bars only at locations indicated on the Contract Documents and shop drawings.
5. Both shop and field bending shall be accomplished without heating the bars.
6. Minor placing adjustments can be made to avoid interference with other reinforcement and/or embedded devices. The final arrangement, however, is subject to review and acceptance of the Architect/Engineer.
7. Immediately notify the Architect/Engineer if reinforcing cannot be installed as detailed on the "Furnish as Submitted" shop drawings. No cutting of reinforcing should occur unless the Architect/Engineer has reviewed and allowed such cuts.

B. Embedded Devices:

1. Set hangers, anchor bolts, inserts, and other embedded devices accurately in place.
2. Make sure all such devices are installed so that work to be attached thereto will be properly received.
3. Keep devices straight and true-to-line.

C. Welded Wire Fabric:

1. Splice the welded wire fabric by lapping each section at least two meshes wide plus one wire with the adjacent section, but not less than 8".
2. Extend fabric into all openings, doorways, and the like, unless otherwise indicated.
3. Reinforce all equipment pads with 6 x 6 x W2.1x W2.1 welded wire fabric unless otherwise indicated.
4. Support the welded wire fabric over metal deck in floor or roof slabs with continuous slab bolster – upper (with continuous bars at the top and bottom) spaced at 2’-6” o.c. maximum.
5. Support the welded wire fabric in slab-on-grade, with #4 continuous bars spaced at 2’-6” o.c. (maximum in one direction) and supported on concrete brick spaced at 2’-6” o.c.

3.4 CLEANING REINFORCING

A. Final Cleaning:

1. Prior to casting concrete, all loose mill and rust scale, oil, mud, ice, and other foreign coatings which destroy and/or reduce bond between the reinforcement and concrete shall be removed.
2. Wire brushing and/or other suitable methods shall be used to complete cleaning operations.

3.5 INSPECTION

A. Scheduling:

1. Notify the Architect/Engineer 24 hours in advance that forms and reinforcing are in place and are ready for inspection. Keep Architect/Engineer informed of the basic schedule so that he can anticipate inspection times in advance of the required 24-hour notice. Canceled pours are subject to additional inspection charges by the Architect/Engineer against the Contractor where the Architect/Engineer representative is already in route to the site at the time the concrete pour is canceled. Inspection costs shall be based upon the hourly rate of the Architect/Engineer representative plus travel expenses.
2. Do not cast concrete until the Architect/Engineer has observed and accepted the installation.
3. Premature notification of the Architect/Engineer to inspect the reinforcement of forms shall be subject to additional inspection charges by the Architect/Engineer as described above.

END OF SECTION 03 20 00

SECTION 03 30 00

CAST-IN-PLACE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete as shown or implied by the Contract Documents.
2. Coordinate installation of vapor retarder, specified in Division 07.
3. Concrete fill in metal stair pans.
4. Concrete requirements for housekeeping pads and inertial isolation slabs.

B. Related Sections:

1. Division 03 Section: Concrete Formwork
2. Division 03 Section: Concrete Reinforcement
3. Division 03 Section: Grouting
4. Division 05 Section: Composite Metal Decking
5. Division 05 Section: Metal Stairs
6. Division 09 Flooring sections, for finishing and testing requirements for finished flooring.
7. Divisions 21, 22, and 23 for housekeeping pads and inertial isolation slabs
8. Division 26 - Electrical, for housekeeping pads
9. Division 32 Section: Site Concrete, for exterior walls and slabs-on-grade

1.2 REFERENCES

A. American Concrete Institute (ACI):

1. 116R – Cement and Concrete Terminology
2. 117 – Standard Specifications for Tolerances for Concrete Construction and Materials
3. 211.1 – Standard Practice For Selecting Proportions For Normal, Heavy Weight, And Mass Concrete
4. 211.2 – Standard Practice For Selecting Proportions For Structural Lightweight Concrete
5. 214 – Recommended Practice For Evaluation Of Strength Test Results Of Concrete
6. 301 – Specifications for Structural Concrete
7. 304R – Guide for Measuring, Mixing, Transporting, and Placing Concrete
8. 305 R – Recommended Practice For Hot Weather Concreting
9. 306 R – Recommended Practice For Cold Weather Concreting
10. 318 – Building Code Requirements For Reinforced Concrete

B. ASTM International (ASTM):

1. C 33 – Standard Specification for Concrete Aggregates
2. C 94 – Standard Specification for Ready-Mixed Concrete

3. C 143 – Standard Test Method for Slump of Hydraulic Cement Concrete
4. C 150 – Standard Specification for Portland Cement
5. C 260 – Standard Specification for Air-Entraining Admixtures for Concrete
6. C 309 – Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
7. C 330 – Standard Specification for Lightweight Aggregates for Structural Concrete
8. C 494 – Standard Specification for Chemical Admixtures for Concrete
9. C 618 – Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use as a Mineral Admixture in Concrete
10. D 6 – Standard Test Method for Loss on Heating of Oil and Asphaltic Compounds
11. D 297 – Standard Test Methods for Rubber Products-Chemical Analysis
12. D 994 – Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type)
13. D 1752 – Standard Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction
14. E 1155 – Standard Test Method for Determining F_F Floor Flatness and F_L Floor Levelness Numbers

1.3 SUBMITTALS

A. Product Data: Submit manufacturers literature for each type of product furnished.

B. Shop Drawings:

1. Provide layout drawings for coordination of floor slab pours. Indicate locations of expansion joints, construction joints, and control joints.

C. Quality Assurance Submittals:

1. Concrete Mix: Submit proposed concrete mix designs for each strength, slump, and combination of admixtures required for the Project.
2. Test Reports:

a. Submit chloride ion tests or total chloride tests (with generally accepted method to relate total chloride to chloride ion) to show compliance with maximum ion concentrations.

1) Tests may be from another job, utilizing the same proportions of aggregates, cements, and admixtures.

b. Submit slump, air-entrainment, compressive strength, and flatness and levelness test reports to the Architect/Engineer.

1.4 QUALITY ASSURANCE

A. Codes and Standards:

1. In addition to complying with all pertinent codes and regulations, comply with all pertinent requirements of the following American Concrete Institute Publications:

a. ACI 117 – Standard Specifications for Tolerances for Concrete Construction and Materials
b. ACI 211.1 – Standard Practice For Selecting Proportions For Normal, Heavy Weight, And Mass Concrete
c. ACI 211.2 – Standard Practice For Selecting Proportions For Structural Lightweight Concrete
d. ACI 214 – Recommended Practice For Evaluation Of Strength Test Results Of Concrete
e. ACI 305 R – Recommended Practice For Hot Weather Concreting
f. ACI 306 R – Recommended Practice For Cold Weather Concreting
g. ACI 318 – Building Code Requirements For Reinforced Concrete

2. Where provisions of pertinent codes and standards conflict with this section of the Project Manual, the more stringent provisions shall govern.

B. Qualification for Testing:

1. The following field-testing procedures shall be performed only by personnel holding current certificates issued by ACI for Concrete Field Testing Technician - Grade I as required by the local code.

a. Sampling of fresh concrete
b. Testing fresh concrete for slump
c. Testing fresh concrete for entrained air
d. Making concrete specimens for compression tests

2. Flatness and levelness testing: Floor flatness and levelness testing shall be performed by a technician trained in the use of the testing equipment and the procedures of ASTM E 1155.

C. Preinstallation Conference: Conduct conference at Project site to comply with requirements in Division 01 Section: Project Management and Coordination. Review methods and procedures related to concrete Work, including, but not limited to, the following:

1. Review and finalize construction schedule and verify availability of materials, Installer's personnel, equipment, and facilities needed to make progress and avoid delays.
2. Review requirements for concrete tolerances, finishing, and curing methods, prior to commencing concrete work

a. Include floor covering installers, to review specific tolerance and finish requirements.

1.5 PROJECT CONDITIONS

A. Environment Conditions:

1. Extreme temperature conditions:

a. When extreme hot or cold weather conditions occur, or are expected to occur, which might detrimentally affect concrete, employ handling and placing techniques to guard against such effects.

1) Comply with the ACI nomograph.

b. Comply with the recommendations of American Concrete Institute publications ACI 305 R and ACI 306 R, for hot and cold weather concreting.

2. Inclement weather:

a. Unless adequate protection is provided, do not place exterior concrete during rain, sleet, or snow.
b. Do not use calcium chloride or admixtures containing soluble chlorides.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Cement: ASTM C 150, Type I or III

B. Fine Aggregate: ASTM C 33 with fineness modules, 2.40 to 3.00. For pumped concrete, 15 to 30% passing number 50 sieve and 5 to 10% passing a number 100 sieve.

C. Coarse Aggregate:

1. ASTM C 33 with maximum size:

a. Three-fourths of minimum clear spacing between reinforcing bars or between bars and forms

2. Provide crushed stone for sidewalks, curbs, and exterior slabs/stairs
3. Pea gravel shall not be used as an aggregate for any part of the elevated structure or the foundation system. Pea gravel may be acceptable for miscellaneous structural items as approved by the Architect/Engineer.

D. Lightweight Aggregate: ASTM C 330
1. Nominal maximum size: ¾”
2. Pre-soak aggregate prior to mixing in accordance with aggregate supplier recommendations

E. Water: Clean, fresh, potable

F. Air-Entraining Admixture: ASTM C 260

G. Concrete shall not exceed maximum chloride ion content for corrosion protection as defined in ACI 318.

H. Fly Ash: ASTM C 618, Class C or F

1. Fly ash shall not replace more than 20% of the cement.

I. Curing and Sealing Compounds:

1. Products: Furnish one of the following curing or curing and sealing compounds for each application listed:

a. Interior concrete slabs to receive floor coverings or other applied material: ASTM C 309, Type 1D, Class B; water based, all resin, dissipating, VOC compliant, clear with fugitive dye.

1) The Euclid Chemical Company; Kurez DR VOX
2) Dayton Superior Corporation; Day-Chem Rez Cure (J-11-W)
3) Laticrete International, Inc.; L&M Cure R
4) W.R. Meadows; 1100-CLEAR

b. Interior concrete slabs, finish scheduled as sealed concrete, or formed concrete requiring use of a curing compound: ASTM C 309, Type 1, Class B; water based, all resin, VOC compliant, clear.

1) Dayton Superior Corporation; Safe Cure & Seal 309 J18
2) The Euclid Chemical Company; Aqua-Cure VOX
3) Laticrete International, Inc.; Dress & Seal WB
4) W.R. Meadows; VOCOMP-20
5) BASF Corporation Building Systems; Kure-N-Seal W

c. Interior concrete slabs, finish scheduled as hardener/sealer or hardened sealed concrete: Clear, chemically reactive, waterborne solution of inorganic silicate or siliconate materials and proprietary components; odorless; colorless; that penetrates, hardens, and densifies concrete surfaces.

1) Conspec by Dayton Superior; Intraseal
2) Curecrete Distribution Inc.; Ashford Formula
3) Dayton Superior Corporation; Sure Hard Densifier J17
4) The Euclid Chemical Company; Euco Diamond Hard
5) Laticrete International, Inc.; Seal Hard
6) W.R. Meadows; Liqui-Hard

d. Product used shall be compatible with waterproofing if forms are stripped from concrete to receive waterproofing prior to 7 days curing above 50°F.
e. Refer to Part 3 Article “Curing” for removal of curing compounds.

2. If curing compound is not used, and the forms are stripped prior to 7 days curing, the following methods are approved:

a. Ponding or continuous sprinkling
b. Continuously wet mats
c. Sand kept continuously wet

J. Expansion Strips:

1. Self-expanding cork: ASTM D 1752, Type III, preformed, self-expanding strips formed of cork particles with a non-bitumen, isolable resin binder for all interior and exterior slabs at building vertical faces, or as noted.
2. Asphaltic board expansion joint: ASTM D 994, preformed joint material. Material shall not deform under normal handling, or become brittle. Use in exterior slabs, except at building vertical faces or as noted.
3. Closed-cell poly as denoted on the drawings.

K. Waterstops:

1. 20 OZ. Copper formed to shapes shown on the drawings.
2. PVC flat ribbed waterstops:

    a. Manufacturers:

        1) Vinylex Waterstop & Accessories
        2) Sika Greenstreak

    b. Shapes and sizes to be reviewed by the Architect/Engineer.

3. PVC dumbbell waterstops:

    a. Manufacturers:

        1) Vinylex Waterstop & Accessories
        2) Sika Greenstreak

    b. Shapes and sizes to be reviewed by the Architect/Engineer.

4. Self-Expanding Butyl Strip Waterstops: Manufactured rectangular strip, butyl rubber with sodium bentonite or other hydrophilic polymers, for adhesive bonding to concrete, 3/4 by 1 inch (19 by 25 mm).

    a. Products: Subject to compliance with requirements, provide one of the following:
        1) Carlisle Coatings & Waterproofing; MiraStop
        2) CETCO; Volclay Waterstop-RX
        3) Concrete Sealants Inc.; Conseal CS-231
        4) Sika Corporation; Swellstop
        5) Henry Company; HF302 Hydro-Flex
        6) JP Specialties, Inc.; Earth Shield Type 20 or 23

5. Additional types, shapes, and sizes to fit the job conditions, with review by Architect/Engineer.

    a. Standard: Vinylex Waterstop & Accessories

L. Joint Sealant:

1. Flatwork: Two-part polysulfide compound

    a. Standard: The Euclid Chemical Company; Tammsflex NS/Tammsflex SL

2. Vertical joints: Two-part polysulfide compound

    a. Standard: W.R. Meadows

3. Vertical joints: Two-part polyurethane, refer to Division 07 Section: Sealants.

M. Water Reducing Admixtures:

1. Normal set: ASTM C 494, Type A
2. Retarders: ASTM C 494, Type D
3. Accelerators: ASTM C 494, Type C or E
4. High range water reducers: ASTM C 494, Type F

N. Crystalline Waterproofing Admixture: Waterproofing admixture that reacts with concrete to form dendritic crystalline structures in concrete pores and cracks.
1. Acceptable products:
    a. Kryton International, Inc.; Krystol Internal Membrane (KIM)
    b. Xypex Chemical Corporation; Xypex Admix
2. Provide in concrete where “integral crystalline waterproofing” or “integral waterproofing” is indicated.

O. Evaporation Retardant:

1. Standard: BASF Corporation; MasterKure ER 50
2. Apply per manufacturer's directions.

P. Vapor Retarders:

1. Refer to Division 07 Section: Vapor Retarders, or use the information within this section if there is no Specification section which pertains to vapor retarders.

2. Plastic Vapor Barrier: ASTM E 1745, Class A with a permeance of 0.01 as tested before and after mandatory conditioning (ASTM E 1745 Section 7.1 and sub paragraph 7.1.1-7.1.5) less than 0.01 perms (grains/(ft^2 hr in Hg). Include manufacturer’s recommended adhesive or pressure sensitive tape.
    a. Products:
        1) Fortifiber Corporation; Moistop Ultra 15.
        2) Reef Industries; Griffolyn G 15.
        3) Stego Industries, Stego Wrap 15.

Q. Bond Break:

1. 15 pound per square (100 sq.ft.) building paper

R. Bonding Agent:

1. Select bonding agent to suite the job condition and application.
2. Products:

    a. Conpro Chemicals Private Limited; Conpro SB-4
    b. The Euclid Chemical Company; SBR Latex

c. Laticrete International, Inc.; Everbond

3. Apply per manufacturer recommendations.
4. Finished concrete surface shall be roughened and cleaned, prior to application of the bonding agent.

2.2 MIX DESIGNS

A. Normal Weight Concrete:
1. Compressive strength: 4000 psi
2. Minimum cement content: 517 pounds per cubic yard (adjust for air entrainment)
3. Water/cement ratio: 0.45 maximum (typical), 0.40 for concrete exposed to de-icing salts, brackish water or salt spray. No water to be added to concrete after plant batching.
4. Slump: 4” + 1”, adjust with addition of admixture(s) for pumping.
5. Typical for all slabs, walls, beams, columns and footings unless noted otherwise.

B. Air-Entrainment:

1. Provide air entrainment at:

a. All concrete that is to be exposed to the elements (weather) in the completed structure.
b. All concrete in contact with salts.

2. All other concrete may be air-entrained or non-air-entrained, at the Contractor's option.

a. Hard-troweled finishes shall not have air-entrainment.

3. Percentage of air content shall be determined in accordance with the admixture manufacturer's recommendations, to meet ASTM C173 or ASTM C231, based on aggregate size and a moderate level of exposure.

C. Selection of Concrete Proportions:

1. Proportions of materials for concrete shall be established in accordance with Section 5.2 of ACI 318.

2. Follow ACI 211 and ACI 301 to determine the water-cement ratio for lightweight concrete.

3. Concrete Mixing:
a. Plant mix concrete materials in same proportions as approved concrete mix design in accordance with ACI 304.
1) Incorporate admixtures in quantities and using methods recommended by admixture manufacturers.
2) Incorporate only admixtures included in the approved mix design, or with approval by Architect/Engineer.
b. Do not add water to batched concrete without approval by Architect/Engineer.

D. High Slump Concrete:

1. Slumps greater than those specified may be used (up to 10") under the following conditions:

    a. Prior approval has been obtained from the Architect/Engineer, including location of pours and proposed mixes.
    b. Admixture systems or high range water reducers are used to achieve the high slumps.
    c. Water/cement ratios are compatible with normal mixes.
    d. Compressive strength of the concrete exceeds normal mixes at specified slumps.
    e. If high range water reducers are used, the admixture is added by a concrete technician employed by the concrete supplier.

2. Submit mix designs to Architect/Engineer for review.
3. This review is made to ensure that portions of the mix meet the specifications. All performance related criteria must still be met.

PART 3 - EXECUTION

3.1 SITE VERIFICATION OF CONDITIONS

A. Inspection:

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that all items to be embedded in concrete are in place.
3. Verify that concrete may be placed to the lines and elevations indicated on the Drawings, with all required clearance from reinforcement.

B. Discrepancies:

1. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 PREPARATION

A. Remove all wood scraps, ice, snow, frost, standing water, and debris from the area in which concrete will be placed.

B. Thoroughly wet the surface of excavations (except in freezing weather), coat forms with release agent, and remove all standing water.

C. Thoroughly clean all transporting and handling equipment.

D. All concrete slabs on grade to be placed on a granular fill. Depth of fill to equal the slab thickness unless otherwise noted.

E. Substrate over which the vapor barrier will be placed shall be compacted, smooth, and free of glass, large stones, and other objects that might puncture the barrier.

3.3 CONCRETE MIXING

A. Plant mix concrete materials in same proportions as approved concrete mix design and in accordance with ACI 304.

1. Incorporate admixtures in quantities and using methods recommended by admixture manufacturers.
2. Incorporate only admixtures included in the approved mix design, or with approval by Architect/Engineer.

B. Do not add water to batched concrete without approval by Architect/Engineer.

3.4 PLACING CONCRETE

A. Method:

1. Convey concrete from mixer to place of final deposit by methods that will prevent separation and loss of materials.
2. For chuting, pumping, and pneumatically conveying concrete, use only equipment of such size and design as to ensure a practically continuous flow of concrete at the delivery end without loss or separation of materials.
3. Deposit concrete as nearly as possible in its final position to avoid segregation due to re-handling and flowing.
4. Contractor shall use screed poles or similar devices to ensure that all slabs are cast at the proper elevations and that specified tolerances are maintained.
5. Deflections of supporting structure are to be anticipated to produce a level slab.

B. Rate of Placement:

1. Place concrete at such a rate that concrete is at all times plastic and flows readily between reinforcement.
2. When placing is once started, carry it on as a continuous operation until placement of the panel or section is complete.
3. Do not pour a greater area at one time than can be properly finished; this is particularly important during hot or dry weather.

C. Compaction:

1. Thoroughly consolidate all concrete by suitable means during placement, working it around all embedded fixtures and into corners of forms.
2. During placement, thoroughly compact the concrete by hand tamping and by mechanical vibration.

D. Acceptability:

1. Do not use retempered concrete or concrete that has been contaminated by foreign materials.

E. Limits of Pour:

1. Contractor to submit concrete placement drawings showing all the proposed construction joints for the prior approval of the Architect/Engineer.

2. Minimum time period between adjacent pours shall be 24 hours.

3.5 LEVELING AND FINISHING

A. General: Finish concrete in accordance with ACI 301.

B. Finishing Exposed Walls:

1. Remove fins and fill tie holes, honeycombs and air holes (bug holes).
2. Provide a rubbed finish on all interior exposed concrete walls.
3. Provide a smooth rubbed finish on all exposed exterior concrete walls, including site walls.
4. Finishing methods:

a. Rubbed finish:

1) Not later than one day after form removal, rub with carborundum brick or another abrasive to remove fins, ridges and other surface irregularities.

b. Smooth rubbed finish:

1) Not later than one day after form removal, moisten concrete surfaces and rub with carborundum brick or another abrasive until producing a uniform color and texture. Do not apply cement grout other than that created by the rubbing process.

C. Finishing Slabs, Flatwork, Walk, Stairs:

1. Trowel all interior slabs to a smooth, hard finish unless otherwise indicated.

a. Provide a non-slip finish in all areas subject to public traffic.

2. Surfaces to receive a light broom finish:

a. Exterior slabs, walks, stairs
b. Interior floors to receive a dry set mortar installation of ceramic tile, tile, or pavers.
c. Interior stair treads not scheduled to receive floor covering

3. Where floor drains or floor slopes are indicated, slope slabs uniformly to provide even fall for drainage.

D. Tolerances:

1. Place concrete so members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

    a. Level Alignment: Variance in elevation of top of slab in any typical structural bay shall not exceed 1/2 inch.
    b. Structural Steel and composite metal deck structures: Concrete shall be placed in a manner that produces a slab that will meet the specified flatness and levelness tolerances prior to application of any superimposed loads.

2. Floor slabs: Finish floor slabs to meet the following flatness and levelness test requirements.
3. Definitions:

    a. Test surface: The entire floor area on any one building level.
    b. Test Section: Any subdivision of the test surface measuring no less than 8 feet on a side and no less than 320 square feet.

4. Test Sections less than 8 feet on a side or less than 320 square feet or at slab boundaries, block-outs or other discontinuities excluded by ASTM E 1155: Finish and measure surface so gap at any point between concrete surface and an unleveled freestanding 10-foot- (3.05-m-) long straightedge, resting on two high spots and placed anywhere on the surface, does not exceed 1/4 inch.

    a. Finish interior slab surfaces to the following tolerances, measured with a Type II apparatus within 24 hours according to ASTM E 1155/E 1155M for a randomly trafficked floor surface. Submit report to the Architect/Engineer within 72 hours of concrete placement.

        1) Specified overall values of flatness, F_F 30; and levelness, F_L 20; with minimum local values of flatness, F_F 24; and levelness, F_L 15.

        2) Note that floor levelness value need only be measured at slabs on grade and elevated floor slabs that are shored.

3.6 JOINTS

A. Expansion Joints:

1. Provide where indicated on the Contract Documents.
2. Install expansion strips full depth of joints.
3. Where caulking of joints is indicated on Drawings, install fillers to 1/2 inch of top and pour full with sealant.

    a. Standard: See "Joint Sealant for Flatwork," this section.

4. Provide self-expanding cork at all intersections of exterior concrete and vertical surfaces. Caulk top 1/2 inch of joint.
5. Where asphalt expansion joints are not sealed hold top of asphalt 1/4 inch below abutting concrete. Tool joints on both sides of expansion joint.

B. Tooled Joints:

1. Provide standard tooled joints where indicated on the Contract Documents.
2. Make joints straight, clean, and unragged.
3. Tool concrete on both sides of asphalt pavement.

C. Construction Joints:

1. Joints shall be made with properly constructed bulkheads and include formed keyways.
2. Reinforcing shall extend through all construction joints unless otherwise noted on the Contract Documents.
3. The Contractor shall consult with the Architect/Engineer before starting concrete work to establish a satisfactory placing schedule and to determine the location of construction joints so as to minimize the effects on the floor systems.
4. Horizontal construction joints, other than where shown on the Contract Documents, will not be permitted.
5. Vertical construction joints shall be located between quarter and third points of the spans. Submit construction joint layout for A/E review and approval.

D. Control Joints:

1. Control joints shall be provided in all slabs on grade unless waived by the Architect/Engineer. Elevated slabs shall not have control joints unless specifically detailed. Joints may not be required under carpet and sheet vinyl floor finishes.
2. Locate as shown on drawings or along column lines and at intervals not exceeding 20 feet in each direction. Review location with A/E prior to pouring slabs.
3. Control joints shall be 1/4 of the slab thickness and shall be sealed in accordance with "Joint Sealant" this section. Saw cut joints within 12 hours of placing the slab.

E. Bond Break:
1. Install where indicated, Lap seams a minimum of 4 inches.

F. Waterstops:

1. Install where indicated.

2. Install near center of concrete pour, unless otherwise indicated on the drawings.

3. Provide 3 inches minimum concrete cover for all bentonite waterstops unless otherwise indicated on the drawings or approved by the Architect/Engineer.

3.7 CURING

A. Formed Surfaces:

1. Cure formed surfaces by either of the following methods:

a. Refer to Division 03 Section: Concrete Formwork for minimum time periods that formwork must remain in place even when curing compound is used.

b. Leave forms in place until the cumulative number of days or fractions thereof, not necessarily consecutive, has totaled seven days during which the temperature of the air in contact with the concrete is 50°F or above.
c. Remove forms at an earlier time, but apply curing compound to concrete surfaces.
d. Apply compound in accordance with manufacturer's recommendations.
e. Do not add curing/sealing compound to walls that receive waterproofing unless a letter has been submitted to the Architect/Engineer, prior to the compound's use, that the specific compounds are compatible with their system.

B. Troweled Finish:

1. As soon as surface has dried sufficiently to not be marred by the application, apply sealer/curing compound in accordance with manufacturer's recommendations.
2. Do not add curing/sealing compound to walls that receive waterproofing unless a letter has been submitted to Architect/Engineer, prior to the compound's use, that the specific compounds are compatible with their system.
3. After application, keep all traffic, tools, materials, and equipment off such treated areas for at least twenty-four hours.
4. For floors scheduled as sealed concrete, after all other work in the area has been completed, apply a second coat of sealer/curing compound.

C. Wet Cure:

1. Concrete not covered with curing compound should be kept wet for at least 7 days.
2. Keep forms continuously wet to prevent the moisture loss until forms are removed.

D. Curing Compound Removal:

1. Remove residual curing compound from floor slabs to receive applied finishes using methods recommended by the manufacturer of the curing compound.
2. Remove curing compound no earlier than 28 days after application or after structure is enclosed and protected from exterior water sources.
3. Wet mop or rinse and wet vacuum slab to remove traces of cleaning products.

E. Hardener/Sealer:

1. Apply to wet-cured concrete in accordance with manufacturer’s instructions.

3.8 PATCHING AND REPAIR

A. Inspection/Remedial Work:

1. Immediately after forms and curing membranes have been removed, inspect all concrete surfaces and patch all pour joints, voids, rock pockets, form tie holds, and other imperfections before the concrete is thoroughly dry.

B. Patching and Minor Repairs:

1. At all permanently exposed portion of interior concrete formed surfaces, repair surface defects including color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface.

    a. 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.

        1) Make edges of cuts perpendicular to concrete surface.

    b. Clean, dampen with water, and brush-coat holes and voids with bonding agent.
    c. Fill and compact with patching mortar before bonding agent has dried.
    d. 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 Portland cement and standard Portland cement so that, when dry, patching mortar will match surrounding color.

    a. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching.
    b. Compact mortar in place and strike off slightly higher than surrounding surface.

3. Repair defects on concealed formed surfaces that affect concrete durability and structural performance as determined by Architect/Engineer.
4. Remove all fins, offsets and projections by dry-stoning surfaces which will be exposed in the finished structure or will receive waterproofing or other barrier coating or membrane.

    a. Provide additional patching of foundation wall for application of waterproofing membrane, in accordance with the manufacturer's recommendations.

5. Remove or fill all ridges, trowel marks, protrusions or pits more than 1/8-inch diameter on floor slabs by dry-stoning, grinding, or filling with trowelable cementitious underlayment.

C. Patching of Existing Concrete:

1. Patch in manner to receive new finishes so that existing and patched surfaces are smooth and continuous and have a uniform appearance, using methods specified for patching and repair.

D. Major Defective Areas:

1. If the defects are serious or affect the strength of the structure, or if patching does not satisfactorily restore the quality and appearance of the surface, the Architect/Engineer may require the concrete to be removed and replaced complete in accordance with the provisions of this Section, all at no additional cost to the Owner.
2. Floor slabs that do not meet tolerances specified shall be remediated by the Contractor to the elevation, flatness, or levelness specified at no additional cost to the Owner.

a. Contractor shall use floor-leveling materials acceptable to the manufacturer of floor finishes scheduled for the area to be remediated.

3.9 TESTS

A. Testing Laboratory:

1. The **Contractor** shall engage the testing agency to conduct the testing for compliance with the requirements of the Project Manual.

B. Compression Tests:

1. Secure minimum five standard cylinders from each pour of concrete, additional five sets of cylinders for every 50 cubic yards of concrete placement of the day, in accordance with ASTM C31, and cure under standard moisture and temperature conditions.
2. From each batch test in accordance with ASTM C39.
3. Test two cylinders at 7 days and two cylinders at 28 days, and save one for additional test, if needed.
4. Submit duplicate tests reports of results from testing to Architect/Engineer.
5. Take steps immediately to evaluate unsatisfactory test results. Test the fifth cylinder.
6. In the event of unsatisfactory test results, an investigation as outlined in Section 5.6.4 of ACI 318-Latest Edition shall be employed.

C. Slump/Air-Entrainment:

1. Perform slump tests in accordance with ASTM C 143.
2. Determine the air content of air-entrained concrete in accordance with ASTM standards.
3. Report results of slump tests on each compression test report, and report whether the concrete represented by the compression tests is air-entrained or non air-entrained.

D. Floor Profile:

1. Test floor profile in accordance with ASTM E 1155 within 24 hours of floor placement, before shoring is removed.
2. Submit test results to Architect/Engineer within 72 hours of concrete placement.

E. Retesting:

1. Should additional testing be required because of unsatisfactory tests results, the Contractor shall bear the costs incurred for correcting any deficiencies and the costs of any tests.

END OF SECTION 03 30 00

SECTION 03 60 00

EPOXY GROUT

PART I - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish labor and materials to install epoxy grout as shown or implied by the Contract Documents.
2. Furnish labor and materials necessary to grout anchor bolts and reinforcing bars into existing concrete and to patch existing concrete at equipment anchorages.
3. Furnish labor and materials to patch and repair existing concrete.
4. Furnish labor and materials to repair new construction as required by field errors or omissions.

B. Related Sections:

1. Division 03 Section: Concrete Formwork.
2. Division 03 Section: Concrete Reinforcement.
3. Division 03 Section: Grout.
4. Division 05 Section: Structural Steel.

1.2 QUALITY ASSURANCE

A. Codes and Standards:

1. Repairing concrete with epoxy grout and epoxy mortars shall conform to all requirements of "Standard Specification for Repairing Concrete with Epoxy Mortars (ACI 503.4-Latest Edition)," publishing by the American Concrete Institute, Detroit Michigan, except as modified by the requirements of this project specification.

1.3 SUBMITTALS

A. Before any of the materials of this Section are delivered to the job site, submit product literature to the Architect/ Engineer in accordance with Division 01 Section “Submittal Procedures” of these Specifications.

PART 2 - PRODUCTS

2.1 MANUFACTURER

A. Reference Standard: Provide products manufactured by the following:

1. Sika Corporation.

2.2 PRODUCTS

A. Epoxy Grout for Grouting Anchor Bolts or Concrete Patching Mortar (when mixed with recommended aggregate):

1. For overhead installations:

a. Sikadur 35, Hi-Mod LV; Sika Corp.
b. Sonneborn Epofil; Degussa Building Systems

2. For non-overhead installations:

a. Sikadur 31 Hi-Mod Gel; Sika Corp.

3. Standard for patching, filling holes in concrete slabs:

a. Sikatop 122; Sika Corporation
b. Master Builders R-310; Degussa Building Systems

4. Due to the large number of different applications and field conditions, additional products may be required by the Architect/Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Surface Preparation:

1. Surfaces of existing concrete shall be dry and structurally sound prior to grouting.
2. The surfaces of concrete at the perimeter of openings, which will be in contact with the grout fill, shall be cleaned. Remove dirt, oil, grease, and other foreign matter.
3. Apply cleaning agent, lacquer thinner by means which will not allow spillage and dripping on existing facilities below.
4. Existing steel reinforcing shall be cleaned by wire brush or by sand blasting, or needle gun, with all loose or damaged material removed.

3.2 INSTALLATION

A. Preparation:

1. Form to lines and elevations indicated or required such that adequate anchorage and bearing is provided.

B. Application:

1. Apply grout in accordance with the manufacturer's recommendations. Thoroughly pack forms to minimize shrinkage.
2. Rodding may be required to eliminate voids, honeycombing, and similar defects. Consult manufacturer.
3. Finished installation shall be tight, neat, smooth, and flush with adjoining surfaces and shall be thoroughly bonded thereto.
4. Loose, spalled, cracked, or otherwise defective material will be rejected.
5. Application by trowel is acceptable when forming is impractical or impossible.
6. Notify engineer of proposed method of installation prior to commencement of work.
7. When repairing existing concrete, restore original concrete size and shape with new material.
8. Avoid feathered edges by undercutting edges at sides of patches.
9. Notify engineer of any crack suspected of being a "working joint" prior to patching.

C. Curing:

1. Protect and cure grout in accordance with the manufacturer's recommendations.

END OF SECTION 03 60 00

SECTION 03 62 00

NON-SHRINK GROUTING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Furnish and install all grout as indicated or implied by the Contract Documents.

B. Related Sections:

1. Section 03 30 00 – Cast-in-Place Concrete
2. Section 05 12 00 – Structural Steel Framing
3. Section 05 50 00 – Metal Fabrications

1.2 DELIVERY AND STORAGE

A. Prevent damage to or contamination of non-shrink grouting materials during delivery, handling, and storage.

B. Store all non-shrink grouting materials in undamaged condition with package labels and seals intact.

1.3 SUBMITTALS

A. Product Literature:

1. Submit sufficient data regarding installation methods and compression strength.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Metallic Non-Shrink Non-Catalyzed Mortar: ASTM C1107 .

1. Standard: Embeco 636 grout; Master Builders.
2. General use: precision grouting of equipment, structure, or building systems.
3. All grout subject to fatigue.

B. Non-Metallic Non-Shrink Cementitious Grout: ASTM C1107.

1. Standard: Masterflow 713 Grout; Master Builders.

2. General use: Precision grouting of equipment, structure, or building systems.

3. If grout is subject to fatigue, use metallic grout.

C. Latex Modified Concrete: ASTM C1059.

1. Standard: Latex.

a. Acrylic Additive; Sonneborn Division of ChemRex.

2. Standard: Concrete

a. Per Cast-in-Place Concrete section of this Specification.

3. General use: Patching large holes and areas.
4. Submit mix design.

D. Pre-mixed Repair Mortar or Gel:

1. Vertical and horizontal surfaces:

a. Sikatop 122; Sika Corp.
2. Overhead surfaces:
a. Sikatop 123; Sika Corp.
3. General use: Fill large cracks and reform lines of beams, columns, or walls in areas too small to form.

E. Portland Cement:

1. ASTM C33, fine aggregate.

F. Sand:

1. ASTM C33, fine aggregate.

G. Water:

1. Potable.

2.2 MIXES

A. Description:

1. Follow manufacturer's recommendations for grout mixing.
2. Use minimum amount of water necessary to produce a flowable grout without causing either segregation or bleeding.
3. Portland cement mortar for raked-out edges of non-shrink grout:

a. One (1) part Portland cement, two (2) parts sand, 0.50 parts water by weight.

2.3 MIXING

A. Procedures:

1. Mix non-shrink grout materials in water in a mechanical mixer for no less than 5 minutes.
2. Do not retemper grout or add more water for any reason.

PART 3 - EXECUTION

3.1 INSTALLATIONS

A. Description:

1. Thoroughly clean all surfaces with which grout will be in contact free from dirt, grease, rust, and other deleterious substances. Form to lines and elevations indicated or required such that adequate bearing for structural elements is provided.
2. Apply non-shrink grout immediately after mixing. Thoroughly pack forms to minimize shrinkage. Rodding is required to eliminate all voids, honeycombing and similar defects. Cure grout as recommended by manufacturer. Finished installation shall be tight, neat, smooth, and flush with adjoining surfaces and shall be thoroughly bonded thereto. Loose, spalled, cracked, or otherwise defective material will be rejected.

3.2 SURFACE PREPARATION

A. Description:

1. Remove all defective concrete, laitance, dirt, oil, grease, and other foreign material from concrete surfaces. Clean all steel surfaces.
2. Lightly roughen concrete surfaces.
3. Align, level, and maintain final positioning of all components.
4. Take special precautions during extreme weather conditions according to manufacturer's written instructions.
5. Saturate all concrete surfaces with clean water, remove excess water. Leave no standing water.

3.3 PLACING GROUT

A. Description:

1. Plan material in accordance with manufacturer's recommendation.
2. Place non-shrink grouting material quickly and continuously.
3. Apply grout from one side only to avoid air pockets.
4. If shims are used, do not remove for at least 48 hours after grout has been placed. After removal of shims, fill voids with plain cement-sand grout.
5. After non-shrink grout has reached initial set, rake out exposed edges approximately 1 inch and point with Portland cement mortar.

3.4 PLACEMENT OF LATEX MODIFIED CONCRETE

A. Description:

1. Chip substrate as required to expose fresh clean material.
2. Chip edges of voids so as not to produce feathered edges.
3. Mix per submitted mix design with clean uncontaminated containers and tools. Thoroughly mix material. Place and vibrate as required to produce uniform void-free mix.
4. Protect uncured material from detrimental environmental conditions.

3.5 PLACEMENT OF PREMIXED REPAIR MORTAR OR GEL

A. Description:

1. Mix per manufacturer's instructions.
2. Chip substrate as required to expose fresh clean material.
3. Chip edges of voids so as to not produce feathered edges.
4. Install per manufacturer's instructions.

3.6 CURING

A. Description:

1. Cure grout for 3 days after placing by keeping work wet and covered.

END OF SECTION 03 62 00

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. All structural steel framing, including connections and accessories, as shown or implied by the Contract Documents.

B. Related Sections:

1. Division 03 Section “Grouting”
2. Division 05 Section “Steel Roof Decking”.
3. Division 05 Section “Composite Metal Decking”.
4. Division 07 Section “Cementitious Fireproofing”.
5. Division 07 Section “Thin-Film Intumescent Fireproofing”.
6. Division 09 Section “Painting”.

C. Allowances: Provide the following under the allowances indicated as specified in Division 01–Allowances:

1. Structural Steel Allowance: include an Allowance of <___> tons of structural steel for use as directed by the Architect/Engineer. Allowance shall include costs for the following:

a. Furnishing the quantity of steel indicated in the sizes selected by the Architect/Engineer.
b. Shop drawing preparation for additional material.
c. Fabrication of steel, ready for installation on site.
d. Priming of steel members.
e. Delivery to site and erection in location directed by Architect/Engineer.
f. Required bolts, welding supplies, shims, and miscellaneous materials or erection aids required for a complete installation.

1.2 QUALITY ASSURANCE

A. Qualifications of Suppliers and Personnel:

1. The steel fabricator and erector shall have successfully completed work of this type and scope. The fabrication facility shall be certified as an AISC Category I facility.
2. All welding shall be performed by operators who have been recently qualified as prescribed in "Structural Welding Code" of the American Welding Society (except for welds which do not carry calculated stress).

B. Codes and Standards:

1. In addition to complying with all pertinent codes and regulations, comply with:
2. "Specifications for Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction
3. "Structural Welding Code" of the American Welding Society
4. "Code of Standard Practice for Steel Buildings and Bridges" of the American Institute of Steel Construction.

C. Conflicting Requirements:

1. In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards or this Section of the Project Manual, the provisions of the more stringent shall govern.

D. Fabricators Shop Testing, Inspection and Quality Control:

1. For AISC certified facilities, submit a written program for the proposed fabrication quality control testing and inspection. After review and acceptance of these documents by the Architect/Engineer, perform all shop testing and inspection as specified herein. If the Fabricator's facility is not AISC certified, the Contractor's independent testing laboratory will perform all shop testing and inspection work, and the fabricators will be backcharged for this work.
2. Structural Steel Fabrication Shop Quality Control Program: As a minimum, perform at least the following shop tests and inspections and submit daily reports of the results of all tests. State in each report whether the tested specimens conform to all requirements of the Contract Documents, and specifically note any discrepancies. If the inspections indicate defects in the Work, increase the degree of testing to ensure that the full extent of defects in the joint are found and that similar defects are not present in similar joints.

    a. Provide evidence that all welders to be employed in the Work hold current AWS certification for the welding procedures that each will perform. If recertification of welders is required, the retesting is the Contractor's responsibility.
    b. Visually inspect all fabrication operations, including dimensional and fit-up/alignment and control.
    c. Visually inspect all plate edges and rolled shape edges for material defects.
    d. High strength bolted connections:

        1) Check all bolted connections in accordance with the procedures outlined in the RCSC "Specification for Structural Joints Using ASTM A325 or A490 Bolts", latest edition.

    e. Welding visual inspection:

        1) Inspect all welding operations and welds, including edge preparation, fit-up, preheat, and adherence to welding procedures.

            a) Inspect welds prior to shop painting of steel.
            b) Measure the weld profiles for 15 percent of the length of each weld, at random.

f. Welding magnetic particle testing: Test in accordance with ASTM E109 for a minimum of:

1) 20 percent of all shear plate fillet welds at random, final pass only.
2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.

g. Welding ultrasonic testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.

h. Schedule all work to allow the testing requirements listed above to be completed.

1.3 SUBMITTALS

A. Shop Drawings:

1. Prior to the bulk of shop drawing preparation, submit to the Architect/Engineer shop drawings of "typical conditions" and connections to assure that the fabricators assumptions are correct as to type of connection and other pertinent details.
2. Before any structural steel is fabricated, submit shop drawings to the Architect/Engineer for review and receive approval of same in accordance with Division 01 of this Project Manual.
3. Show all shop and erection details including cuts, copes, connections, holes, threaded fasteners, and welds.
4. Show all welds, both shop and field by the currently recommended symbols of the American Welding Society.

B. Proof of Qualification:

1. Submit to the Architect/Engineer evidence satisfactory to him that the steel fabricator and steel erector are qualified for the Work in accordance with the requirements of this Section of the Project Manual.

C. Certification:

1. Submit to the Architect/Engineer a certification that the materials supplied are in accordance with the requirements of this Section of the Project Manual.

1.4 PROJECT CONDITIONS

A. Field Verification:

1. Confirm all dimensions necessary to make the framing assembly fit accurately.
2. Do not fabricate materials until field dimensions have been confirmed.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL

A. Steel Shapes and Plates:

1. All steel w-shapes shall meet the requirements of ASTM A992 or ASTM A572, Grade 50 except plates, angles and channels shall meet the requirements of ASTM A36.

B. Hollow Structural Section (HSS):

1. Round, square and rectangular HSS sections shall meet the requirements of ASTM A500, Grade B.

C. Pipes:

1. Steel pipes shall meet the requirements of ASTM A501 or ASTM A53, Grade B, Type E or S.

2.2 CONNECTIONS

A. Materials:

1. High-strength bolts for shop and field connections: ASTM A325, 3/4 inch minimum diameter.
2. Anchor bolts, nuts and washers: ASTM F1554, Class **[36] [55]**, Grade 2A
3. Machine bolts for minor connections: ASTM A307
4. Shear studs: ASTM A108, Grades 1015 through 1020, Headed-stud type, cold finished carbon steel; AWS D1.1, Type B.
5. Welding electrodes: ASTM A233, Series E70XX

B. All shop connections shall be accomplished using high strength bolts or by welding at the Contractor's option.

C. Use high strength bolts for field connections.

D. Bolted connections shall be bearing type connections with threads in the shear plane.

E. Moment connections as detailed in the Contract Documents are designed as welded connections.

F. All connections shall be consistent with the design assumptions associated with Type "2" or Type "3" construction defined by the American Institute of Steel Construction.

G. Minimum thickness of connection material shall be 5/16".

2.3 PRIMER PAINT

A. General:

1. All primer paint for structural steel shall be compatible with the finish coatings described in Division 09 of this Project Manual.
2. Omit paint from structural steel encased in concrete or designated to receive fireproofing, and from all faying surfaces.
3. Omit paint on all non-corrodible finished angles.

2.4 OTHER MATERIALS

A. All other materials not specifically described but required for a complete and proper installation of structural steel, shall be new, free from rust, first quality of their respective kinds, and subject to the acceptance of the Architect/Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to installation of the Work of this Section, carefully inspect the installed Work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that existing conditions will permit the structural steel to be fabricated and erected in strict accordance with the original design, the shop drawings, and the referenced standards.

B. Discrepancies:

1. Do not proceed with fabrication or installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 FABRICATION

A. General:

1. Fabricate all structural steel in strict accordance with the shop drawings and the referenced standards.

B. Shop Cleaning and Priming:

1. Shop cleaning shall meet recommendations of the final finish manufacturer.
2. Shop paint all structural steel one coat where priming is required.
3. Thoroughly clean all steel that is not to be painted.

C. Milling:

1. Mill the bearing surfaces of all columns/compression members.

D. Leveling Nuts:

1. All column base plates shall be supported on leveling nuts unless noted otherwise. The area between the base plate and concrete shall be grouted in accordance with Division 03 Section “Grouting”.

3.3 WELDING

A. General:

1. For details of joints, comply with requirements for AWS joints accepted with qualification tests.
2. Use ASTM A233, E-70 series electrodes.
3. Follow applicable sections of AWS specifications.

B. Types of Welds:

1. Unless otherwise noted:

a. Make all fillet welds 3/16" minimum.
b. Make all butt welds full penetration welds, using back-up or chip and back-weld.

3.4 ERECTION

A. General:

1. Erect all structural steel in strict accordance with the drawings, the shop drawings, and all pertinent regulations and standards.

B. Bolted Connections:

1. Accomplish high-strength bolted connections in accordance with the American Institute of Steel Construction's publication, "Specifications for Structural Joints Using ASTM A325 or A490 Bolts."
2. All bolts in bolted connections shall be tightened to the “snug tight condition” unless noted otherwise on the drawings.

C. Touch-Up:

1. After erection is complete:

a. Touch-up all shop priming coats damaged during transportation and erection.
b. Prime all field welds on members that have been welded, and paint all field bolts using the priming paint specified for shop priming.

D. Bracing:

1. Furnish, design, and install all temporary erection bracing.

2. Leave such bracing in place until the structure is stabilized by walls, slabs, decks and permanent bracing.

3.5 INSPECTION AND QUALITY ASSURANCE

A. The Testing Laboratory will conduct a program of testing and inspection for both shop fabrication and field erection. During shop fabrication, the program will consist of monitoring the structural steel Contractor's quality control and testing program. If the fabrication facility does not qualify as a certified AISC Category I facility, the Testing Laboratory will perform all shop testing and inspection work. During field erection, the program will consist of all field testing and inspection as specified.

B. Shop Quality Control by Testing Laboratory: Provide periodic monitoring of the Contractor's quality control testing and inspection program. Include the following as a minimum degree of monitoring:

1. Verify all welder qualification, and monitor welding procedures and welding processes.
2. Monitor all fabrication operations.
3. Verify and monitor all shop testing and inspection, including review of the Contractor's testing and inspection records.
4. Perform inspection as necessary on those portions of the structural steel not in evidence of complying with the Contract Documents.

C. Field Quality Control by Testing Laboratory: Perform the following quality control tests and inspections. Interpret test results, submit daily reports and monthly summary reports.

1. Examine the Manufacturer's test certificates for all materials provided. Verify that the lot numbers of the tested material coincides with the lot numbers of the material used on-site.
2. Visually inspect all anchor-bolt nut installation and tightening.
3. High strength bolted connections:

    a. Observe the job site calibration of each size bolted fastener assembly and installation technique in the calibrated tension measuring device. Verify that the proper bolt pretension listed in Table 4 of the RCSC "Specification" is achieved and that installation equipment is of sufficient capacity.
    b. Routinely monitor field bolting procedures during bolt installation. Verify that all bolts in all connections are brought to a "snug tight" condition with all plies of the connection in firm contact. Verify that bolts in connections identified as either slip-critical or direct tension connections are being additionally tightened by the proper technique(s) determined in the tension testing device described above.
    c. Check that all bolted connections are being installed in accordance with the procedures outlined in the RCSC "Specification."

4. Welded connections:

    a. Obtain qualifications of all welders and verify all welding procedures, including the Contractor's compliance with preheat, weather-protection, electrodes, and welding surface preparation requirements.
    b. Visually inspect all field welding operations and welds.

5. Magnetic particle testing: Test in accordance with ASTM E109 for a minimum of:

    a. 20 percent of the length of all field fillet welds, at random, final pass only.
    b. 25 percent of the length of all field partial penetration welds, except column splices, at random, root and final passes.

6. Ultrasonic testing: Test in accordance with ASTM E164 and AWS D1.1 for a minimum of:

    a. 100 percent of all field full penetration welds.
    b. 100 percent of the length of 25 percent of all field partial penetration column splices, at random.

7. Schedule all work to allow the testing requirements listed above to be completed.
8. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.

D. Following procedure shall be followed for inspection and testing of all joints of the seismic force resisting systems:

1. The testing agency responsible for quality assurance shall submit the following documents to the A/E and the owner:

    a. Qualifications of the management and quality assurance personnel designated for the project.
    b. Qualification records for the inspectors and non destructive testing technicians designated for the project.
    c. Daily or weekly inspection reports including the nonconformance reports.

2. Inspection points and frequencies of quality assurance task and documentation for the seismic load resisting system shall be as explained below:

    a. Observe (O): Observe these on a random, daily basis.
    b. Perform (P): Perform these functions prior to final acceptance of the item.
    c. Document (D): The inspector shall prepare reports indicating that the work meets the requirements of the contract documents. The report shall indicate the deficiencies and whether the noncompliance has been satisfactorily repaired or not. Inspect after repair and provide a report.

3. Visual welding inspection shall be the primary method to confirm the procedure materials and the workmanship are as specified and approved. Minimum inspection tasks shall be as follows:

    a. Observe and perform material identification, joint preparation, dimensions, cleanliness tack weld quality and location, backing type, configuration of the access holes, dimensions and cleanliness of the fillet welds and the field welding process.
    b. Document visual inspection of the weld for crack, weld/base metal fusion, crater cross-section, weld profile, weld size, undercut, porosity placement of the reinforcement fillets, backing bars/weld tabs removed and finished (if required) and the repair activities.

c. Perform and document all repair or corrective work activities.

4. Nondestructive testing of the welds shall be performed by ultrasonic or magnetic particle testing (MT) as follows:

   a. MT inspection for cracks at welding of doubler plates, continuity plates or stiffeners in the k-area base metal within 3” of weld. Document the findings until accepted.
   b. Ultrasonic testing shall be performed for all complete joint penetration (CJP) groove weld in materials 5/16” or thicker. Perform MT inspection on 25 percent of all beam-to-column CJP groove welds. Document the findings until accepted.
   c. Ultrasonic testing for Lamellar Tearing for base metal thicker than 1-1/2”. Document the findings until accepted.
   d. MT inspection of beam cope and access hole for beams with 1-1/2” or thicker flange. Document the findings until accepted.
   e. MT inspection of reduced beam section repair and web tab removal sites. Document the findings until accepted.

5. Observation of bolting operations shall be the primary method to confirm the materials procedure and workmanship.

   a. Verify materials and procedure prior to installation and document the findings until accepted.
   b. Document data of all rejected connections until accepted.

END OF SECTION 05 12 00

SECTION 05 36 00

COMPOSITE METAL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Composite metal decking and accessories necessary to complete the structure and appurtenances as indicated or implied by the Contractor Documents.

B. Related Sections:

1. Division 03 Section “Concrete Formwork”
2. Division 03 Section “Concrete Reinforcement”
3. Division 03 Section “Cast-in-Place Concrete”
4. Division 05 Section “Structural Steel Framing”
5. Division 05 Section “Steel Roof Decking”
6. Division 05 Section “Metal Fabrications”
7. Division 07 Section “Cementitious Fireproofing”

1.2 SUBMITTALS

A. Product Data: Manufacturer’s standard printed product information, indicating compliance with requirements.

B. Shop Drawings:

1. Submit shop drawings showing deck layout, projections, openings, framing and supports, type and location of welds, and details of accessories.
2. Shop Drawing shall include:

a. Deck type, gage, and finish.
b. Connections of deck to framing members, indicating type and locations.
c. Connections of deck to adjacent deck pieces, indicating type and locations.
d. Shop and erection details.
e. Markings, quantities, and locations of all deck sheets.
f. Details of all deck accessories.
g. Locations and dimensions of all shop cut openings.
h. Details showing method of framing openings less than 12 inches square.

3. Fabrication shall not begin until shop drawings have been reviewed.

C. Welding certificates.

D. Field quality-control test and inspection reports.

1.3 QUALITY ASSURANCE

A. Material, Fabrication and Erection: Comply with the following standards:

1. AISI – Specifications for the Design of Cold Formed Steel Structural Members.
2. Steel Deck Institute – Design Manual for Composite Decks, Form Decks, and Roof Decks.

B. Erector Qualifications:

1. Erector: Approved by the fabricator.
2. Welders: AWS qualified according to AWS D1.3, "Structural Welding Code - Sheet Steel" and hold a current and valid certificate.

C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Provide units tested and labeled for use in indicated assembly for fire resistance rating indicated.
2. Label steel deck units with appropriate markings of applicable testing and inspecting agency.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Protect steel deck and accessories to prevent damage during delivery, storage and handling.

B. Storage:

C. Store all materials on sills off the ground in such a manner that pieces lie flat without Storage:

1. Store steel deck at the project site off the ground with one end elevated to provide drainage, and s covered with a ventilated, waterproof cover.
2. Clean steel deck that has become soiled prior to installation.

1.5 PROJECT CONDITIONS

A. Verifying Conditions:

1. Take all necessary field measurements to make all work fit accurately. Do not fabricate any materials until such verification has been made.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Composite Steel Deck:

1. Galvanized sheet steel: ASTM A 653, Structural Steel (SS) Grade 33 or higher, G60 zinc coating.

    a. Gage and size as indicated on the Drawings.
    b. Units installed in fire rated assemblies: 20 gage, minimum

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Fire Rated Assemblies:

1. Unit shall be classified for use in UL assembly rating No. D925, or equivalent according to the hourly fire resistance rating required, manufacturer and products selected for fireproofing, and structural member sizes indicated.

2.2 COMPOSITE DECK

A. Fabricate composite deck with section properties computed in accordance with AISI "Specification for the Design of Cold-Formed Steel Structural Members".

1. Formed in fluted sections with interlocking side laps and embossments or other means to provide bond between concrete and deck units.
2. Form deck units in lengths to span three or more support spacing, with flush ends and nesting side laps.

B. Cover Plates:

1. Sheet steel of same quality as deck units
2. Gage to match steel deck before coating
3. Configure to match contour of floor deck units

C. Closure Strips:

1. Sheet steel of same quality as deck units
2. Gage to match steel deck before coating
3. Configure to provide tight-fitting closures at open ends of cells or flutes and sides of floor decking.

2.3 ACCESSORIES

A. Provide closures, reinforcing channels, and related accessories in sheet steel with same finish and gage as steel roof deck, 20 gage minimum.

1. Closures: Formed channel equal to deck depth, with 1 inch flanges, or as indicated.

B. Pour Stops: Form pour stops from galvanized steel to slab thickness indicated.

1. Hem top edge of pour stop with 1/2 inch return turned down 45 degrees from horizontal.
2. Provide pour stops in steel thickness indicated, or if not indicated, in thickness recommended in the SDI "Pour Stop Selection Table".

C. Metal fasteners for fastening side laps: Self-drilling, No. 10 minimum steel-to-steel screws.

1. Reference standard: ITW Buildex; Light-Duty Teks with Hex Washer Head

D. Opening reinforcement: 16 gage galvanized steel sheet, for penetration openings through deck with dimensions between 8 inches and 12 inches.

E. Flexible Closure Strips:

1. Non-fire-rated assemblies: Vulcanized, closed-cell, synthetic rubber.
2. Fire-rated assemblies: Mineral wool safing insulation. Refer to Division 07 Section "Firestopping".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Check supporting members for correct layout and alignment.

B. Verify that surfaces to receive floor deck are free of debris.

C. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

A. General:

1. Install deck units and accessories in accordance with manufacturer's recommendations and shop drawings.
2. Install deck after structural support is in place, plumb and true.

B. Placing Floor Deck Units:

1. Position deck units with ends bearing a minimum of 1-1/2 inches on supporting members.
2. Align cells over entire length of run.
3. Provide support angles and closure plates at columns as required to provide adequate support for deck units and to contain the concrete.
4. Do not stagger joints between panels, except where necessary to maintain multiple spans.

C. Cutting and Fitting:

1. Cut and fit deck units and accessories around projections through floor.
2. Make cuts neat, square, and trim.
3. Install pour stops at floor edge and openings, upturned to top surface of slab.

a. Provide stops of sufficient strength to remain stationary without distortion.
b. Do not use pour stops as screeds.
c. Provide closure strip at end of deck where deck changes direction.

4. Provide angle frame supports at all penetrations through the deck larger than 12 inches in either direction.

D. Fastening Deck Units:

1. Secure floor deck units to supporting members with shear connectors or 3/4 inch minimum diameter fusion welds at 12 inches maximum spacing.

    a. Minimum of two welds per unit at each support.

2. Lock side laps between adjacent deck units at intervals not over 2 feet on center maximum with 5/8 inch diameter puddle welds, 1 inch fillet welds, or self-drilling screws.
3. Tack weld end closures at 2 feet on center maximum
4. Tack weld side closures at 2 feet on center maximum.
5. Welds shall be free of sharp points and edges.

E. Touch-Up Painting:

1. Wire brush, clean, and paint scarred areas, welds, and rust spots on top and bottom surfaces of deck units.
2. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.
3. Apply galvanizing repair paint immediately after welded surfaces have cooled.

3.3 PROTECTION

A. Do not use deck units for storage or working platforms until permanently secured in position.

B. Ensure that construction loads do not exceed carrying capacity of deck.

END OF SECTION 05 36 00

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

B. Downspout boots.

C. Cast iron trench castings.

1.2 RELATED REQUIREMENTS

A. Section 05 51 00 - Metal Stairs.

B. Section 05 52 13 - Pipe and Tube Railings.

C. Section 07 71 23 - Manufactured Gutters and Downspouts: Downspout boots.

D. Section 32 33 00 - Site Furnishings: Steel pipe bollards to match other site furnishings.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

G. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

H. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

J. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2021.

K. ASTM A1011/A1011M - 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; 2018a.

L. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019a.

M. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

N. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

O. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

Q. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata 2020.

R. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

S. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

T. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

C. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.5 QUALITY ASSURANCE

A. Design _____ under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Stainless Steel, General: ASTM A666, Type 304.

F. Stainless Steel Tubing: ASTM A554, Type 304, 16 gauge, 0.0625 inch (1.59 mm) minimum metal thickness, 1-1/2 inch (38 mm) diameter.

G. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

H. Slotted Channel Fittings: ASTM A1011/A1011M.

I. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

J. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

K. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

L. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

M. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

N. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.2 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.

D. Bolts, Nuts, and Washers: Stainless steel.

E. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.3 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 FABRICATED ITEMS

A. Bollards: Schedule 40 steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

C. Lintels: As detailed; prime paint finish.

D. Door Frames for Overhead Doors, Wall Openings: Channel sections; prime paint finish.

2.5 DOWNSPOUT BOOTS

A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots, integral cleanout, cleanout cover, and tamper proof fasteners.
   1. Configuration: Angular.
   2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.
   3. Finish: Manufacturer's standard factory applied powder coat finish.
   4. Color: To be selected by Architect from manufacturer's standard range.
   5. Accessories: Manufacturer's standard stainless steel fasteners, stainless steel building wall anchors, integral neoprene gaskets, and rubber coupling.

2.6 CAST IRON TRENCH CASTINGS

A. Cast Iron Trench Castings:
   1. Material: Cast iron; ASTM A48/A48M, Class 35 B (heavy duty).
   2. Grate Type: Manufacturer's standard Type A.

2.7 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, and items specified for _____ finish.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Prime Painting: One coat.

D. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating. (Provide minimum 530 g/sq m galvanized coating.)

2.8 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I color anodized.

B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

C. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick; light bronze.

D. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils (0.018 mm) thick; light bronze.

2.9 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Obtain approval prior to site cutting or making adjustments not scheduled.

SECTION 05 51 00
METAL STAIRS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Stairs with grating treads.

B. Prefabricated stairs.

C. Structural steel stair framing and supports.

D. Handrails and guards.

1.2 REFERENCE STANDARDS

A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.

B. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2021.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.

H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

J. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2021).

K. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.

L. ASTM A1011/A1011M - 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; 2018a.

M. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

N. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

P. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

Q. NAAMM AMP 510 - Metal Stairs Manual; 1992.

R. NAAMM MBG 531 - Metal Bar Grating Manual; 2017.

S. NAAMM MBG 532 - Heavy Duty Metal Bar Grating Manual; 2019.

T. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

U. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Design Data: As required by authorities having jurisdiction.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

1.4 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Fabricator Qualifications:
   1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.
   2. A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
   3. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.1 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
   2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
   3. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
      a. Stair Capacity: Uniform live load of 100 lb/sq ft (4.7 kPa) and a concentrated load of 300 lb (and a concentrated load of 14.4 kg) with deflection of stringer or landing framing not to exceed 1/360 of span.
      b. Railing Assemblies: Comply with applicable local code.
   4. Dimensions: As indicated on drawings.
   5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   7. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Industrial: All joints made neatly.
      a. Welded Joints: Welded on back side wherever possible.
      b. Welds Exposed to Touch: Ground smooth.
      c. Bolts Exposed to Touch in Travel Area: No nuts or screw threads exposed to touch.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.2 METAL STAIRS WITH GRATING TREADS

A. Jointing and Finish Quality Level: Industrial, as defined above.

B. Risers: Open.

C. Treads: Steel bar grating.
   1. Grating Type: Welded.
   2. Bearing Bar Depth: 3/4 inch (19 mm), minimum.
   3. Top Surface: Standard.
   4. Nosing: Checkered plate.
   5. Nosing Width: 1-1/4 inch (32 mm), minimum.
   6. Anchorage to Stringers: End plates welded to grating, bolted to stringers.

D. Stringers: Rolled steel channels.

1. Stringer Depth: 10 inches (250 mm).
2. End Closure: Sheet steel, 14 gauge, 0.075 inch (1.9 mm) minimum; welded across ends.

E. Railings: Steel pipe railings.

F. Finish: Shop- or factory-prime painted.

2.3 HANDRAILS AND GUARDS

A. Guards: Pipe railings, see Section 05 52 13.

2.4 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

D. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.

E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

F. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230 with G40/Z120 coating.

G. Checkered Plate: ASTM A786/A786M, rolled steel floor plate; manufacturer's standard pattern.

H. Gratings: Bar gratings that comply with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes.

2.5 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

2.6 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.

2. Number of Coats: Two.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

3.3 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Stair railings and guardrails.

B. Balcony railings and guardrails.

1.2 RELATED REQUIREMENTS

A. Section 05 51 00 - Metal Stairs: Handrails other than those specified in this section.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.

D. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

G. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017, with Amendment (2021).

H. AWS C3.4M/C3.4 - Specification for Torch Brazing; 2016.

I. AWS C3.5M/C3.5 - Specification for Induction Brazing; 2016, with Amendment (2017).

J. AWS C3.9M/C3.9 - Specification for Resistance Brazing; 2020.

K. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Samples: Submit two, 12 inch (____ mm) long samples of handrail. Submit two samples of elbow, wall bracket, and end stop.

D. Fabricator's Qualification Statement.

1.5 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months.

C. Fabricator Qualifications:
1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.
2. A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
3. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.1 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot (1095 N/m) applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds (890 N) applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.
1. Top Rails and Wall Rails: 1-1/2 inches (38 mm) diameter, round.
2. Intermediate Rails: 1-1/2 inches (38 mm) diameter, round.
3. Posts: 1-1/2 inches (38 mm) diameter, round.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

H. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
   1. Ease exposed edges to a small uniform radius.
   2. Welded Joints:
      a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
      b. Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.
   3. Brass/Bronze Brazed Joints:
      a. Perform torch brazing in accordance with AWS C3.4M/C3.4.
      b. Perform induction brazing in accordance with AWS C3.5M/C 3.5.
      c. Perform resistance brazing in accordance with AWS C3.9M/C3.9.

2.2 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

C. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.3 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

SECTION 05 53 05
METAL GRATINGS AND FLOOR PLATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formed metal floor, mezzanine, and stair tread gratings.

B. Flat surface floor and stair tread plating.

C. Perimeter closure.

1.2 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2021).

D. ASTM A1011/A1011M - 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; 2018a.

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

G. NAAMM MBG 531 - Metal Bar Grating Manual; 2017.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide span and deflection tables.

C. Shop Drawings: Indicate details of component supports, openings, perimeter construction details, and tolerances.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Samples: Submit two samples, 6 by 6 inch (____ by ____ mm) in size illustrating surface finish, color, and texture.

1.4 QUALITY ASSURANCE

A. Designer Qualifications: Design gratings and plates under direct supervision of a Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable code for loading requirements.

2.2 MATERIALS

A. Steel Floor Plate: ASTM A786/A786M; manufacturer's standard pattern.

B. Sheet Steel for Die Stamping: ASTM A1011/A1011M Designation CS hot-rolled sheet.

C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.3 ACCESSORIES

A. Fasteners and Saddle Clips: Galvanized steel:

B. Perimeter Closure: Of same material as grating.

2.4 FABRICATION

A. Fabricate grates and plates to accommodate design loads.

2.5 FINISHES

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Galvanizing for Steel Shapes: ASTM A123/A123M.

C. Galvanizing for Steel Hardware: ASTM A153/A153M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated on drawings.

B. Verify that opening sizes and dimensional tolerances are acceptable.

C. Verify that supports are correctly positioned.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions.

B. Place frames in correct position, plumb and level.

C. Mechanically cut galvanized finish surfaces. Do not flame cut.

D. Anchor by welding.

E. Set perimeter closure flush with top of grating and surrounding construction.

F. Secure to prevent movement.

3.3 TOLERANCES

A. Comply with NAAMM MBG 531.

SECTION 06 10 00
ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Rough opening framing for doors, windows, and roof openings.

B. Concealed wood blocking, nailers, and supports.

1.2 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

B. PS 20 - American Softwood Lumber Standard; 2020.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

1.4 QUALITY ASSURANCE

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

1.6 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
1. Lumber: S4S, No. 2 or Standard Grade.
2. Boards: Standard or No. 3.

2.3 ACCESSORIES

A. Fasteners and Anchors:
1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
2. Drywall Screws: Bugle head, hardened steel, power driven type, length three times thickness of sheathing.

PART 3 EXECUTION

3.1 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

3.2 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

F. Provide the following specific nonstructural framing and blocking:
1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.

5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

SECTION 06 10 53
MISCELLANEOUS ROUGH CARPENTRY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roofing nailers.

B. Roofing cant strips.

C. Preservative treated wood materials.

D. Communications and electrical room mounting boards.

E. Concealed wood blocking, nailers, and supports.

F. Miscellaneous wood nailers, furring, and grounds.

1.2 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim: Sill flashings.

B. Section 09 21 16 - Gypsum Board Assemblies: Gypsum-based sheathing.

1.3 REFERENCE STANDARDS

A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. AWPA U1 - Use Category System: User Specification for Treated Wood; 2021.

D. PS 1 - Structural Plywood; 2009 (Revised 2019).

E. PS 20 - American Softwood Lumber Standard; 2020.

F. SPIB (GR) - Grading Rules; 2014.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and application instructions.

C. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

1.6 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. Species: Douglas Fir-Larch, unless otherwise indicated.
   2. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).

B. Sizes: Nominal sizes as indicated on drawings, S4S.

C. Moisture Content: S-dry or MC19.

D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No.2 or Standard Grade.
   2. Boards: Standard or No.3.

2.3 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1, A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.4 ACCESSORIES

A. Fasteners and Anchors:
   1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.
   2. Anchors: Toggle bolt type for anchorage to hollow masonry.

B. Sill Flashing: See Section 07 62 00.

2.5 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative to ____ lb/cu ft retention (to ____ kg/cu m retention).
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber exposed to weather.
      c. Treat lumber in contact with roofing, flashing, or waterproofing.
      d. Treat lumber less than 18 inches (450 mm) above grade.
      e. Treat lumber in other locations as indicated.
   2. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative to 0.25 lb/cu ft retention (to 4.0 kg/cu m retention).
      a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
      b. Treat plywood in contact with roofing, flashing, or waterproofing.
      c. Treat plywood less than 18 inches (450 mm) above grade.
      d. Treat plywood in other locations as indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Where wood framing bears on cementitious foundations, install full width sill flashing continuous over top of foundation, lap ends of flashing minimum of 4 inches (100 mm) and seal.

B. Install sill gasket under sill plate bearing on foundations; puncture gasket cleanly to fit tightly around protruding anchor bolts.

C. Coordinate installation of rough carpentry members specified in other sections.

3.2 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Provide the following specific nonstructural framing and blocking:
   1. Cabinets and shelf supports.
   2. Wall brackets.
   3. Grab bars.
   4. Towel and bath accessories.

3.4 ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

3.5 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

3.6 CLEANING

A. Waste Disposal: See Section 01 74 19 - Construction Waste Management and Disposal.
   1. Comply with applicable regulations.
   2. Do not burn scrap on project site.
   3. Do not burn scraps that have been pressure treated.
   4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

SECTION 06 41 00
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Factory finishing.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 12 36 00 - Countertops.

1.3 REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

C. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

D. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
   2. Single Source Responsibility: Provide and install this work from single fabricator.

B. Quality Certification:

1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
2. Provide designated labels on shop drawings as required by certification program.
3. Provide designated labels on installed products as required by certification program.
4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
5. Replace, repair, or rework all work for which certification is refused.

PART 2 PRODUCTS

2.1 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets: Custom grade.

C. Breakroom Cabinets: Plastic laminate faced, Custom grade.

2.2 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Provide sustainably harvested wood, certified or labeled; see Section 01 60 00.

2.3 LAMINATE MATERIALS

A. Provide specific types as indicated.
1. Horizontal Surfaces: HGS, 0.048 inch (1.22 mm) nominal thickness, through color, _____ color, finish as indicated.
2. Vertical Surfaces: VGS, 0.028 inch (0.71 mm) nominal thickness, through color, _____ color, finish as indicated.
3. Laminate Backer: BKL, 0.020 inch (0.51 mm) nominal thickness, undecorated; for application to concealed backside of panels faced with high pressure decorative laminate.

2.4 COUNTERTOPS

A. Countertops: See Section 12 36 00.

2.5 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Fasteners: Size and type to suit application.

C. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

2.6 HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard back-mounted system using surface mounted metal shelf standards and coordinated cantilevered shelf brackets, satin chrome finish, for nominal 1 inch (25 mm) spacing adjustments.

C. Fixed Specialty Workstation and Countertop Brackets:
   1. Material: Steel.
   2. Finish: Manufacturer's standard, factory-applied powder coat.
   3. Color: Black.

D. Fixed Standard Shelf, Countertop, and Workstation Brackets:
   1. Material: Steel.
   2. Finish: Manufacturer's standard, factory-applied primer.
   3. Color: Black.

E. Fixed Americans with Disabilities Act (ADA)-Compliant Vanity and Countertop Brackets:
   1. Material: Steel.
   2. Color: Black.

F. Drawer and Door Pulls: "U" shaped wire pull, steel with chrome finish, 4 inch centers ("U" shaped wire pull, steel with chrome finish, 100 mm centers).

G. Sliding Door Pulls: Circular shape for recessed installation, steel with satin finish.

H. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.

I. Cabinet Catches and Latches:
   1. Type: Friction catch.

J. Drawer Slides:
   1. Type: Extension types as indicated.
   2. Static Load Capacity: Commercial grade.
   3. Mounting: Side mounted.
   4. Stops: Integral type.

K. Drawer Systems: Integrated drawer slide and side.
   1. Side Type: Single wall.
   2. Mounting: Side mounted.
   3. Stops: Integral type.

L. Hinges: European style concealed self-closing type, steel with nickel-plated finish.

M. Hooks: Surface-mounted; stainless steel, satin finish.

2.7 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)

PART 3 EXECUTION

3.1 INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim for this purpose.

E. Secure cabinets to floor using appropriate angles and anchorages.

F. Countersink anchorage devices at exposed locations. Conceal with solid wood plugs of species to match surrounding wood; finish flush with surrounding surfaces.

3.2 ADJUSTING

A. Adjust moving or operating parts to function smoothly and correctly.

3.3 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

SECTION 06 61 16

SOLID SURFACING

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 surface material countertops.
2. Solid surface material backsplashes.
3. Solid surface material end splashes.
4. Solid surface material window sills.

1.3 ACTION SUBMITTALS

A. Product Data: For countertop materials.
B. Shop Drawings: For countertops. Show materials, finishes, edge and backsplash profiles, methods of joining and cutouts for plumbing fixtures.

1. Show locations and details of joints.
2. Show direction of directional pattern, if any.

C. Samples: Submit 6” x 6” samples of each color as specified or shown on the Drawings. Indicate full range of color and pattern variation. Approved samples will be retained as a standard for approval of work.
D. Product Data: Indicate product description, fabrication information and compliance with specified performance requirements. Submit manufacturer’s care and maintenance data, including repair and cleaning instructions. Include in project close-out documents.

1.4 CLOSEOUT SUBMITTALS

A. Maintenance Data: For solid surface material countertops to include in maintenance manuals. Include Product Data for care products used or recommended by Installer and names, addresses and telephone numbers of local sources for products.

1.5 QUALITY ASSURANCE

A. Fabricator Qualifications: Shop that employs skilled workers who custom-fabricate countertops like those required for this Project and whose products have a record of successful in-service performance.
B. Installer Qualifications: Fabricator of countertops.

1.6 FIELD CONDITIONS

A. Field Measurements: Verify dimensions of countertops by field measuring after base cabinets are installed but before countertop fabrication is complete.

1.7 COORDINATION

A. Coordinate locations of utilities that will penetrate countertops or backsplashes.

PART 2 - PRODUCTS

2.1 SOLID SURFACE MATERIALS

A. ACCEPTABLE MANUFACTURERS

1. “BASIS OF DESIGN” Corian (SS-1).
2. Other approved by Designer prior to Bidding.
3. Refer to Finish Legend (IN100) for complete specifications. Refer to drawings for details.

B. MATERIAL

1. (SS-1) Refer to Finish Legend on IN100.
2. Homogeneous-filled plastic resin complying with ICPA.
   a. Particleboard: ANSI A208.1, Grade M-2-Exterior Glue.
   b. Plywood: Exterior softwood plywood complying with DOC PS 1, Grade C-C Plugged and touch sanded.

2.2 COUNTERTOP & WINDOWSILL FABRICATON

A. Fabricate countertops according to solid surface material manufacturer's written instructions and to the AWI/AWMAC/WI's “Architectural Woodwork Standards”.

B. Configuration: Basis of Design : refer to “Interior Sections and Details” for complete specifications. Refer to individual section drawings type details.

C. Fabricate tops with shop-applied edges and backsplashes unless otherwise indicated. Comply with solid surface material manufacturer's written instructions for adhesives, sealers, fabrication and finishing.

1. Fabricate with loose backsplashes for field assembly.

D. Joints: Fabricate countertops without joints.

E. Joints: Fabricate countertops in sections for joining in field.

1. Joint Locations: Not within 18 inches of a sink or cooktop and not where a countertop section less than 36 inches long would result, unless unavoidable.
2. Splined Joints: Accurately cut kerfs in edges at joints for insertion of metal splines to maintain alignment of surfaces at joints. Make width of cuts slightly more than thickness of splines to provide snug fit. Provide at least three splines in each joint.

F. Cutouts and Holes:

1. Undercounter Plumbing Fixtures: Make cutouts for fixtures using template or pattern furnished by fixture manufacturer. Form cutouts to smooth, even curves.
2. Counter-Mounted Plumbing Fixtures: Prepare countertops in shop for field cutting openings for counter-mounted fixtures. Mark tops for cutouts and drill holes at corners of cutout locations. Make corner holes of largest radius practical.
3. Fittings: Drill countertops in shop for plumbing fittings, undercounter soap dispensers and similar items.

2.3 INSTALLATION MATERIALS

A. Adhesive: Product recommended by solid surface material manufacturer.

1. Adhesives shall have a VOC content of 70 g/L or less.
2. Adhesive shall comply with the testing and product 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".

B. Sealant for Countertops: Comply with applicable requirements in Section 07 92 00 "Joint Sealants".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates to receive solid surface material countertops and conditions under which countertops will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of countertops.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install countertops level plumb, and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
B. Fasten countertops by screwing through corner blocks of base units into underside of countertop. Predrill holes for screws as recommended by manufacturer. Align adjacent surfaces and using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches and clean entire surface.
C. Fasten sub tops to cabinets by screwing through sub tops into corner blocks of base cabinets. Shim as needed to align sub tops in a level plane.
D. Secure countertops to sub tops with adhesive according to solid surface material manufacturer's written instructions. Align adjacent surfaces and using adhesive in color to match countertop, form seams to comply with manufacturer's written instructions. Carefully dress joints smooth, remove surface scratches, and clean entire surface.
E. Bond joints with adhesive and draw tight as countertops are set. Mask areas of countertops adjacent to joints to prevent adhesive smears.

1. Install metal splines in kerfs in countertop edges at joints. Fill kerfs with adhesive before inserting splines and remove excess immediately after adjoining units are drawn into position.
2. Clamp units to temporary bracing, supports or each other to ensure that countertops are properly aligned and joints are of specified width.

F. Install backsplashes and end splashes by adhering to wall and countertops with adhesive. Mask areas of countertops and splashes adjacent to joints to prevent adhesive smears.
G. Complete cutouts not finished in shop. Mask areas of countertops adjacent to cutouts to prevent damage while cutting. Make cutouts to accurately fit items to be installed, and at right angles to finished surfaces unless beveling is required for clearance. Ease edges slightly to prevent snipping.
1. Seal edges of cutouts in particleboard sub tops by saturating with varnish.
H. Apply sealant to gaps at walls; comply with Section 07 92 00 “Joint Sealants”.
I. Keep components clean during installation. Remove adhesives, sealants, and other stains. Keep clean until date of substantial completion. Replace stained components.

END OF SECTION

SECTION 06 64 00

PLASTIC PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Plastic sheet wall paneling.

B. Related Requirements:

1. Section 06 10 00 "Rough Carpentry" for wood furring for installing plastic paneling.
2. Section 09 29 00 "Gypsum Board" substrate.
3. Section 09 90 00 "Painting and Transparent" finishes.
4. Section 09 65 13 "Resilient Base."

1.2 REFERENCES

A. American Society for Testing and Materials: Standard Specifications (ASTM)

1. ASTM C 1629, Section 6.4 – Hard Body Impact, tested to level 3 compliance.
2. ASTM C 1629, D 4977 – Surface Abrasion, tested to level 3 compliance.
3. ASTM C 1629, D 5420 – Indentation, tested to level 3 compliance.
4. ASTM D 2197 – Hoffman Scratch, tested to 10kg max load.
5. ASTM D 3273 – Mold and Mildew Resistant
6. ASTM G21/G22 – Fungal and Bacteria Resistant

1.3 ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Sustainable Design Submittals:

1. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project and cost for each regional material.
2. Product Certificates: For indigenous materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each indigenous material.
3. Product Certificates: For regional materials, indicating location of material manufacturer and point of extraction, harvest, or recovery for each raw material. Include distance to Project, means of transportation, and cost for each regional material.
4. Product Data: For adhesives, indicating VOC content.
5. Laboratory Test Reports: For adhesives, indicating compliance with requirements for low-emitting materials.

6. Product Data: For sealants, indicating VOC content.
7. Laboratory Test Reports: For sealants, indicating compliance with requirements for low-emitting materials.
8. Laboratory Test Reports: For wall materials, indicating compliance with requirements for low-emitting materials.

C. Samples: For plastic paneling and trim/accessories, in manufacturer's standard sample sizes.

1.4 QUALITY ASSURANCE

A. Installer Qualifications: Experience completing a minimum of five projects of similar size, type, and complexity. Workers employed on this Project competent in techniques required by manufacturer for installation indicated.

B. Testing Agency: Acceptable to authorities having jurisdiction and FM Approvals.

C. Surface-Burning Characteristics: Determined by testing identical products in accordance with ASTM E84 (Class A) by a testing agency acceptable to authorities having jurisdiction.

D. FM 4880 approved.

E. Meets USDA/FSIS requirements.

F. UL 2818 GREENGUARD GOLD certified.

G. Hazard Analysis Critical Control Point (HACCP) Certified: GLASBORD panels are suitable for use in food and beverage facilities that operate in accordance with a HACCP-based Food Safety Program.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Do not deliver or install plastic paneling until spaces are enclosed and weathertight and temporary HVAC system is operating and maintaining ambient temperature and humidity conditions at occupancy levels during the remainder of the construction period.

1.6 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace defective panels and components that fail in materials or workmanship under normal conditions of use within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Exposed fibers.
b. Rust.
c. Rot.
d. Corrosion.
e. Structural surface cracks.
f. Painting or refinishing required with normal pigmentation and UV degradation

excepted.

2. Warranty Period - Glass-Fiber-Reinforced Plastic Paneling: 3-years from date of Substantial Completion.
3. Warranty Period - Factory-Laminated Glass-Fiber-Reinforced Plastic Paneling: 3-years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MATERIALS AND MANUFACTURERS

A. PLASTIC SHEET PANELING

1. Glass-Fiber-Reinforced Plastic Paneling: Gelcoat-finished, glass-fiber-reinforced plastic panels complying with ASTM D5319. Panels will be USDA accepted for incidental food contact.

    a. "BASIS OF DESIGN": Valto Engineered Materials/Crane Composites (FRP-1); Class A; 4’ x 10’ Wall Panels; 0.09” Thickness.
    b. Other approved by Designer prior to Bidding.
    c. Refer to Finish Legend (IN100) for complete specifications. Refer to drawings for details.

2. Surface-Burning Characteristics: As follows when tested by a qualified testing agency in accordance with ASTM E84 (Class A). Identify products with appropriate markings of applicable testing agency.
3. Obtain plastic paneling trim accessories from same/single manufacturer.

B. ACCESSORIES

1. Trim Accessories: Manufacturer's standard trim/accessory pieced designed to retain and cover edges of panels. Provide division bars, inside corners, outside corners, and caps as required to conceal edges.
2. Color: Matched to panels.
3. Moldings: PVC pattern/color-matched to panel.
4. Exposed Fasteners: Nylon drive rivets recommended by panel manufacturer.
5. Concealed Mounting Splines: Continuous, H-shaped aluminum extrusions designed to fit into grooves routed in edges of factory-laminated panels and to be fastened to substrate.
6. Adhesive: As recommended by plastic paneling manufacturer.
7. Sealant: Mildew-resistant, single-component, neutral-curing silicone sealant recommended by plastic paneling manufacturer and complying with requirements in Section 079200 "Joint Sealants."
8. Caulk Color: Matched to Panels; 100% silicone-based colored caulk.

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.

1. Corners: Plumb and straight.
2. Surfaces: Smooth, sound, and uniform.
3. Nails or Screw Fasteners: Countersunk.
4. Joints and Cracks: Filled flush and smooth with adjoining surfaces.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove wallpaper, vinyl wall covering, loose or soluble paint, and other materials that might interfere with adhesive bond.

B. Prepare substrate by sanding high spots and filling low spots as needed to provide flat, even surface for panel installation.

C. Clean substrates of substances that could impair adhesive bond, including oil, grease, dirt, and dust.

D. Ensure that all HVAC, electrical, plumbing, and similar work above the ceiling level has been completed.

E. Condition panels by unpacking and placing in installation space before installation in accordance with manufacturer's written recommendations.

F. Lay out paneling before installing. Locate panel joints to provide equal panels at ends of walls not less than half the width of full panels.

1. Mark plumb lines on substrate at trim accessory locations for accurate installation.
2. Locate trim accessories to allow clearance at panel edges in accordance with manufacturer's written instructions.

3.2 INSTALLATION

A. Install plastic paneling in accordance with manufacturer's written instructions. Do all cutting with carbide-tipped saw blades or drill bits, or cut with snips.

B. Install panels plumb, level, square, flat, and in proper alignment.

C. Install panels to be water resistant and washable.

D. Install panels with manufacturer's recommended gap for panel field and corner joints.

E. Install panels with fasteners. Layout fastener locations and mark on face of panels sot aht fasteners are accurately aligned.

F. Drill oversized fastener holes in panels, greater in diameter than fasteners, and center fasteners in holes.

G. Apply sealant to fastener holes before installing fasteners.

H. Install trim accessories with adhesive and nails or staples. Do not fasten through panels.

I. Fill grooves in trim accessories with sealant before installing panels, and bed inside corner trim in a bead of sealant.

J. Maintain uniform space between panels and wall fixtures. Fill space with sealant.

K. Maintain uniform space between adjacent panels and between panels and floors, ceilings, and fixtures. Fill space with sealant.

L. Remove excess sealant and smears as paneling is installed. Clean with solvent recommended by sealant manufacturer and then wipe with clean dry cloths until no residue remains.

END OF SECTION

SECTION 07 05 53
FIRE AND SMOKE ASSEMBLY IDENTIFICATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.2 RELATED REQUIREMENTS

A. Section 09 91 23 - Interior Painting: Paint finish.

1.3 REFERENCE STANDARDS

A. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.

C. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.6 FIELD CONDITIONS

A. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Partition Identification Labels:
   1. Fire Wall Signs, Inc; _____: www.firewallsigns.com/#sle.
   2. Safety Supply Warehouse, Inc; _____: www.safetysupplywarehouse.com/#sle.

2.2 FIRE AND SMOKE ASSEMBLY IDENTIFICATION

A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC).

B. Applied Fire and Smoke Assembly Identification: Identification markings applied to partition with paint and a code compliant stencil. See Section 09 91 23 for products.

C. Languages: Provide sign markings in English.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2 PREPARATION

A. See Section 09 91 23 for substrate preparation for painted markings.

3.3 INSTALLATION

A. Locate markings as required by ICC (IBC).

B. Install applied markings in accordance with Section 09 91 23.

C. Install neatly, with horizontal edges level.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

SECTION 07 11 13
BITUMINOUS DAMPPROOFING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Bituminous dampproofing.

1.2 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation: Rigid insulation board used as protection board.

1.3 REFERENCE STANDARDS

A. ASTM D41/D41M - Standard Specification for Asphalt Primer Used in Roofing, Dampproofing, and Waterproofing; 2011 (Reapproved 2023).

B. ASTM D1187/D1187M - Standard Specification for Asphalt-Base Emulsions for Use as Protective Coatings for Metal; 1997 (Reapproved 2024).

C. ASTM D1227/D1227M - Standard Specification for Emulsified Asphalt Used as a Protective Coating for Roofing; 2013, with Editorial Revision (2019).

D. NRCA (WM) - The NRCA Waterproofing Manual; 2021.

PART 2 PRODUCTS

2.1 BITUMINOUS DAMPPROOFING

A. Bituminous Dampproofing: Cold-applied water-based emulsion; asphalt with mineral colloid or chemical emulsifying agent; with or without fiber reinforcement; asbestos-free; suitable for application on vertical and horizontal surfaces.
   1. Asphalt-Base Emulsion for Metal Protective Coating: ASTM D1187/D1187M, Type I - Continuous water exposure within few days after drying or Type II - Continuous weather exposure after drying.
   2. Emulsified Asphalt for Roofing Protective Coating: ASTM D1227/D1227M, Type II, Class 1 - Mineral colloid emulsifying agents with non-asbestos fibers.
   3. VOC Content: Not more than permitted by local, State, and federal regulations.
   4. Applied Thickness: 1/16 inch (1.5 mm), minimum, wet film.

B. Primers, Mastics, and Related Materials: Type as recommended by dampproofing manufacturer.

2.2 BITUMEN MATERIALS

A. Cold Asphaltic Type:

1. Bitumen: Emulsified asphalt, ASTM D1227/D1227M, with fiber and/or filler reinforcement other than asbestos, Type II, Class 1 or 2.
2. Asphalt Primer: ASTM D41/D41M, compatible with substrate.

2.3 ACCESSORIES

A. Protection Board: Rigid insulation; see Section 07 21 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions are acceptable prior to starting this work.

B. Verify substrate surfaces are durable, free of matter detrimental to adhesion or application of dampproofing system.

C. Verify that items penetrating surfaces to receive dampproofing are securely installed.

3.2 PREPARATION

A. Protect adjacent surfaces not designated to receive dampproofing.

B. Clean and prepare surfaces to receive dampproofing in accordance with manufacturer's instructions.

C. Do not apply dampproofing to surfaces unacceptable to manufacturer.

D. Apply mastic to seal penetrations, small cracks, or minor honeycombs in substrate.

3.3 APPLICATION

A. Foundation Walls: Apply two coats of asphalt dampproofing.

B. Perform this work in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

C. Prime surfaces in accordance with manufacturer's instructions and NRCA (WM) applicable requirements.

D. Prime surfaces at a rate approved by manufacturer for application indicated, and allow primer to dry thoroughly.

E. Apply bitumen with mop.

F. Apply bitumen at a temperature limited by equiviscous temperature (EVT) plus or minus 25 degrees F (14 degrees C); do not exceed finish blowing temperature for four hours.

G. Apply from 2 inches (50 mm) below finish grade elevation down to top of footings.

H. Seal items watertight with mastic, that project through dampproofing surface.

SECTION 07 21 00
THERMAL INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Board insulation at perimeter foundation wall and underside of floor slabs.

B. Batt insulation and vapor retarder in exterior wall, ceiling, and roof construction.

C. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

1.2 RELATED REQUIREMENTS

A. Section 07 26 00 - Vapor Retarders: Separate vapor retarder materials.

1.3 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

E. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

F. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification. Keep copies of contractor accreditation and installer certification on project site during and after installation. Present on-site documentation upon request.

1.5 QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1. Installer Qualification: Use accredited contractors, certified installers, evaluated materials, and third-party field quality control audit.
2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

1.6 FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

PART 2 PRODUCTS

2.1 APPLICATIONS

A. Insulation Under Concrete Slabs: Extruded polystyrene (XPS) board.

B. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

C. Insulation in Metal Framed Walls: Batt insulation with integral vapor retarder.

2.2 FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.
1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.
2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.
3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.
4. Type and Thermal Resistance, R-value (RSI-value): Type IV, 5.0 (0.88), minimum, per 1 inch (25.4 mm) thickness at 75 degrees F (24 degrees C) mean temperature.
5. Complies with fire resistance requirements indicated on drawings as part of an exterior non-load-bearing exterior wall assembly when tested in accordance with NFPA 285.
6. Board Edges: Shiplap.
7. Type and Water Absorption: Type XII, 0.3 percent by volume, maximum, by total immersion.

2.3 BATT INSULATION MATERIALS

A. Mineral Fiber Batt Insulation: Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.

2.4 ACCESSORIES

A. Self-Adhered Transition Flashing: Multipurpose, self-adhered flashing with modified butyl adhesive, polyester fiber top sheet, and polypropylene interlayer.

1. Application: Primerless adhesion for use as through-wall flashings and wall transitions to roof and below-grade systems.
2. Thickness: 45 mil, 0.045 inch (1.14 mm), nominal.
3. Size: 6 inches (152 mm) wide, in rolls 75 feet (23 m) long.

B. Flashing Tape: Special reinforced film with high performance adhesive.
1. Application: Window and door opening flashing tape.
2. Width: As required for application.
3. Primer: Tape manufacturer's recommended product.

C. Sill Plate Sealer: Closed-cell foam tape with rubberized adhesive membrane; bridges gap between foundation structure and sill plate or skirt board.
1. Width: 3-1/2 inches (89 mm).
2. Ultraviolet (UV) and Weathering Resistance: Approved in writing by manufacturer for up to 30 days of weather exposure.

D. Tape: Polyethylene self-adhering type, mesh reinforced, 2 inch (50 mm) wide.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.2 BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Adhere a 6 inches (152 mm) wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.
1. Tape seal joints.
2. Extend sheet full height of joint.

B. Apply adhesive to back of boards:
1. Three continuous beads per board length.

C. Install boards horizontally on foundation perimeter.
1. Place boards to maximize adhesive contact.

D. Extend boards over expansion joints, unbonded to foundation on one side of joint.

E. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.3 BOARD INSTALLATION UNDER CONCRETE SLABS

A. Place insulation under slabs on grade after base for slab has been compacted.

B. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

C. Prevent insulation from being displaced or damaged while placing vapor retarder and placing slab.

3.4 BATT INSTALLATION

A. Install insulation and vapor retarder in accordance with manufacturer's instructions.

B. Install in exterior wall and roof spaces without gaps or voids. Do not compress insulation.

C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.

D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.

E. Install with factory-applied vapor retarder membrane facing warm side of building spaces. Lap ends and side flanges of membrane over framing members.

F. Tape seal butt ends, lapped flanges, and tears or cuts in membrane.

G. Coordinate work of this section with requirements for vapor retarder, see Section 07 26 00.

3.5 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Coordination of Air Barrier Association of America (ABAA) Tests and Inspections:
   1. Provide testing and inspection required by ABAA Quality Assurance Program (QAP).
   2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
   3. Cooperate with ABAA testing agency.
   4. Allow access to air barrier work areas and staging.
   5. Do not cover air barrier work until tested, inspected, and accepted.

3.6 PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

B. Protect installed insulation from damage due to harmful weather exposures, physical abuse, and other causes. Provide temporary coverings or enclosures where insulation is subject to abuse and cannot be concealed and protected by permanent construction immediately after installation.

SECTION 07 26 00
VAPOR RETARDERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vapor retarders.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Vapor retarder under concrete slabs on grade.

B. Section 07 21 00 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.

C. Section 07 62 00 - Sheet Metal Flashing and Trim: Metal flashings installed in conjunction with vapor retarders.

1.3 DEFINITIONS

A. Vapor Retarder: Airtight barrier made of material that is relatively water vapor impermeable, to degree specified, with seams and joints sealed to adjacent surfaces.

B. Vapor Retarder Class: A measure of a material or assembly's ability to limit the amount of moisture that passes through that material or assembly. Vapor retarder class is defined using Procedure A, Desiccant Method at 73 degrees F (23 degrees C) and 50 percent Relative Humidity (RH), in accordance with ASTM E96/E96M and ICC (IBC)-2018, as follows:
   1. Class I: 0.1 perm or less.
   2. Class II: Greater than 0.1 perm to 1.0 perm.
   3. Class III: Greater than 1.0 perm to 10 perms.
   4. Vapor Permeable: 5 perms or greater.

1.4 REFERENCE STANDARDS

A. ASTM D1970/D1970M - Standard Specification for Self-Adhering Polymer Modified Bituminous Sheet Materials Used as Steep Roofing Underlayment for Ice Dam Protection; 2021.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials; 2022a, with Editorial Revision (2023).

D. ICC (IBC)-2018 - International Building Code; 2018.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on material characteristics, performance criteria, and limitations.

C. Shop Drawings: Provide drawings of special joint conditions.

D. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

1.6 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 VAPOR RETARDERS

A. Underslab Vapor Retarders: See Section 03 30 00.

B. Vapor Retarder Sheet: Polyamide nylon sheet intended for use with unfaced, vapor-permeable insulation such as fiberglass and mineral wool in wall and ceiling cavities.
   1. Thickness: 2 mil, 0.002 inch (0.0508 mm).
   2. Water Vapor Permeance: 1.0 perm (57 ng/(Pa s sq m)), maximum, when tested in accordance with ASTM E96/E96M using Desiccant Method.
   3. Surface Burning Characteristics: Smoke developed index of 450 or less, and flame spread index of 25 or less, Class A, when tested in accordance with ASTM E84.
   4. Seam Lap and Perimeter Adhesive: Provide manufacturer's recommended method using either tape or sealants.

2.2 ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Vapor Retarder and Adjacent Substrates: As indicated, complying with vapor retarder manufacturer's installation instructions.

B. Flexible Flashing: Self-adhesive sheet flashing complying with ASTM D1970/D1970M; slip resistance requirement waived if not installed on roof.
   1. Width: 4 inches (102 mm).
   2. Ultraviolet (UV) and Weathering Resistance: Approved by manufacturer for up to 30 days of weather exposure.

C. Stainless Steel Flashing: Flexible flashing with 2 mil, 0.002 inch (0.051 mm) thick Type 304 stainless steel sheet, 8 mil, 0.008 inch (0.203 mm) of butyl adhesive and siliconized release liner.
   1. Roll Length: 50 feet (15.2 m) long.
   2. Width: 6 inches (152 mm) wide.
   3. Overlap joints at least 2 inches (51 mm).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces and conditions comply with requirements of this section.

3.2 PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive adhesives and sealants in accordance with manufacturer's installation instructions.

3.3 INSTALLATION

A. Install materials in accordance with manufacturer's installation instructions.

B. Vapor Retarders: Install continuous airtight barrier over surfaces indicated, with sealed seams and sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended temperature range in accordance with manufacturer's installation instructions.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Owner’s Inspection and Testing: Cooperate with Owner’s testing agency.
   1. Allow access to work areas and staging.
   2. Notify Owner’s testing agency in writing of schedule for work of this section to allow sufficient time for testing and inspection.
   3. Do not cover work of this section until testing and inspection is accepted.

3.5 PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

SECTION 07 41 13
METAL ROOF PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal roof panel system of preformed steel panels.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Roof sheathing.

B. Section 07 42 13 - Metal Wall Panels: Preformed wall panels.

C. Section 07 92 00 - Joint Sealants: Sealing joints between metal roof panel system and adjacent construction.

1.3 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. ASTM E1592 - Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference; 2005 (Reapproved 2017).

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Summary of test results, indicating compliance with specified requirements.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Specimen warranty.

C. Shop Drawings: Include layouts of roof panels, details of edge and penetration conditions, spacing and type of connections, flashings, underlayments, and special conditions.
   1. Show work to be field-fabricated or field-assembled.
   2. Include structural analysis signed and sealed by qualified structural engineer, indicating compliance of roofing system to specified loading conditions.

D. Verification Samples: For each roofing system specified, submit samples of minimum size 12 inches (305 mm) square, representing actual roofing metal, thickness, profile, color, and texture.

E. Test Reports: Indicate compliance of metal roofing system to specified requirements.

F. Warranty: Submit specified manufacturer's warranty and ensure that forms have been completed in Owner's name and are registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section and with at least three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.6 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Provide mock-up of 4 sq ft (___ sq m), including underlayment, shingles, eave protection membrane, associated flashings, and _____.

C. Locate as directed by Architect.

D. Mock-up may remain as part of the work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Store roofing panels on project site as recommended by manufacturer to minimize damage to panels prior to installation.

1.8 FIELD CONDITIONS

A. Do not install metal roof panels, eave protection membrane, underlayment, or fasteners when surface, ambient air, or wind chill temperatures are below 45 degrees F (7 degrees C).

1.9 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

C. Special Warranty: Provide 2-year warranty for weathertightness of roofing system, including agreement to repair or replace metal roof panels that fail to keep out water commencing on the Date of Substantial Completion. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Metal Roof Panels: Provide complete roofing assemblies, including roof panels, clips, fasteners, connectors, and miscellaneous accessories, tested for compliance with the following minimum standards:
   1. Structural Design Criteria: Provide panel assemblies designed to safely support design loads at support spacing indicated, with deflection not to exceed L/180 of span length(L) when tested in accordance with ASTM E1592.
   2. Overall: Complete weathertight system tested and approved in accordance with ASTM E1592.
   3. Thermal Movement: Design system to accommodate without deformation anticipated thermal movement over ambient temperature range of 100 degrees F (56 degrees C).

2.2 METAL ROOF PANELS

A. Metal Roof Panels: Provide complete engineered system complying with specified requirements and capable of remaining weathertight while withstanding anticipated movement of substrate and thermally induced movement of roofing system.

B. Metal Panels: Factory-formed panels with factory-applied finish.
   1. Steel Panels:
      a. Steel Thickness: Minimum 24 gauge, 0.024 inch (0.61 mm).
   2. Profile: Standing seam, with minimum 1-inch (25.4 mm) seam height; concealed fastener system for field seaming with special tool.
   3. Texture: Smooth.
   4. Width: Maximum panel coverage of 24 inches (610 mm).

2.3 ATTACHMENT SYSTEM

A. Concealed System: Provide manufacturer's standard stainless steel or nylon-coated aluminum concealed anchor clips designed for specific roofing system and engineered to meet performance requirements, including anticipated thermal movement.

2.4 SECONDARY FRAMING

A. Miscellaneous Secondary Framing: Light gauge steel framing incidental to structural supports; fabricated from steel sheet.

B. Framing Material: ASTM A 1011/A 1011M, Designation SS steel sheet.
   1. Profile: Manufacturer's standard cee, zee, asymmetrical zee, hat channel, plain channel, single slope eave strut, double slope eave strut, and angle.
   2. Thickness: 12 gauge, 0.1046 inch (2.657 mm).
   3. Finish: Galvanized per ASTM A653/A653M, G90.

C. Framing Connectors: Factory-made formed steel sheet, ASTM A653/A653M SS Grade 50, with G60/Z180 hot dipped galvanized coating and factory punched holes.

2.5 FABRICATION

A. Panels: Provide factory fabricated panels with applied finish and accessory items, using manufacturer's standard processes as required to achieve specified appearance and performance requirements.

2.6 FINISHES

A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss as selected by Architect from manufacturer's standard line.

2.7 ACCESSORIES

A. Miscellaneous Sheet Metal Items: Provide flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, and equipment curbs of the same material, thickness, and finish as used for the roofing panels. Items completely concealed after installation may optionally be made of stainless steel.

B. Rib and Ridge Closures: Provide prefabricated, close-fitting components of steel with corrosion resistant finish or combination steel and closed-cell foam.

C. Sealants:
1. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.
2. Concealed Sealant: Non-curing butyl sealant or tape sealant.

D. Thermal Insulation: Provide flexible blanket, rigid, or semi-rigid type, faced with white, flexible, non-dusting vapor retarder tested for maximum flame spread index of 50, per ASTM E84; for installation using spacer blocks.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation of preformed metal roof panels until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Coordinate roofing work with provisions for roof drainage, flashing, trim, penetrations, and other adjoining work to ensure that completed roof will be free of leaks.

B. Separate dissimilar metals by applying a bituminous coating, self-adhering rubberized asphalt sheet, or other permanent method approved by metal roof panel manufacturer.

C. At locations where metal will be in contact with wood or other absorbent material subject to wetting, seal joints with sealing compound and apply one coat of heavy-bodied bituminous paint.

3.3 INSTALLATION

A. Overall: Install roofing system in accordance with approved shop drawings and metal roof panel manufacturer's instructions and recommendations, as applicable to specific project conditions; securely anchor components of roofing system in place allowing for thermal and structural movement.
   1. Install roofing system with concealed clips and fasteners, except as otherwise recommended by manufacturer for specific circumstances.
   2. Minimize field cutting of panels. Where field cutting is required, use methods that will not distort panel profiles. Use of torches for field cutting is prohibited.

B. Accessories: Install necessary components that are required for complete roofing assembly, including flashings, gutters, downspouts, trim, moldings, closure strips, preformed crickets, caps, equipment curbs, rib closures, ridge closures, and similar roof accessory items.

C. Roof Panels: Install metal roof panels in accordance with manufacturer's installation instructions, minimizing transverse joints except at junction with penetrations.

D. Insulation: Install insulation between roof covering and supporting members to present a neat appearance; fold, staple, and tape seams unless otherwise approved by Architect.

3.4 CLEANING

A. Clean exposed sheet metal work at completion of installation. Remove grease and oil films, excess joint sealer, handling marks, and debris from installation, leaving the work clean and unmarked, free from dents, creases, waves, scratch marks, or other damage to the finish.

3.5 PROTECTION

A. Do not permit storage of materials or roof traffic on installed roof panels. Provide temporary walkways or planks as necessary to avoid damage to completed work. Protect roofing until completion of project.

B. Touch-up, repair, or replace damaged roof panels or accessories before Date of Substantial Completion.

SECTION 07 42 13
METAL WALL PANELS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured metal panels for exterior wall panels, interior liner panels, soffit panels, and subgirt framing assembly, with insulation, related flashings, and accessory components.

1.2 RELATED REQUIREMENTS

A. Section 07 21 00 - Thermal Insulation.

B. Section 07 92 00 - Joint Sealants: Sealing joints between metal wall panel system and adjacent construction.

1.3 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Wall Assemblies Containing Combustible Components; 2023.

1.4 SUBMITTALS

A. Product Data - Wall System: Manufacturer's data sheets on each product to be used, including:
   1. Physical characteristics of components shown on shop drawings.
   2. Storage and handling requirements and recommendations.
   3. Installation instructions and recommendations.

B. Shop Drawings: Indicate dimensions, layout, joints, construction details, support clips, and methods of anchorage.

C. Samples: Submit two samples of wall panel and soffit panel, 12 inches by 12 inches (305 mm by 305 mm) in size illustrating finish color, sheen, and texture.

D. Test Reports: Submit test report verifying compliance with NFPA 285 for previously-tested exterior wall assembly.

E. Manufacturer's qualification statement.

F. Installer's qualification statement.

G. Warranty Documentation for Installation of Building Rainscreen Assembly: Submit installer warranty and ensure that forms have been completed in Owner's name and registered with installer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in installing products specified in this section 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.

1.6 MOCK-UPS

A. Construct mock-up, 4 feet (____ m) long by 4 feet (____ m) wide; include panel and soffit system, glazing, attachments to building frame, associated vapor retarder and air seal materials, weep drainage system, sealants and seals, _____, and related insulation in mock-up.

B. Mock-up may remain as part of work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Protect panels from accelerated weathering by removing or venting sheet plastic shipping wrap.

C. Store prefinished material off the ground and protected from weather; prevent twisting, bending, or abrasion; provide ventilation; slope metal sheets to ensure proper drainage.

D. Prevent contact with materials that may cause discoloration or staining of products.

1.8 FIELD CONDITIONS

A. Do not install wall panels when air temperature or relative humidity are outside manufacturer's limits.

1.9 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Finish Warranty: Provide 5-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with warrantor.

C. Special Warranty: Provide 2-year warranty covering water tightness and integrity of seals of metal wall panels. Complete forms in Owner's name and register with warrantor.

PART 2 PRODUCTS

2.1 METAL WALL PANEL SYSTEM

A. Wall Panel System: Factory fabricated prefinished metal panel system, site assembled.

1. Provide exterior wall panels, interior liner panels, soffit panels, and subgirt framing assembly.
2. Design and size components to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of wall.
3. Design Pressure: In accordance with applicable codes.
4. Fire Performance: Tested in accordance with, and complying with acceptance criteria of NFPA 285.
5. Maximum Allowable Deflection of Panel: L/180 for length(L) of span.
6. Movement: Accommodate movement within system without damage to components or deterioration of seals, movement between system and perimeter components when subject to seasonal temperature cycling; dynamic loading and release of loads; and deflection of structural support framing.
7. Drainage: Provide positive drainage to exterior for moisture entering or condensation occurring within panel system.
8. Fabrication: Formed true to shape, accurate in size, square, and free from distortion or defects; pieces of longest practical lengths.
9. Corners: Factory-fabricated in one continuous piece with minimum 2-inch (51 mm) returns.

B. Exterior Wall Panels:
1. Profile: Vertical; style as indicated.
2. Side Seams: Double-interlocked, tight-fitting, sealed with continuous gaskets.
3. Material: Precoated steel sheet, 22 gauge, 0.0299 inch (0.76 mm) minimum thickness.
4. Panel Width: 48 inches (___ mm).
5. Color: As selected by Architect from manufacturer's standard line.

C. Interior Liner Panels:
1. Profile: Vertical; style as indicated.
2. Side Seams: Interlocking, sealed with continuous bead of sealant.
3. Material: Precoated steel sheet, 18 gauge, 0.0478 inch (1.21 mm) minimum thickness.
4. Panel Width: 48 inch (___ mm).
5. Color: As selected by Architect from manufacturer's standard line.

D. Soffit Panels:
1. Profile: Style as indicated, with venting provided.

E. Subgirt Framing Assembly:
1. 16 gauge, 0.0598 inch (1.52 mm) thick formed non-precoated steel sheet.
2. Profile as indicated; to attach panel system to building.

F. Internal and External Corners: Same material, thickness, and finish as exterior sheets; profile to suit system; shop cut and factory mitered to required angles.

G. Expansion Joints: Same material, thickness and finish as exterior sheets; ___ gauge, ___ inch (___ mm) thick; manufacturer's standard brake formed type, of profile to suit system.

H. Trim: Same material, thickness and finish as exterior sheets; brake formed to required profiles.

I. Anchors: Galvanized steel.

2.2 MATERIALS

A. Precoated Steel Sheet: Hot-dipped galvanized steel sheet, ASTM A653/A653M, Structural Steel (SS) or Forming Steel (FS), with G90/Z275 coating; continuous coil-coated on exposed surfaces with specified finish coating and on panel back with specified panel back coating.

B. Insulation: Glass fiber type; see Section 07 21 00.

2.3 FINISHES

A. Fluoropolymer Coil Coating System: Polyvinylidene fluoride (PVDF) multi-coat superior performing organic coatings system complying with AAMA 2605, including at least 70 percent PVDF resin, and at least 80 percent of coil coated aluminum surfaces having minimum total dry film thickness (DFT) of 0.9 mil, 0.0009 inch (0.023 mm); color and gloss as selected by Architect from manufacturer’s standard line.

2.4 ACCESSORIES

A. Cladding Support Clips: Thermally-broken, thermal spacer clips for support of cladding z-girts, angles, channels, and other framing.
   1. Galvanized Steel Support Clip: G90/Z275 galvanized coating complying with ASTM A653/A653M support clip with integral glass fiber reinforced polyamide thermal isolator pad.

B. Gaskets: Manufacturer's standard type suitable for use with system, permanently resilient; ultraviolet and ozone resistant.

C. Concealed Sealants: Non-curing butyl sealant or tape sealant, see Section 07 92 00

D. Exposed Sealant: Elastomeric; silicone, polyurethane, or silyl-terminated polyether/polyurethane.

E. Fasteners: Manufacturer's standard type to suit application; with soft neoprene washers, steel, hot dip galvanized. Fastener cap same color as exterior panel.
   1. Metal-to-Metal Fasteners: Self-drilling, self-tapping screws.

F. Field Touch-up Paint: As recommended by panel manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that building framing members are ready to receive panels.

3.2 PREPARATION

A. Install subgirts perpendicular to panel length, securely fastened to substrates and shimmed and leveled to uniform plane, and spaced at intervals indicated.

3.3 INSTALLATION

A. Install panels on walls and soffits in accordance with manufacturer's instructions.

B. Fasten panels to structural supports; aligned, level, and plumb.

C. Lap panel ends 2 inches (51 mm), minimum.

D. Use concealed fasteners unless otherwise indicated by Architect.

E. Seal and place gaskets to prevent weather penetration. Maintain neat appearance.

3.4 TOLERANCES

A. Offset From True Alignment Between Adjacent Members Abutting or In Line: 1/16 inch (1.6 mm), maximum.

B. Variation from Plane or Location As Indicated on Drawings: 1/4 inch (6.4 mm), maximum.

3.5 CLEANING

A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.

B. Remove site cuttings from finish surfaces.

C. Remove protective material from wall panel surfaces.

D. Clean and wash prefinished surfaces with mild soap and water; rinse with clean water.

3.6 PROTECTION

A. Protect metal wall panels until completion of project.

B. Touch-up, repair, or replace damaged wall panels or accessories before Date of Substantial Completion.

SECTION 07 62 00
SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fabricated sheet metal items, including flashings, counterflashings, gutters, downspouts, sheet metal roofing, exterior penetrations, _____, and other items indicated in Schedule.

B. Sealants for joints within sheet metal fabrications.

C. Precast concrete splash pads.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood nailers for sheet metal work.

B. Section 07 71 23 - Manufactured Gutters and Downspouts.

C. Section 07 92 00 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. ASTM B370 - Standard Specification for Copper Sheet and Strip for Building Construction; 2022.

C. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

D. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2018).

E. CDA A4050 - Copper in Architecture - Handbook; current edition.

F. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples, 6 by ___ inches (6 by ___ mm) in size, illustrating metal finish color.

1.5 QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with 3 years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

C. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1 SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24-gauge, 0.0239-inch (0.61 mm) thick base metal, shop pre-coated with PVDF coating.
   1. Fluoropolymer Coating: High performance organic powder coating, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by Architect from manufacturer's standard colors.

B. Anodized Aluminum: ASTM B209/B209M; 20 gauge, 0.032 inch (0.81 mm) thick; clear anodized finish.
   1. Color Anodized Finish: AAMA 611, AA-M12C22A42/44, Class I, integrally or electrolytically colored anodic coating not less than 0.7 mil, 0.0007 inch (0.018 mm) thick.
      a. Color: As selected by Architect from manufacturer's standard colors.

C. Pre-Finished Aluminum: ASTM B209/B209M; 18 gauge, 0.040 inch (1.02 mm) thick; plain finish shop pre-coated with silicone modified polyester coating.
   1. Fluoropolymer Coating: High performance organic powder coating, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system.
   2. Color: As selected by Architect from manufacturer's standard colors.

D. Copper: ASTM B370, cold rolled 16 oz/sq ft, 24 gauge, 0.0216 inch (0.55 mm) thick; natural finish.

2.2 FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch (13 mm); miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18-inch (450 mm) long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches (50 mm) over roofing gravel. Return and brake edges.

2.3 GUTTER AND DOWNSPOUT FABRICATION

A. Gutters: SMACNA (ASMM) Rectangular profile.

B. Downspouts: Rectangular profile.

C. Gutters and Downspouts: Size indicated.

D. Accessories: Profiled to suit gutters and downspouts.
   1. Anchorage Devices: In accordance with SMACNA (ASMM) requirements.
   2. Gutter Supports: Brackets.
   3. Downspout Supports: Brackets.

E. Splash Pads: Precast concrete type, of size and profiles indicated; minimum 3,000 psi (21 MPa) at 28 days, with minimum 5 percent air entrainment.

F. Downspout Boots: Steel.

G. Downspout Extenders: Same material and finish as downspouts.

H. Seal metal joints.

2.4 EXTERIOR PENETRATION FLASHING PANELS

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.

2.5 ACCESSORIES

A. Concealed Sealants: Non-curing butyl sealant.

B. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

C. Fenestration Perimeter Flashing Attachments: Two-piece flashing receiver and clip of extruded aluminum, at least 0.045 inch (1.14 mm) thick, for attaching flashing at perimeter of exterior wall fenestration openings.
   1. Provide flashing receiver profile appropriate for flashing applications.

D. Asphalt Roof Cement: ASTM D4586/D4586M, Type I, asbestos-free.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2 PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Install surface mounted reglets true to lines and levels, and seal top of reglets with sealant.

3.3 INSTALLATION

A. Comply with drawing details.

B. Insert flashings into reglets to form tight fit; secure in place with lead wedges; pack remaining spaces with lead wool; seal flashings into reglets with sealant.

C. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

D. Apply plastic cement compound between metal flashings and felt flashings.

E. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

F. Exterior Flashing Receivers: Install in accordance with manufacturer's recommendations, and in proper relationship with adjacent construction, and as follows:

G. Seal metal joints watertight.

H. Connect downspouts to downspout boots, and grout connection watertight.

I. Set splash pads under downspouts, and set in place with _____.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for field inspection requirements.

B. Inspection will involve surveillance of work during installation to ascertain compliance with specified requirements.

SECTION 07 71 00
ROOF SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufactured roof specialties, including copings, fascias, and gravel stops.

1.2 REFERENCE STANDARDS

A. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2022.

C. NRCA (RM) - The NRCA Roofing Manual; 2023.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

D. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

PART 2 PRODUCTS

2.1 COMPONENTS

A. Roof Edge Flashings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
   1. Configuration: Fascia, cant, and edge securement for roof membrane.
   2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test methods RE-1 and RE-2 to positive and negative design wind pressure as defined by applicable local building code.
   3. Material: Formed steel sheet, galvanized, 24 gauge, 0.024 inch (0.6 mm) thick, minimum.
   4. Finish: 70 percent polyvinylidene fluoride.
   5. Color: To be selected by Architect from manufacturer's standard range.

B. Copings: Factory fabricated to sizes required; corners mitered; concealed fasteners.
   1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness, and finish as cap; concealed stainless steel fasteners.
   2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
   3. Material: Formed steel sheet, galvanized, 24 gauge, 0.024 inch (0.6 mm) thick, minimum.
   4. Finish: 70 percent polyvinylidene fluoride.
   5. Color: To be selected by Architect from manufacturer's standard range.

C. Pipe and Penetration Flashing: Base of rounded aluminum, compatible with sheet metal roof systems, and capable of accomodating pipes sized between 3/8 inch (9.5 mm) and 12 inches (305 mm).
   1. Caps: EPDM.
   2. Color: As indicated on drawings.

D. Roof Penetration Sealing Systems: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.

E. Engineered Roof Perimeter Blocking: Prefabricated 20-gauge, 0.036-inch (0.91 mm) galvanized steel retainer for lightweight concrete; with cleat to accept copings; attach to roof deck in lieu of wood blocking at roof edge; for low slope roof installations.

F. Pipe Penetration Wall Seal: Seal for HVAC piping wall penetrations with wall mounted rigid plastic outlet cover and elastomeric wall seal gasket.

G. Pipe Penetration Wall Seal and Insulated Piping Protection System: Seal for HVAC piping wall penetrations with wall mounted rigid plastic outlet cover and elastomeric wall seal gasket and having mechanical line insulation with PVC protective cover.

2.2 FINISHES

A. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

2.3 ACCESSORIES

A. Sealant for Joints in Linear Components: As recommended by component manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Seal joints within components when required by component manufacturer.

C. Anchor components securely.

D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

SECTION 07 71 23
MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pre-finished aluminum gutters and downspouts.

1.2 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Downspout boots.

B. Section 07 62 00 - Sheet Metal Flashing and Trim.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Comply with applicable code for size and method of rain water discharge.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on prefabricated components.

C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

D. Samples: Submit two samples, 12 inch (____ mm) long illustrating component design, finish, color, and configuration.

1.6 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

C. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.1 MATERIALS

A. Pre-Finished Galvanized Steel Sheet: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 0.02 inch (0.6 mm) thick base metal.
   1. Finish: Shop pre-coated with modified silicone coating.
   2. Color: As indicated.

B. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M); 0.032 inch (0.8 mm) thick.
   1. Color: As indicated.

2.2 COMPONENTS

A. Gutters: CDA rectangular style profile.

B. Downspouts: CDA Rectangular profile.

C. Anchors and Supports: Profiled to suit gutters and downspouts.
   1. Anchoring Devices: In accordance with CDA requirements.
   2. Gutter Supports: Brackets.
   3. Downspout Supports: Brackets.

D. Fasteners: Galvanized steel , with soft neoprene washers.

2.3 FABRICATION

A. Form gutters and downspouts of profiles and size indicated.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

2.4 FINISHES

A. Class II Color Anodized Finish: AAMA 611 AA-M12C22A41, integrally colored anodic coating not less than 0.4 mil, 0.0004 inch (0.010 mm) thick.

B. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604, multiple coat, thermally cured fluoropolymer finish system; color as indicated.

2.5 ACCESSORIES

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.2 PREPARATION

3.3 INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Sheet Metal: Join lengths with formed seams sealed watertight. Flash and seal gutters to downspouts and accessories.

C. Slope gutters 1/4 inch per foot (____ mm/m) .

SECTION 07 72 00
ROOF ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof curbs.

B. Equipment rails.

C. Roof penetrations mounting curbs.

D. Snow guards.

1.2 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim: Roof accessory items fabricated from sheet metal.

B. Section 07 71 00 - Roof Specialties: Other manufactured roof items.

C. Section 07 71 23 - Manufactured Gutters and Downspouts.

1.3 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Installation methods.
   4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.
   1. Snow Guards: Submit design calculations for loadings and spacings based on manufacturer testing.
   2. Submit shop drawings sealed and signed by a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

D. Warranty Documentation:
   1. Submit manufacturer warranty.

2. Ensure that forms have been completed in Owner's name and registered with manufacturer.
3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.5 DELIVERY, STORAGE, AND HANDLING

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Store products in manufacturer's unopened packaging until ready for installation.

C. Store products under cover and elevated above grade.

1.6 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1 ROOF CURBS

A. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.
   1. Applications: Roof curbs used for roof penetrations/openings as indicated on drawings.
   2. Roof Curb Mounting Substrate: Curb substrate consists of standing seam metal roof panel system.
   3. Sheet Metal Material:
      a. Galvanized Steel: Hot-dip zinc coated steel sheet complying with ASTM A653/A653M, SS Grade 33 (230); G60 (Z180) coating designation; 18 gauge, 0.048 inch (1.21 mm) thick.
         1) Color: As selected by Architect from manufacturer's standard line of colors.
   4. Fabricate curb bottom and mounting flanges for installation directly on metal roof panel system to match slope and configuration of system.
      a. Extend side flange to next adjacent roof panel seam and comply with seam configurations and seal connection, providing at least 6 inch (152 mm) clearance between curb and metal roof panel flange allowing water to properly flow past curb.
      b. Where side of curb aligns with metal roof panel flange, attach fasteners on upper slope of flange to curb connection allowing water to flow past below fasteners, and seal connection.
      c. Maintain at least 12 inch (305 mm) clearance from curb, and lap upper curb flange on underside of down sloping metal roof panel, and seal connection.
      d. Lap lower curb flange overtop of down sloping metal roof panel and seal connection.

B. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.
   1. Height Above Finished Roof Surface: 8 inches (203 mm), minimum.

C. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches (400 mm) square unless otherwise indicated.
   1. Height Above Finished Roof Surface: 8 inches (203 mm), minimum.

2.2 SNOW GUARDS

A. Unit Snow Guards: Individual projecting metal shapes, attached to standing seams of roof panel, and mechanically fastened to roof deck.
   1. Projecting Metal Shapes: Zinc plated steel, triangular spike design.
   2. Placement: As indicated on drawings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.4 CLEANING

A. Clean installed work to like-new condition.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

SECTION 07 84 00
FIRESTOPPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.2 RELATED REQUIREMENTS

A. Section 07 05 53 - Fire and Smoke Assembly Identification.

B. Section 09 21 16 - Gypsum Board Assemblies: Gypsum wallboard fireproofing.

1.3 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

B. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).

C. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.

D. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020a.

E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2023a.

F. ITS (DIR) - Directory of Listed Products; Current Edition.

G. FM (AG) - FM Approval Guide; Current Edition.

H. SCAQMD 1168 - Adhesive and Sealant Applications; 1989, with Amendment (2022).

I. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

J. UL (DIR) - Online Certifications Directory; Current Edition.

K. UL (FRD) - Fire Resistance Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

D. Sustainable Design Submittal: Submit VOC content documentation for nonpreformed materials.

E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.5 QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
   1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
   2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at www.icc-es.org will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:
   1. Verification of minimum three years documented experience installing work of this type.

1.6 FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.1 MATERIALS

A. Firestopping Materials: Any materials meeting requirements.

B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.

C. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

D. Fire Ratings: Refer to drawings for required systems and ratings.

2.2 FIRESTOPPING ASSEMBLY REQUIREMENTS

A. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.

B. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
   1. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   2. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

C. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
   1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
   2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
   3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
   4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

2.3 FIRESTOPPING FOR PERIMETER CONTAINMENT

A. Perimeter Joint Systems That Have Movement Capabilities (Dynamic-D):
   1. 2 Hour Construction: UL System CW-D-1004; Specified Technologies Inc. AS200 Elastomeric Spray.
   2. 2 Hour Construction: UL System CW-D-1004; Specified Technologies Inc. Fast Tack Firestop Spray.
   3. 2 Hour Construction: UL System CW-D-1011; Specified Technologies Inc. Fast Tack Firestop Spray.
   4. 2 Hour Construction: UL System CW-D-2042; Specified Technologies Inc. Fast Tack Firestop Spray.

2.4 FIRESTOPPING FOR FLOOR-TO-FLOOR, FLOOR-TO-WALL, HEAD-OF-WALL, AND WALL-TO-WALL JOINTS

A. Gypsum Board Walls:
   1. Wall-to-Wall Joints That Have Movement Capabilities (Dynamic-D):
      a. 2 Hour Construction: UL System WW-D-0180; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
      b. 2 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.

2.5 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS

A. Blank Openings:
   1. 2 Hour Construction: UL System W-L-0020; Specified Technologies Inc. Composite Sheet.
   2. 2 Hour Construction: UL System W-L-0032; Specified Technologies Inc. FP Intumescent Firestop Plug.

3. 2 Hour Construction: UL System W-L-0038; Specified Technologies Inc. FP Intumescent Firestop Plug.
4. 2 Hour Construction: UL System W-L-3334; Hilti CP 653 Speed Sleeve.

B. Penetrations By:
1. Multiple Penetrations in Large Openings:
   a. 2 Hour Construction: UL System W-L-1408; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   b. 2 Hour Construction: UL System W-L-8013; Hilti CFS-BL Firestop Block.
   c. 2 Hour Construction: UL System W-L-8025; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
   d. 2 Hour Construction: UL System W-L-8050; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
   e. 2 Hour Construction: UL System W-L-8071; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   f. 2 Hour Construction: UL System W-L-8073; Specified Technologies Inc. Composite Sheet.
   g. 2 Hour Construction: UL System W-L-8079; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. Uninsulated Metallic Pipe, Conduit, and Tubing:
   a. 2 Hour Construction: UL System W-L-1054; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   b. 2 Hour Construction: UL System W-L-1164; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   c. 2 Hour Construction: UL System W-L-1222; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
   d. 2 Hour Construction: UL System W-L-1477; Specified Technologies Inc. EZ Firestop Grommet.
   e. 2 Hour Construction: UL System W-L-1506; Hilti CFS-D Firestop Cable Disc.
3. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
   a. 2 Hour Construction: UL System W-L-2048; Specified Technologies Inc. SSW Wrap Strips.
   b. 2 Hour Construction: UL System W-L-2074; Specified Technologies Inc. SSC Collars.
   c. 2 Hour Construction: UL System W-L-2128; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   d. 2 Hour Construction: UL System W-L-2237; Specified Technologies Inc. LCC Intumescent Firestop Collars.
4. Electrical Cables Not In Conduit:
   a. 2 Hour Construction: UL System W-L-3065; Hilti FS-ONE MAX Intumescent Firestop Sealant, CP 606 Flexible Firestop Sealant, CD 601S Elastomeric Firestop Sealant, or CP 618 Firestop Putty Stick.
   b. 2 Hour Construction: UL System W-L-3076; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
   c. 2 Hour Construction: UL System W-L-3390; Specified Technologies Inc. EZ-Path Series 44 Fire-Rated Pathway.
   d. 2 Hour Construction: UL System W-L-3395; Hilti CP653 Speed Sleeve.
   e. 2 Hour Construction: UL System W-L-3395; Hilti CFS-SL SK Firestop Sleeve Kit.

5. Cable Trays with Electrical Cables:
   a. 2 Hour Construction: UL System W-L-4008; Specified Technologies Inc. SSB Intumescent Firestop Pillows.
   b. 2 Hour Construction: UL System W-L-4011; Hilti CFS-BL Firestop Block.
   c. 2 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.
6. Insulated Pipes:
   a. 2 Hour Construction: UL System W-L-5014; Specified Technologies Inc. SSS Intumescent Firestop Sealant.
   b. 2 Hour Construction: UL System W-L-5028; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   c. 2 Hour Construction: UL System W-L-5029; Hilti FS-ONE Intumescent Firestop Sealant.
   d. 2 Hour Construction: UL System W-L-5121; Specified Technologies Inc. LCI Intumescent Firestop Sealant.
7. HVAC Ducts, Insulated:
   a. 2 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.
   b. 2 Hour Construction: UL System W-L-7164; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.
   c. 2 Hour Construction: UL System W-L-7238; Specified Technologies Inc. FyreFlange HVAC Firestop Angle.

2.6 FIRESTOPPING SYSTEMS

A. Firestopping: Any material meeting requirements.
   1. Fire Ratings: See drawings for required systems and ratings.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.3 INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Install labeling required by code.

3.4 FIELD QUALITY CONTROL

A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174 and ASTM E2393.

B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

3.5 CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.6 PROTECTION

A. Protect adjacent surfaces from damage by material installation.

SECTION 07 91 00
PREFORMED JOINT SEALS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Precompressed foam seals.

B. Compression gaskets.

C. Preformed strip seals.

1.2 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Liquid and mastic joint sealants and their backing materials.

1.3 REFERENCE STANDARDS

A. ASTM D2240 - Standard Test Method for Rubber Property--Durometer Hardness; 2015 (Reapproved 2021).

B. ASTM D2628 - Standard Specification for Preformed Polychloroprene Elastomeric Joint Seals for Concrete Pavements; 1991 (Reapproved 2016).

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's technical data sheets for each product, including chemical composition, movement capability, color availability, limitations on application, and installation instructions.

C. Samples for Color Selection: 4 inch (102 mm) long pieces of each color available; at least 2 samples of each color.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section with at least three years of documented experience.

1.6 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a two year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealers that fail to achieve watertight seal or exhibit loss of adhesion or cohesion.

PART 2 PRODUCTS

2.1 PRECOMPRESSED FOAM SEALS

A. Precompressed Foam Seal: Comprised of urethane, modified-acrylic impregnated, open-cell polyurethane, or closed-cell neoprene foam impregnated with water-repellent, and with self-adhesive faces protected prior to installation by release paper.
   1. Color: Black.
   2. Size as required to provide water-tight seal when installed.

2.2 COMPRESSION GASKETS

A. Compression Gasket: Extruded hollow polychloroprene (neoprene) gasket complying with ASTM D2628; not requiring blockout recess in substrate; not requiring vacuum to collapse seal for installation.
   1. Color: Black.
   2. Durometer Hardness, Type A: Within 55 to 65, when tested in accordance with ASTM D2240.
   3. Calculate size in accordance with manufacturer's recommendations.

2.3 PREFORMED STRIP SEALS

A. Preformed Strip Seal: Factory formed profile for adhered application to face of joint substrate.
   1. Measure size of existing joints before selecting seal width.
   2. Provide compatible materials for application as recommended by manufacturer.

2.4 ACCESSORIES

A. Adhesive: As recommended by seal manufacturer.

B. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and strip seal.

C. Substrate Cleaner: Non-corrosive, non-staining type recommended by seal manufacturer; compatible with joint forming materials.

D. Primer: Type recommended by seal manufacturer to suit application; non-staining.

E. Backing Tape: Self-adhesive polyethylene tape with surface that seal will not adhere to.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joints are ready to receive this work.

B. Measure joint dimensions and verify that seal products are of the correct size to properly seal the joints.

3.2 PREPARATION

A. Properly prepare construction components adjacent to the work of this section to prevent damage and disfigurement due to this work.

3.3 INSTALLATION

A. Install in accordance with manufacturer's written instructions.

B. Precompressed Foam Seals:
   1. Install only when ambient temperature is within recommended application temperature range of adhesive. Consult manufacturer when installing outside this temperature range.
   2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
   3. Remove loose materials and foreign matter that could impair adhesion of sealant.
   4. Do not stretch precompressed seal; avoid joints except at corners, ends, and intersections; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

C. Compression Gaskets:
   1. Install only when ambient temperature is within recommended application temperature range of adhesive. Consult manufacturer when installing outside this temperature range.
   2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
   3. Remove loose materials and foreign matter that could impair adhesion of sealant.
   4. Avoid joints except at ends, corners, and intersections; seal joints with adhesive; install with face 1/8 to 1/4 inch (3 to 6 mm) below adjoining surface.

D. Preformed Strip Seals:
   1. Install when ambient temperature is within recommended application temperature range of adhesive, and consult with manufacturer before installing outside this temperature range.
   2. Prepare joints and install seals in accordance with manufacturer's written recommendations.
   3. Remove loose materials and foreign matter that could impair adhesion.
   4. When installing over existing non-functioning sealant, remove portions of existing installation that protrude beyond surface; install backing tape on surface of existing sealant installation to prevent adhesion of strip seal.

3.4 CLEANING

A. Clean adjacent soiled surfaces.

3.5 PROTECTION

A. Protect joints from damage until adhesives have properly cured.

SECTION 07 92 00
JOINT SEALANTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.2 RELATED REQUIREMENTS

A. Section 07 84 00 - Firestopping: Firestopping sealants.

B. Section 07 91 00 - Preformed Joint Seals: Precompressed foam, gaskets, and strip seals.

C. Section 08 71 00 - Door Hardware: Setting exterior door thresholds in sealant.

D. Section 08 80 00 - Glazing: Glazing sealants and accessories.

E. Section 09 21 16 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

F. Section 09 22 16 - Non-Structural Metal Framing: Sealing between framing and adjacent construction in acoustical and sound-rated walls and ceilings.

1.3 REFERENCE STANDARDS

A. ASTM C834 - Standard Specification for Latex Sealants; 2017.

B. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

D. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2022.

E. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2022.

F. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.

2. List of backing materials approved for use with the specific product.
3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
4. Substrates the product should not be used on.
5. Substrates for which use of primer is required.
6. Substrates for which laboratory adhesion and/or compatibility testing is required.
7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
8. Sample product warranty.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

1.5 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

1.6 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

PART 2 PRODUCTS

2.1 JOINT SEALANT APPLICATIONS

A. Scope:
1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.

a. Wall expansion and control joints.
b. Joints between door, window, and other frames and adjacent construction.
c. Openings below ledge angles in masonry.

2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
   a. Joints between door, window, and other frames and adjacent construction.
   b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
3. Do not seal the following types of joints.
   a. Intentional weepholes in masonry.
   b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
   c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
   d. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
1. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
2. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.

D. Interior Wet Areas: Bathrooms, restrooms, kitchens, and custodial closets; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

2.2 JOINT SEALANTS - GENERAL

2.3 NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Color: To be selected by Architect from manufacturer's standard range.

B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percent, minimum.
2. Color: To be selected by Architect from manufacturer's standard range.
3. Cure Type: Single-component, neutral moisture curing

C. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: White.

D. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.
1. Movement Capability: Plus and minus 25 percent, minimum.

2. Color: To be selected by Architect from manufacturer's standard range.

E. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: To be selected by Architect from manufacturer's standard range.

F. Acrylic Latex Sealant: ASTM C834; for use as acoustical sealant and in firestopping systems for expansion joints and through penetrations.
1. Color: Standard colors matching finished surfaces.
2. Fire Rated System: Complies with UL 263 and ASTM E119 with UL fire resistance classifications.

G. Butyl Sealant: Solvent-based; ASTM C1311; single component, nonsag; not expected to withstand continuous water immersion or traffic.
1. Color: To be selected by Architect from manufacturer's standard range.

2.4 SELF-LEVELING SEALANTS

A. Self-Leveling Silicone Sealant: ASTM C920, Grade P, Uses M and A; single or multicomponent, explicitly approved by manufacturer for traffic exposure when recessed below traffic surface; not expected to withstand continuous water immersion.

B. Self-Leveling Polyurethane Sealant for Horizontal Expansion Joints: ASTM C920, Grade P, Uses T, M, and O; multi-component; explicitly approved by manufacturer for horizontal expansion joints.
1. Color: To be selected by Architect from manufacturer's standard range.

2.5 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.
1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.2 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.3 INSTALLATION

A. Perform installation in accordance with ASTM C1193.

B. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer.

C. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

D. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

E. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

SECTION 08 11 13
HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Fire-rated hollow metal doors and frames.

C. Thermally insulated hollow metal doors with frames.

D. Hollow metal borrowed lites glazing frames.

E. Accessories, including glazing, louvers, and matching panels.

1.2 RELATED REQUIREMENTS

A. Section 08 71 00 - Door Hardware.

B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.

C. Section 09 91 13 - Exterior Painting: Field painting.

D. Section 09 91 23 - Interior Painting: Field painting.

1.3 ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. ASCE: American Society of Civil Engineers.

C. HMMA: Hollow Metal Manufacturers Association.

D. NAAMM: National Association of Architectural Metal Manufacturers.

E. NFPA: National Fire Protection Association.

F. SDI: Steel Door Institute.

G. UL: Underwriters Laboratories.

1.4 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2018.

C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2015.

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2020.

F. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

G. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

H. ASTM A879/A879M - Standard Specification for Steel Sheet, Zinc Coated by the Electrolytic Process for Applications Requiring Designation of the Coating Mass on Each Surface; 2022.

I. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.

J. ASTM A1011/A1011M - 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; 2018a.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

M. ITS (DIR) - Directory of Listed Products; Current Edition.

N. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2007.

O. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

P. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

Q. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2022.

R. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

S. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

T. UL (DIR) - Online Certifications Directory; Current Edition.

U. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

V. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Samples: Submit two samples of metal, 2 by 2 inches (51 by 51 mm) in size, showing factory finishes, colors, and surface texture.

E. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.

F. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

G. Manufacturer's Qualification Statement.

H. Installer's Qualification Statement.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

C. Maintain at project site copies of reference standards relating to installation of products specified.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:
   1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
   2. Accessibility: Comply with ICC A117.1 and ADA Standards.
   3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
   4. Door Edge Profile: Manufacturers standard for application indicated.
   5. Typical Door Face Sheets: Flush.

6. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.2 HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 2 - Heavy-duty.
    b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 1 - Full Flush.
    d. Door Face Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
    e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
2. Door Core Material: Polyurethane, 1.8 lbs/cu ft minimum density.
    a. Foam Plastic Insulation: Manufacturer's standard board insulation with maximum flame spread index (FSI) of 75, and maximum smoke developed index (SDI) of 450 in accordance with ASTM E84, and completely enclosed within interior of door.
3. Door Thermal Resistance: R-Value of 8.7, minimum, for installed thickness of polyurethane.
4. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
5. Weatherstripping: Refer to Section 08 71 00.
6. Door Finish: Factory primed and field finished.

B. Interior Doors, Non-Fire-Rated:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 2 - Heavy-duty.
    b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    c. Model 1 - Full Flush.
    d. Door Face Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
2. Door Core Material: Manufacturers standard core material/construction and in compliance with requirements.
3. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
4. Door Finish: Factory primed and field finished.

C. Fire-Rated Doors:
1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    a. Level 2 - Heavy-duty.

b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.

2. Fire Rating: As indicated on Door Schedule, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Temperature-Rise Rating (TRR) Across Door Thickness: In accordance with local building code and authorities having jurisdiction.
4. Provide units listed and labeled by UL (DIR) or ITS (DIR).
   a. Attach fire rating label to each fire rated unit.
5. Smoke and Draft Control Doors (Indicated with letter "S" on Drawings and/or Door Schedule): Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall construction rated the same or greater than the fire-rated doors, and the following;
   a. Maximum Air Leakage: 3.0 cfm/sq ft (0.02 cu m/sec/sq m) of door opening at 0.10 inch w.g. (24.9 Pa) pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
   b. Gasketing: Provide gasketing or edge sealing as necessary to achieve leakage limit.
   c. Label: Include the "S" label on fire-rating label of door.
6. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
7. Door Thickness: 1-3/4 inches (44.5 mm), nominal.
8. Door Finish: Factory primed and field finished.

2.3 HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Exterior Door Frames: Face welded type.
   1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.
   2. Frame Metal Thickness: 16 gauge, 0.053 inch (1.3 mm), minimum.
   3. Frame Finish: Factory primed and field finished.
   4. Weatherstripping: Separate, see Section 08 71 00.

C. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
   1. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
   2. Frame Finish: Factory primed and field finished.

D. Door Frames, Fire-Rated: Face welded type.
   1. Fire Rating: Same as door, labeled.
   2. Frame Metal Thickness: 18 gauge, 0.042 inch (1.0 mm), minimum.
   3. Frame Finish: Factory primed and field finished.

E. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

2.4 FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

2.5 ACCESSORIES

A. Frame Anchors
   1. Jamb Anchors
      a. Type: Anchors of minimum size and type required by applicable door and frame standard, and suitable for performance level indicated above.
         1) Stud-Wall Type: Designed to engage stud, welded to back of frames; not less than 0.042 inch (1.0668 mm) thick.
      b. 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.
         1) Head Anchors: Two Anchors per head for frames more than 42 inches wide and mounted in metal-stud partitions.
   2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor.
   3. 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
   4. Material: ASTM A879/A879M , Commercial Series, 04Z coating designation; mill phosphatized.
      a. For anchors built into exterior walls, steel sheet complying with ASTM A1008/A1008M or ASTM A1011/A1011M ; hot-dip galvanized according to ASTM A153/A153M , Class B.

B. Door Window Frames: Door window frames with glazing securely fastened within door opening.
   1. Frame Material: 18 gauge, 0.0478 inch (1.21 mm), galvanized steel.

C. Glazing: As specified in Section 08 80 00, factory installed.

D. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

E. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

F. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.2 PREPARATION

3.3 INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Install door hardware as specified in Section 08 71 00.
   1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

E. Comply with glazing installation requirements of Section 08 80 00.

F. Coordinate installation of electrical connections to electrical hardware items.

G. Touch up damaged factory finishes.

3.4 TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch (1.6 mm) measured with straight edge, corner to corner.

3.5 ADJUSTING

A. Adjust for smooth and balanced door movement.

3.6 SCHEDULE

A. Refer to Door and Frame Schedule on the drawings.

SECTION 08 33 23
OVERHEAD COILING DOORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Exterior coiling doors.

B. Fire-rated coiling doors.

C. Electric operators and control stations.

D. Wiring from electric circuit disconnect to operators and control stations.

1.2 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

B. Section 08 71 00 - Door Hardware: Cylinder cores and keys.

C. Section 09 91 13 - Exterior Painting: Field paint finish.

D. Section 09 91 23 - Interior Painting: Field paint finish.

E. Section 26 05 33.13 - Conduit for Electrical Systems: Conduit from electric circuit to operator and from operator to control station.

F. Section 26 05 33.13 - Conduit for Electrical Systems: Conduit from fire alarm system.

G. Section 26 05 83 - Wiring Connections: Power to disconnect.

H. Section 28 46 00 - Fire Detection and Alarm: Fire alarm interconnection.

1.3 REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

B. ITS (DIR) - Directory of Listed Products; Current Edition.

C. NEMA EN 10250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2024.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2008 (Reaffirmed 2020).

E. NEMA MG 00001 - Motors and Generators; 2024.

F. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

G. UL (DIR) - Online Certifications Directory; Current Edition.

H. UL 325 - Standard for Door, Drapery, Gate, Louver, and Window Operators and Systems; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general construction, electrical equipment, and component connections and details.

C. Shop Drawings: Indicate pertinent dimensioning, anchorage methods, hardware locations, and installation details.

D. Samples: Submit two slats, 6 by 6 inches (___ by ___ mm) in size illustrating shape, color and finish texture.

E. Manufacturer's Installation Instructions: Indicate installation sequence and procedures, adjustment and alignment procedures.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years documented experience.

C. Products Requiring Electrical Connection: Listed and classified by ITS (DIR), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for purpose specified.

1.6 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer Warranty: Provide five-year manufacturer warranty for three-ply multifilament polyester fabric curtain. Complete forms in Owner's name and register with manufacturer.

C. Manufacturer Warranty: Provide lifetime manufacturer warranty for counterweights and tension springs. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Overhead Coiling Doors:

1. Wayne-Dalton, a Division of Overhead Door Corporation; ____: www.wayne-dalton.com/#sle.
2. Basis of Design, not to exclude others. Overhead Door Corporation; Model 422: https://www.overheaddoor.com/.

B. Overhead Coiling Fire Doors:
1. Basis of Design, not to exclude others. Overhead Door Corporation; FireKing, Model 631: https://www.overheaddoor.com/.

2.2 COILING DOORS

A. Exterior Coiling Doors: Steel slat curtain.
1. Capable of withstanding positive and negative wind loads of 20 psf (940 Pa) without undue deflection or damage to components.
2. Sandwich slat construction with insulated core of foamed-in-place polyurethane insulation; minimum R-value of 8.1 (RSI-value of 1.43).
a. Vision Lites: Dual pane glazed.
1) Material: Manufacturer's standard polycarbonate sheet with proprietary abrasion resistant surfaces.
2) Spacing: Manufacturer's standard for door width.
3) Location on Door Curtain: As indicated on drawings.
3. Finish: Factory painted, white color.
4. Hood Enclosure: Manufacturer's standard; primed steel.
5. Electric operation.
6. Mounting: Within framed opening.

B. Fire-Rated Coiling Doors: Steel slat curtain; comply with NFPA 80.
1. 1 hour fire rating.
2. Provide products listed and labeled by ITS (DIR) or UL (DIR) as suitable for purpose specified and indicated on drawings.
3. Oversized Openings: Provide certificate of compliance from authorities having jurisdiction indicating approval of fire rated units and operating hardware assembly.
4. Finish: Factory painted, color as selected.
5. Coiling Door Release Mechanism: Fire alarm system activated with automatically governed closing speed.
6. Electric operation.
7. Mounting: Within framed opening.

2.3 MATERIALS AND COMPONENTS

A. Metal Curtain Construction: Interlocking slats.
1. Curtain Bottom for Slat Curtains: Fitted with angles to provide reinforcement and positive contact in closed position.
2. Weatherstripping for Exterior Doors: Moisture and rot proof, resilient type, located at jamb edges, bottom of curtain, and where curtain enters hood enclosure of exterior doors.
3. Steel Slats: Minimum thickness, ___ gauge, ___ inch (___ mm); ASTM A653/A653M galvanized steel sheet.

B. Guide Construction: Continuous, of profile to retain door in place with snap-on trim, mounting brackets of same metal.

C. Hood Enclosure and Trim: Internally reinforced to maintain rigidity and shape.
   1. Prime painted.

D. Lock Hardware:
   1. For motor operated units, additional lock or latching mechanisms are not required.

2.4 ELECTRIC OPERATION

A. Operator, Controls, Actuators, and Safeties: Comply with UL 325; provide products listed by ITS (DIR), UL (DIR), or testing agency acceptable to authorities having jurisdiction.
   1. Provide interlock switches on motor operated units.
   2. Provide tamperproof operation cycle counter.

B. Electric Operators:
   1. Mounting: Side mounted.
   2. Motor Enclosure:
      a. Exterior Coiling Doors: NEMA MG 00001, Type 4; open drip proof.
      b. Interior Coiling Doors: NEMA MG 00001, Type 1; open drip proof.
   3. Motor Rating: 1/3 HP (250 W); continuous duty.
   4. Motor Voltage: 120 volts, single phase, 60 Hz.
   5. Motor Controller: NEMA ICS 2, full voltage, reversing magnetic motor starter.
   6. Controller Enclosure: NEMA EN 10250, Type 4.
   7. Opening Speed: 12 inches per second (300 mm/sec).
   8. Brake: Manufacturer's standard type, activated by motor controller.
   9. Manual override in case of power failure.
   10. See Section 26 05 83 for electrical connections.

C. Control Station: Provide standard three button, 'Open-Close-Stop' momentary-contact control device for each operator complying with UL 325.
   1. 24 volt circuit.
   2. Surface mounted, at interior door jamb.
   3. Entrapment Protection Devices: Provide sensing devices and safety mechanisms complying with UL 325.
      a. Primary Device: Provide electric sensing edge, wireless sensing, NEMA 1 photo eye sensors, or NEMA 4X photo eye sensors as required with momentary-contact control device.

D. Safety Edge: Located at bottom of coiling door, full width, electro-mechanical sensitized type, wired to stop and reverse door direction upon striking object, hollow neoprene covered.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that opening sizes, tolerances and conditions are acceptable.

3.2 INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install fire-rated doors in accordance with NFPA 80.

C. Use anchorage devices to securely fasten assembly to wall construction and building framing without distortion or stress.

D. Securely and rigidly brace components suspended from structure. Secure guides to structural members only.

E. Fit and align assembly including hardware; level and plumb, to provide smooth operation.

F. Coordinate installation of electrical service with Section 26 05 83.

G. Complete wiring from disconnect to unit components.

H. Complete wiring from fire alarm system.

I. Install enclosure and perimeter trim.

3.3 TOLERANCES

A. Maintain dimensional tolerances and alignment with adjacent work.

B. Maximum Variation From Plumb: 1/16 inch (1.6 mm).

C. Maximum Variation From Level: 1/16 inch (1.6 mm).

D. Longitudinal or Diagonal Warp: Plus or minus 1/8 inch per 10 feet (3.2 mm per 3 m) straight edge.

3.4 ADJUSTING

A. Adjust operating assemblies for smooth and noiseless operation.

3.5 CLEANING

A. Clean installed components.

B. Remove labels and visible markings.

SECTION 08 51 13
ALUMINUM WINDOWS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Extruded aluminum windows with fixed sash and infill panels.

B. Factory glazing.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Rough opening framing.

B. Section 06 10 00 - Rough Carpentry: Wood perimeter shims.

C. Section 07 25 00 - Weather Barriers: Sealing frame to water-resistive barrier installed on adjacent construction.

D. Section 07 92 00 - Joint Sealants: Sealing joints between window frames and adjacent construction.

E. Section 08 80 00 - Glazing.

1.3 REFERENCE STANDARDS

A. AAMA/WDMA/CSA 101/I.S.2/A440 - North American Fenestration Standard/Specification for Windows, Doors, and Skylights; 2017.

B. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

C. AAMA 502 - Voluntary Specification for Field Testing of Newly Installed Fenestration Products; 2012.

D. AAMA 609 & 610 - Cleaning and Maintenance Guide for Architecturally Finished Aluminum (Combined Document); 2015.

E. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

F. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

G. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

H. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

I. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2016).

K. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors; 2002 (Reapproved 2018).

L. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Include component dimensions, information on glass and glazing, internal drainage details, and descriptions of hardware and accessories.

C. Shop Drawings: Indicate opening dimensions, elevations of different types, framed opening tolerances, anchorage locations, and installation requirements.

D. Grade Substantiation: Prior to submitting shop drawings or starting fabrication, submit one of the following showing compliance with specified grade:
1. Evidence of AAMA Certification.
2. Evidence of WDMA Certification.
3. Evidence of CSA Certification.
4. Test report(s) by independent testing agency itemizing compliance and acceptable to authorities having jurisdiction.

E. Test Reports: Prior to submitting shop drawings or starting fabrication, submit test report(s) by independent testing agency showing compliance with performance requirements in excess of those prescribed by specified grade.

F. Manufacturer's Installation Instructions: Include complete preparation, installation, and cleaning requirements.

G. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

H. Manufacturer's qualification statement.

I. Installer's qualification statement.

J. Specimen warranty.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Comply with requirements of AAMA CW-10.

B. Protect finished surfaces with wrapping paper or strippable coating during installation. Do not use adhesive papers or sprayed coatings that bond to substrate when exposed to sunlight or weather.

1.7 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C).

B. Maintain this minimum temperature during and 24 hours after installation of sealants.

1.8 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Correct defective work within a five year period after Date of Substantial Completion.

C. Manufacturer Warranty: Provide 5-year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units. Complete forms in Owner's name and register with manufacturer.

D. Manufacturer Warranty: Provide 20-year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking. Complete forms in Owner's name and register with manufacturer.

PART 2 PRODUCTS

2.1 BASIS OF DESIGN - AW PERFORMANCE CLASS WINDOWS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 having Performance Class of AW, and Performance Grade at least as high as specified design pressure.

B. Fixed, Thermally-Broken:

2.2 ALUMINUM WINDOWS

A. Aluminum Windows: Extruded aluminum frame and sash, factory fabricated, factory finished, with operating hardware, related flashings, and anchorage and attachment devices.
   1. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors; fasteners and attachments concealed from view; reinforced as required for operating hardware and imposed loads.
   2. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
   3. Movement: Accommodate movement between window and perimeter framing and deflection of lintel, without damage to components or deterioration of seals.
   4. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.

B. Fixed, Non-Operable Type:
   1. Construction: Thermally broken.
   2. Glazing: Double; clear; low-e.
   3. Exterior Finish: High performance organic coatings.
   4. Interior Finish: High performance organic coatings.

2.3 PERFORMANCE REQUIREMENTS

A. Grade: AAMA/WDMA/CSA 101/I.S.2/A440 requirements for specific window type:
   1. Performance Class (PC): R.

B. Design Pressure (DP): In accordance with applicable codes.

C. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.

D. Water Leakage: No uncontrolled leakage on interior face when tested in accordance with ASTM E331 at differential pressure of 12.11 psf (580 Pa).

E. Air Leakage: 0.1 cfm/sq ft (0.5 L/sec sq m) maximum leakage per unit area of outside window frame dimension when tested at 1.57 psf (75 Pa) pressure difference in accordance with ASTM E283/E283M.

F. Condensation Resistance Factor of Frame: 50, measured in accordance with AAMA 1503.

G. Overall Thermal Transmittance (U-value): 0.35, maximum, including glazing, measured on window sizes required for this project.

2.4 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

2.5 FINISHES

A. High Performance Organic Coatings: AAMA 2604; multiple-coat, thermally-cured fluoropolymer system.

B. Finish Color: As selected by Architect from manufacturer's standard range.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that wall openings and adjoining water-resistive barrier materials are ready to receive aluminum windows; see Section 07 25 00.

3.2 PRIME WINDOW INSTALLATION

A. Install windows in accordance with manufacturer's instructions.

B. Attach window frame and shims to perimeter opening to accommodate construction tolerances and other irregularities.

C. Align window plumb and level, free of warp or twist. Maintain dimensional tolerances and alignment with adjacent work.

D. Install sill and sill end angles.

E. Provide thermal isolation where components penetrate or disrupt building insulation. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

F. Install glass and infill panels in accordance with requirements; see Section 08 80 00.

3.3 TOLERANCES

A. Maximum Variation from Level or Plumb: 1/16 inches every 3 ft (1.5 mm/m) non-cumulative or 1/8 inches per 10 ft (3 mm/3 m), whichever is less.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

B. Provide field testing of installed aluminum windows by independent laboratory in accordance with AAMA 502 and AAMA/WDMA/CSA 101/I.S.2/A440 during construction process and before installation of interior finishes.
   1. Field test for water penetration in accordance with ASTM E1105 using Procedure B - cyclic static air pressure difference; test pressure shall not be less than 1.9 psf (91 Pa).
   2. Field test for air leakage in accordance with ASTM E783 with uniform static air pressure difference of 1.57 psf (75 Pa).

C. Repair or replace fenestration components that have failed designated field testing, and retest to verify performance complies with specified requirements.

3.5 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

B. Remove protective material from factory finished aluminum surfaces.

C. Upon completion of installation, thoroughly clean aluminum surfaces in accordance with AAMA 609 & 610.

1. SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Hardware for hollow metal doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

D. Lock cylinders for doors that hardware is specified in other sections.

E. Thresholds.

F. Weatherstripping and gasketing.

1.2 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

B. Section 28 10 00 - Access Control: Electronic access control devices.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. BHMA A156.1 - Standard for Butts and Hinges; 2021.

C. BHMA A156.2 - Bored and Preassembled Locks and Latches; 2017.

D. BHMA A156.3 - Exit Devices; 2025.

E. BHMA A156.4 - Door Closers and Pivots; 2024.

F. BHMA A156.5 - Cylinders and Input Devices for Locks; 2020.

G. BHMA A156.7 - Template Hinge Dimensions; 2022.

H. BHMA A156.16 - Standard for Auxiliary Hardware; 2023.

I. BHMA A156.18 - Standard for Materials and Finishes; 2020.

J. BHMA A156.21 - Thresholds; 2025.

K. BHMA A156.22 - Standard for Gasketing; 2021.

L. BHMA A156.23 - Electromagnetic Locks; 2022.

M. BHMA A156.31 - Electric Strikes and Frame Mounted Actuators; 2024.

N. BHMA A156.115 - Hardware Preparation In Steel Doors And Steel Frames; 2016.

O. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

P. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

Q. ITS (DIR) - Directory of Listed Products; Current Edition.

R. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

S. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

T. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

U. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

V. UL (DIR) - Online Certifications Directory; Current Edition.

W. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

C. Keying Requirements Meeting:
   1. Schedule meeting at project site prior to Contractor occupancy.
   2. Attendance Required:
      a. Contractor.
      b. Owner.
      c. Hardware Installer.
      d. Owner's Security Consultant.
   3. Agenda:
      a. Establish keying requirements.
      b. Verify locksets and locking hardware are functionally correct for project requirements.
      c. Verify that keying and programming complies with project requirements.
      d. Establish keying submittal schedule and update requirements.
   4. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
      a. Access control requirements.
      b. Key control system requirements.
   5. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
   6. Deliver established keying requirements to manufacturers.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Provide complete description for each door listed.

D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
   2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
   3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.

E. Samples for Verification:
   1. Submit minimum size of 2 by 4 inch (51 by 102 mm) for sheet samples, and minimum length of 4 inch (102 mm) for other products.
   2. Submit one (1) sample of hinge, latchset, lockset, closer, and _____ illustrating style, color, and finish.
   3. Return full-size samples to Contractor.
   4. Submit product description with samples.

F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

G. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

H. Keying Schedule:
   1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

I. Manufacturer's qualification statement.

J. Installer's qualification statement.

K. Supplier's qualification statement.

L. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.8 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.
   1. Closers: Five years, minimum.
   2. Exit Devices: Three years, minimum.
   3. Locksets and Cylinders: Three years, minimum.
   4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.1 DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Applicable provisions of NFPA 101.
   4. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   5. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), testing firm acceptable to authorities having jurisdiction, or _____ as suitable for application indicated.
   6. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   7. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between

hardware and control components and to building power connection in compliance with NFPA 70.

1. See Section 28 10 00 for additional access control system requirements.

E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. See Door Hardware Schedule.

F. Fasteners:
1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
   a. Aluminum fasteners are not permitted.
   b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
2. Fire-Rated Applications: Comply with NFPA 80.
   a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
   b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.2 HINGES

A. Hinges: Comply with BHMA A156.1, Grade 1.
1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
   a. Provide hinge width required to clear surrounding trim.
2. Provide hinges on every swinging door.
3. Provide following quantity of butt hinges for each door:
   a. Doors From 60 inches (1.5 m) High up to 90 inches (2.3 m) High: Three hinges.

2.3 EXIT DEVICES

A. Exit Devices: Comply with BHMA A156.3, Grade 1.
1. Lever design to match lockset trim.
2. Provide cylinder with cylinder dogging or locking trim.
3. Provide exit devices properly sized for door width and height.
4. Provide strike as recommended by manufacturer for application indicated.
5. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.

2.4 ELECTRIC STRIKES

A. Electric Strikes: Comply with BHMA A156.31, Grade 1.
1. Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.
2. Provide non-handed 24 VDC electric strike suitable for door frame material and scheduled lock configuration.

2.5 ELECTROMAGNETIC LOCKS

A. Electromagnetic Locks: Comply with BHMA A156.23, Grade 1.
1. Voltage: 12 VDC, and provide power supplies by same manufacturer as locks.

2. Mounting: Surface mounted to door and frame on secure side, with fasteners, brackets, and spacer bars as required for application.

2.6 LOCK CYLINDERS

A. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
1. Provide standard, electronic, conventional, full size interchangeable core (FSIC), and small format interchangeable core (SFIC) type cylinders, Grade 1, with six-pin core in compliance with BHMA A156.5 at locations indicated.
2. Provide cylinders from same manufacturer as locking device.
3. Provide cams and/or tailpieces as required for locking devices.

2.7 CYLINDRICAL LOCKS

A. Manufacturers:

B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.
1. Bored Hole: 2-1/8 inch (54 mm) diameter.
2. Backset: 2-3/4 inch (70 mm) unless otherwise indicated.
3. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
a. Finish: To match lock or latch.

2.8 CLOSERS

A. Closers: Comply with BHMA A156.4, Grade 1.
1. Type: Surface mounted to door.
2. Provide door closer on each exterior door.
3. Provide door closer on each fire-rated and smoke-rated door.
a. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.

2.9 WALL STOPS

A. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.
1. Type: Bumper, concave, wall stop.
2. Material: Aluminum housing with rubber insert.

2.10 THRESHOLDS

A. Thresholds: Comply with BHMA A156.21.
1. Provide threshold at interior doors for transition between two different floor types, and over building expansion joints, unless otherwise indicated.
2. Provide threshold at each exterior door, unless otherwise indicated.
3. Type: Flat surface.
4. Material: Aluminum.
5. Threshold Surface: Fluted horizontal grooves across full width.
6. Field cut threshold to profile of frame and width of door sill for tight fit.
7. Provide non-corroding fasteners at exterior locations.

2.11 WEATHERSTRIPPING AND GASKETING

A. Weatherstripping and Gasketing: Comply with BHMA A156.22.
   1. Head and Jamb Type: Adjustable.
   2. Door Sweep Type: Encased in retainer.
   3. Material: Aluminum, with brush weatherstripping.

2.12 FIRE DEPARTMENT LOCK BOX

A. Manufacturers:
   1. Basis of Design: Not to exclude others.
   2. Knox Company; Knox-Box Rapid Entry System: www.knoxbox.com/#sle.

B. Fire Department Lock Box:
   1. Capacity: Holds 10 keys.
   2. Finish: Manufacturer's standard black.

2.13 FINISHES

A. Finishes: Provide door hardware of same finish, unless otherwise indicated.
   1. Primary Finish: 625; bright chromium plated over nickel, with brass or bronze base material (former US equivalent US26); BHMA A156.18.
   2. Secondary Finish: 626; satin chromium plated over nickel, with brass or bronze base material (former US equivalent US26D); BHMA A156.18.
      a. Use secondary finish in kitchens, bathrooms, and other spaces containing chrome or stainless steel finished appliances, fittings, and equipment; provide primary finish on one side of door and secondary finish on other side if necessary.
   3. Exceptions:
      a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.
      b. Hinges for Fire-Rated Doors: Steel base material with painted finish, in compliance with NFPA 80.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of correct characteristics.

3.2 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

C. Use templates provided by hardware item manufacturer.

D. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.
   1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
   2. Mounting heights in compliance with ADA Standards:

E. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.3 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 01 40 00 - Quality Requirements.

3.4 ADJUSTING

A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.5 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

D. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.

3.6 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

PART 4 SCHEDULE

A. See drawings for door hardware schedule.

SECTION 08 80 00
GLAZING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Insulating glass units.

B. Glazing compounds.

1.2 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 08 11 13 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

C. Section 08 51 13 - Aluminum Windows: Glazing provided by window manufacturer.

D. Section 10 28 00 - Toilet, Bath, and Laundry Accessories: Mirrors.

1.3 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

F. ASTM C1036 - Standard Specification for Flat Glass; 2021.

G. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

H. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

I. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2021a.

J. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2016.

K. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2019.

L. GANA (GM) - GANA Glazing Manual; 2008.

M. GANA (SM) - GANA Sealant Manual; 2008.

N. GANA (LGRM) - Laminated Glazing Reference Manual; 2019.

O. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (Reaffirmed 2016).

P. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2017.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data on Insulating Glass Unit, Glazing Unit, Plastic Sheet Glazing Unit, Plastic Film. Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Manufacturer's qualification statement.

E. Installer's qualification statement.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), IGMA TM-3000 for glazing installation methods. Maintain one copy on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.
   1. Provide certified glass products through ANSI accredited certifications that include plant audits and independent laboratory performance testing.
      a. Insulating Glass Certification Council (IGCC).

C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.6 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements for additional requirements.

1.7 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.8 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Insulating Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a five (5) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

D. Polycarbonate Sheet Glazing: Provide a five (5) year manufacturer warranty to include coverage for breakage, coating failure, abrasion resistance, including providing products to replace failed units.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.
   1. Design Pressure: Calculated in accordance with ASCE 7.
   2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
   3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
   4. Glass thicknesses listed are minimum.

B. Weather-Resistive Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure water-resistive barrier, vapor retarder, and/or air barrier.
   1. In conjunction with weather barrier related materials described in other sections, as follows:

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:
   1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
   3. Solar Optical Properties: Comply with NFRC 300 test method.

2.2 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
   2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
   3. Impact Resistant Safety Glass: Complies with ANSI Z97.1 - Class B, or 16 CFR 1201 - Category I criteria.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.3 INSULATING GLASS UNITS

A. Fabricator: Certified by glass manufacturer for type of glass, coating, and treatment involved and capable of providing specified warranty.

B. Insulating Glass Units: Types as indicated.
   1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
   2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
   3. Spacer Color: Black.
   4. Edge Seal:
      a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
      b. Color: Black.
   5. Purge interpane space with dry air, hermetically sealed.

C. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.
   1. Applications: Exterior glazing unless otherwise indicated.
   2. Space between lites filled with air.
   3. Outboard Lite: Annealed float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Clear.
      b. Coating: Low-E (passive type), on #2 surface.
   4. Inboard Lite: Laminated float glass, 1/4 inch (6.4 mm) thick, minimum.
      a. Tint: Clear.
   5. Total Thickness: 1 inch (25.4 mm).
   6. Thermal Transmittance (U-Value), Summer - Center of Glass: _____, nominal.
   7. Visible Light Transmittance (VLT): _____ percent, nominal.
   8. Solar Heat Gain Coefficient (SHGC): _____, nominal.

2.4 GLAZING COMPOUNDS

A. Type GC-2 - Butyl Sealant: Single component; ASTM C920 Grade NS, Class 12-1/2, Uses M and A, Shore A hardness of 10 to 20; black color.

B. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; _____ color.

2.5 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.

B. Glazing Tape, Back Bedding Mastic Type: Preformed, butyl-based, 100 percent solids compound with integral resilient spacer rod applicable to application indicated; 5 to 30 cured Shore A durometer hardness; coiled on release paper; black color.
   1. Width: As required for application.
   2. Thickness: As required for application.

C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

D. Glazing Clips: Manufacturer's standard type.

2.6 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Provide shop inspection and testing for Type _____ glass.

PART 3 EXECUTION

3.1 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

C. Verify that sealing between joints of glass framing members has been completed effectively.

D. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.3 INSTALLATION, GENERAL

A. Install glazing in compliance with written instructions of glass, gaskets, and other glazing material manufacturers, unless more stringent requirements are indicated, including those in glazing referenced standards.

B. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.4 INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.5 INSTALLATION - DRY GLAZING METHOD (TAPE AND GASKET SPLINE GLAZING)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Cut glazing tape to length; install on glazing pane. Seal corners by butting tape and sealing junctions with butyl sealant.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

D. Rest glazing on setting blocks and push against fixed stop with sufficient pressure to attain full contact.

E. Install removable stops without displacing glazing spline. Exert pressure for full continuous contact.

F. Carefully trim protruding tape with knife.

3.6 INSTALLATION - DRY GLAZING METHOD (TAPE AND TAPE)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Cut glazing tape to length and set against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

D. Rest glazing on setting blocks and push against tape for full contact at perimeter of pane or unit.

E. Place glazing tape on free perimeter of glazing in same manner described above.

F. Install removable stop without displacement of tape. Exert pressure on tape for full continuous contact.

G. Carefully trim protruding tape with knife.

3.7 INSTALLATION - WET GLAZING METHOD (SEALANT AND SEALANT)

A. Application - Exterior Glazed: Set glazing infills from the exterior of the building.

B. Place setting blocks at 1/4 points and install glazing pane or unit.

C. Install removable stops with glazing centered in space by inserting spacer shims both sides at 24 inch (610 mm) intervals, 1/4 inch (6.4 mm) below sight line.

D. Fill gaps between glazing and stops with _____ type sealant to depth of bite on glazing, but not more than 3/8 inch (9 mm) below sight line to ensure full contact with glazing and continue the air and vapor seal.

E. Apply sealant to uniform line, flush with sight line. Tool or wipe sealant surface smooth.

3.8 INSTALLATION - WET GLAZING METHOD (COMPOUND AND COMPOUND)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Install glazing resting on setting blocks. Install applied stop and center pane by use of spacer shims at 24 inch (610 mm) centers, kept 1/4 inch (6 mm) below sight line.

C. Locate and secure glazing pane using glazers' clips.

D. Fill gaps between glazing and stops with glazing compound until flush with sight line. Tool surface to straight line.

3.9 INSTALLATION - WET/DRY GLAZING METHOD (TAPE AND SEALANT)

A. Application - Interior Glazed: Set glazing infills from the interior of the building.

B. Cut glazing tape to length and install against permanent stops, projecting 1/16 inch (1.6 mm) above sight line.

C. Place setting blocks at 1/4 points with edge block no more than 6 inch (152 mm) from corners.

D. Rest glazing on setting blocks and push against tape to ensure full contact at perimeter of pane or unit.

E. Install removable stops, spacer shims inserted between glazing and applied stops at 24 inch (610 mm) intervals, 1/4 inch (6 mm) below sight line.

F. Fill gaps between pane and applied stop with _____ type sealant to depth equal to bite on glazing, to uniform and level line.

G. Carefully trim protruding tape with knife.

3.10 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements for additional requirements.

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

C. Monitor and report installation procedures and unacceptable conditions.

3.11 CLEANING

A. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

B. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

C. Remove nonpermanent labels immediately after glazing installation is complete.

D. Clean glass and adjacent surfaces after sealants are fully cured.

E. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.12 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

SECTION 08 83 00
MIRRORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Glass mirrors.
   1. Annealed float glass.

1.2 RELATED REQUIREMENTS

A. Section 06 20 00 - Finish Carpentry: Wood mirror frames.

B. Section 10 28 00 - Toilet, Bath, and Laundry Accessories: Metal mirror frames.

1.3 REFERENCE STANDARDS

A. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

B. ASTM C1036 - Standard Specification for Flat Glass; 2021.

C. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data on Mirror Types: Submit structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds: Submit chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.5 QUALITY ASSURANCE

A. Fabricate, store, transport, receive, install, and clean mirrors in accordance with manufacturer's recommendations.

1.6 FIELD CONDITIONS

A. Do not install mirrors when ambient temperature is less than 50 degrees F (10 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.7 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for reflective coating on mirrors and replacement of same.

PART 2 PRODUCTS

2.1 MATERIALS

A. Mirror Design Criteria: Select materials and/or provide supports as required to limit mirror material deflection to 1/200, or to the flexure limit of glass, with full recovery of glazing materials, whichever is less.

B. Mirror Glass: Clear, annealed float glass; ASTM C1036, with copper and silver coatings, and protective overcoating.

2.2 GLAZING COMPOUNDS

A. Silicone Sealant: ASTM C920, Type S, Grade NS, Class 25, Uses M and A; single component; chemical or solvent curing; non-bleeding, non-staining, cured Shore A hardness of 15 to 25; _____ color.

2.3 ACCESSORIES

A. Mirror Attachment Accessories: Stainless steel clips.

B. Channel Frame: One piece, channel frame, stainless steel, Type 430, satin finish, 1/2 inch by 1/2 inch by 3/8 inch deep (12.7 mm by 12.7 mm by 9.5 mm deep) with 90 degree mitered corners.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that openings for mirrored glazing are correctly sized and within tolerance.

B. Verify that surfaces of mirror frames or recesses are clean, free of obstructions, and ready for installation of mirrors.

3.2 PREPARATION

A. Clean contact surfaces with solvent and wipe dry.

B. Prepare installation in accordance with ASTM C1193 for solvent release sealants, and install sealant in accordance with manufacturer's instructions.

3.3 INSTALLATION

A. Install mirrors in accordance with manufacturer's recommendations.

B. Set mirrors plumb and level, and free of optical distortion.

C. Set mirrors with edge clearance free of surrounding construction including countertops or backsplashes.

3.4 CLEANING

A. Remove wet glazing materials from finish surfaces.

B. Remove labels after work is complete.

C. Clean mirrors and adjacent surfaces.

SECTION 08 91 00
LOUVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Louvers, frames, and accessories.

1.2 RELATED REQUIREMENTS

A. Section 07 62 00 - Sheet Metal Flashing and Trim.

1.3 REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2022.

B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2015.

C. AMCA 511 - Certified Ratings Program Product Rating Manual for Air Control Devices; 2021, with Editorial Revision (2022).

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.

D. Samples: Submit two samples 2 by 2 inches (50 by 50 mm) in size illustrating finish and color of exterior and interior surfaces.

E. Test Reports: Independent agency reports showing compliance with specified performance criteria.

F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

G. Maintenance Data: Include lubrication schedules, adjustment requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.6 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.
   1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.1 LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
   1. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft (3.1 g/sq m) water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
   2. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.

B. Louvers: Aluminum outer frames, louver end frames only, non-thermally broken, air ventilator with overlapping louvers.
   1. Frame Size: As indicated on drawings.

2.2 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

2.3 FINISHES

A. High Performance Organic Coatings: AAMA 2604; multiple coats, thermally cured fluoropolymer system.

B. Color: As selected from manufacturer's standard colors.

2.4 ACCESSORIES

A. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.

B. Bird Screen: Interwoven wire mesh of steel, 14 gauge, 0.0641 inch (1.63 mm) diameter wire, 1/2 inch (13 mm) open weave, diagonal design.

C. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

D. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

B. Verify that field measurements are as indicated.

3.2 INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

3.3 CLEANING

A. Clean surfaces and components.

SECTION 09 05 61
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Thin-set ceramic tile and stone tile.

B. Preparation of new and existing concrete floor slabs for installation of floor coverings.

C. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
   1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

D. Patching compound.

1.2 RELATED REQUIREMENTS

A. Section 03 30 00 - Cast-in-Place Concrete: Concrete admixture for slabs to receive adhered flooring, to prevent moisture content-related flooring failures.

B. Section 03 30 00 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

1.3 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or [50 mm] Cube Specimens); 2021.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 2020.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.5 SUBMITTALS

A. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.

2. Manufacturer's required bond/compatibility test procedure.

B. Adhesive Bond and Compatibility Test Report.

1.6 QUALITY ASSURANCE

A. Contractor may perform adhesive and bond test with Contractor's own personnel or hire a testing agency.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

1.8 FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F (18 degrees C) or more than 85 degrees F (30 degrees C).

B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

PART 2 PRODUCTS

2.1 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:
1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

PART 3 EXECUTION

3.1 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
1. Preliminary cleaning.
2. Specified remediation, if required.
3. Patching, smoothing, and leveling, as required.
4. Other preparation specified.

5. Adhesive bond and compatibility test.
6. Protection.

3.2 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.3 PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with requirements and recommendations of floor covering manufacturer.

C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

D. Do not fill expansion joints, isolation joints, or other moving joints.

3.4 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

SECTION 09 21 16
GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Cementitious backing board.

D. Gypsum wallboard.

E. Joint treatment and accessories.

1.2 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Structural steel stud framing.

B. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 07 21 00 - Thermal Insulation: Acoustic insulation.

D. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.

E. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

F. Section 09 22 16 - Non-Structural Metal Framing.

1.3 REFERENCE STANDARDS

A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2020).

B. AISI S220 - North American Standard for Cold-Formed Steel Nonstructural Framing; 2020.

C. AISI S240 - North American Standard for Cold-Formed Steel Structural Framing; 2015, with Errata (2020).

D. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.

E. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2019.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

G. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

H. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2017 (Reapproved 2022).

I. ASTM C514 - Standard Specification for Nails for the Application of Gypsum Board; 2004 (Reapproved 2020).

J. ASTM C557 - Standard Specification for Adhesives for Fastening Gypsum Wallboard to Wood Framing; 2003 (Reapproved 2017).

K. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

L. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2020.

M. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs from 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2022.

N. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2022.

O. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

P. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022, with Editorial Revision (2023).

Q. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

R. ASTM C1629/C1629M - Standard Classification for Abuse-Resistant Nondecorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels; 2023.

S. ASTM C1658/C1658M - Standard Specification for Glass Mat Gypsum Panels; 2019, with Editorial Revision (2020).

T. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

U. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

V. ASTM E413 - Classification for Rating Sound Insulation; 2022.

W. GA-216 - Application and Finishing of Gypsum Panel Products; 2021.

X. GA-226 - Application of Gypsum Board to Form Curved Surfaces; 2019.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of gypsum board assemblies with size, location, and installation of service utilities.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide data on gypsum board, accessories, and joint finishing system.
   2. Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

C. Shop Drawings: Indicate special details associated with fireproofing and acoustic seals.

D. Evaluation Service Reports: Show compliance of grid suspension systems with specified requirements.

E. Installer's Qualification Statement.

1.6 QUALITY ASSURANCE

A. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.7 Delivery, Storage, and Handling

A. See Section 01 74 19 - Construction Waste Management and Disposal for packaging waste requirements.

B. Store gypsum products and accessories indoors and keep above freezing. Elevate boards above floor, on nonwicking supports, in accordance with manufacturer's recommendations.

C. Store metal products to prevent corrosion.

PART 2 PRODUCTS

2.1 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
   1. Acoustic Attenuation: STC as indicated calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Shaft Walls at HVAC Shafts: Provide completed assemblies with the following characteristics:
   1. Air Pressure Within Shaft: Sustained loads of 5 lbf/sq ft (0.24 kPa) with maximum mid-span deflection of L/240.
   2. Acoustic Attenuation: STC of 35-39 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

D. Fire-Resistance-Rated Assemblies: Provide completed assemblies as indicated on drawings.

2.2 METAL FRAMING MATERIALS

A. Steel Sheet: ASTM A1003/A1003M, subject to the ductility limitations indicated in AISI S220 or equivalent.

B. Nonstructural Steel Framing for Application of Gypsum Board: See Section 09 22 16.

C. Nonstructural Framing System Components: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
   1. Studs: C-shaped with knurled or embossed faces.
   2. Runners: U shaped, sized to match studs.

D. Shaft Wall Studs and Accessories: AISI S220; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 and specified performance requirements.

E. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection and prevent rotation of studs while maintaining structural performance of partition.
   1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
   2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
   3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
   4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.

2.3 BOARD MATERIALS

A. Gypsum Wallboard: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
      a. Mold resistant board is required in vertical applications above tile backer board in wet areas. Wet areas include rest rooms and custodial closets..
   3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
   4. Thickness:
      a. As indicated on drawings.
      b. Multi-Layer Assemblies: Thicknesses as indicated on drawings.

B. Impact Resistant Wallboard:
   1. Application: High-traffic areas indicated.
   2. Surface Abrasion: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.
   3. Indentation: Level 1, minimum, when tested in accordance with ASTM C1629/C1629M.
   4. Soft Body Impact: Level 3, minimum, when tested in accordance with ASTM C1629/C1629M.

5. Hard Body Impact: Level 2, minimum, when tested in accordance with ASTM C1629/C1629M.
6. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
7. Type: Fire-resistance-rated Type X, UL or WH listed.
8. Thickness: 5/8 inch (16 mm).
9. Edges: Tapered.

C. Backing Board For Wet Areas: One of the following products:
1. Application: Surfaces behind tile in wet areas including tub and shower surrounds, shower ceilings, and custodial closets.
2. Application: Horizontal surfaces behind tile in wet areas including countertops.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
4. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with ANSI A118.9 or ASTM C1325.
   a. Thickness: 1/2 inch (13 mm).

D. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 1/2 inch (13 mm).
3. Edges: Tapered.

E. Shaftwall and Coreboard: Type X; 1 inch (25 mm) thick by 24 inches (600 mm) wide, beveled long edges, ends square cut.
1. Paper-Faced Type: Gypsum shaftliner board or gypsum coreboard as defined ASTM C1396/C1396M; water-resistant faces.
2. Glass Mat Faced Type: Glass mat shaftliner gypsum panel or glass mat coreboard gypsum panel as defined in ASTM C1658/C1658M.
3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.

2.4 GYPSUM BOARD ACCESSORIES

A. Acoustic Insulation: See Section 07 21 00.

B. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, unless noted otherwise.
1. Corner Beads: Low profile, for 90 degree outside corners.
2. L-Trim with Tear-Away Strip: Sized to fit 1/2-inch (13 mm) thick gypsum wallboard.

C. Joint Materials: ASTM C475/C475M and as recommended by gypsum board manufacturer for project conditions.
1. Fiberglass Tape: 2 inch (50 mm) wide, coated glass fiber tape for joints and corners, except as otherwise indicated.
2. Paper Tape: 2 inch (50 mm) wide, creased paper tape for joints and corners, except as otherwise indicated.
3. Joint Compound: Setting type, field-mixed.

D. Finishing Compound: Surface coat and primer, takes the place of skim coating.

E. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches (0.84 mm) in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

F. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch (0.84 to 2.84 mm) in Thickness: ASTM C954; steel drill screws, corrosion-resistant.

G. Nails for Attachment to Wood Members: ASTM C514.

H. Adhesive for Attachment to Wood, ASTM C557 and Metal:

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2 SHAFT WALL INSTALLATION

A. Shaft Wall Framing: Install in accordance with manufacturer's installation requirements and UL assembly requirements, if applicable. If conflict between manufacturer and UL assembly installation requirements exists, notify the Architect..
   1. Install studs at spacing required to meet performance requirements.

B. Shaft Wall Liner: Cut panels to accurate dimensions and install sequentially between special friction studs.

3.3 ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

3.4 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

C. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.

D. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

E. Installation on Wood Framing: For rated assemblies, comply with requirements of listing authority. For nonrated assemblies, install as follows:
   1. Single-Layer Applications: Adhesive application.

F. Curved Surfaces: Apply gypsum board to curved substrates in accordance with GA-226.

3.5 INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
   1. Not more than 30 feet (10 meters) apart on walls and ceilings over 50 feet (16 meters) long.
   2. At exterior soffits, not more than 30 feet (10 meters) apart in both directions.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

D. Moisture Guard Trim: Install on bottom edge of gypsum board according to manufacturer's instructions and in locations indicated on drawings.

3.6 JOINT TREATMENT

A. Paper Faced Gypsum Board: Use paper joint tape, embed with drying type joint compound and finish with drying type joint compound.

B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
   1. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
   2. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
   3. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.

C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
   1. Feather coats of joint compound so that camber is maximum 1/32 inch (0.8 mm).

D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.7 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

3.8 Cleaning

A. Clean debris in and around work as a result of gypsum panel/board installation. Installer to take care to reduce dust, shavings and debris and to limit impeding of other trades active on site..

3.9 Protection

A. Protect installed gypsum board assemblies from subsequent construction operations.

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal partition, ceiling, and soffit framing.

B. Framing accessories.

1.2 RELATED REQUIREMENTS

A. Section 05 40 00 - Cold-Formed Metal Framing: Execution requirements for anchors for attaching work of this section.

B. Section 06 10 00 - Rough Carpentry: Wood blocking within stud framing.

C. Section 07 21 00 - Thermal Insulation: Insulation.

D. Section 07 84 00 - Firestopping: Sealing top-of-wall assemblies at fire-resistance-rated walls.

E. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

F. Section 08 51 13 - Aluminum Windows: Product requirements for window anchors.

G. Section 09 21 16 - Gypsum Board Assemblies: Metal studs for gypsum board partition framing.

H. Section 09 21 16 - Gypsum Board Assemblies: Execution requirements for anchors for attaching work of this section.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

C. ASTM A1003/A1003M - Standard Specification for Steel Sheet, Carbon, Metallic- and Nonmetallic-Coated for Cold-Formed Framing Members; 2015.

D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

F. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

G. ASTM E413 - Classification for Rating Sound Insulation; 2022.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

1.6 MOCK-UP

A. Provide mock-up of stud wall, ceiling, and soffit framing including insulation, sheathing, window frame, and door frame and finish specified in other sections. Coordinate with installation of associated work specified in other sections.
   1. Mock-up Size: Full-height, minimum 12 feet (3.5 m) long, including corner.
   2. Mock-up may remain as part of the Work.

PART 2 PRODUCTS

2.1 FRAMING MATERIALS

A. Fire-Resistance-Rated Assemblies: Comply with applicable code and as indicated on drawings.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf (L/240 at 240 Pa).
   1. Studs: C shaped with knurled or embossed faces.
   2. Runners: U shaped, sized to match studs.
   3. Ceiling Channels: C shaped.
   4. Furring: Hat-shaped sections, minimum depth of 7/8 inch (22 mm).
   5. Resilient Furring Channels: Single or double leg configuration; 1/2 inch (12 mm) channel depth.

C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
   1. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.

D. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.

E. Preformed Top Track Firestop Seal:
   1. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.

F. Non-Loadbearing Framing Accessories:
   1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
   2. Partial Height Wall Framing Support: Provides stud reinforcement and anchored connection to floor.
      a. Materials: ASTM A36/A36M formed sheet steel support member with factory-welded ASTM A1003/A1003M steel plate base.
   3. Bracing and Bridging: ASTM A653/A653M G90 galvanized steel; for lateral bracing of wall studs with slots for engaging on-module studs.
   4. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
   5. Sheet Metal Backing: 0.036 inch (0.9 mm) thick, galvanized.
   6. Fasteners: ASTM C1002 self-piercing tapping screws.
   7. Anchorage Devices: Powder actuated.
   8. Acoustic Insulation: As specified in Section 07 21 00.
   9. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
   10. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20 Type I - Inorganic.

2.2 FABRICATION

A. Fabricate assemblies of framed sections to sizes and profiles required.

B. Fit, reinforce, and brace framing members to suit design requirements.

C. Fit and assemble in largest practical sections for delivery to site, ready for installation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that rough-in utilities are in proper location.

3.2 INSTALLATION OF STUD FRAMING

A. Extend partition framing to structure where indicated and to ceiling in other locations.

B. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

C. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Align and secure top and bottom runners at 24 inches (600 mm) on center.

E. At partitions indicated with an acoustic rating:
   1. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.
   2. Place one bead of acoustic sealant between runners and substrate , studs and adjacent construction.

F. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.

G. Install studs vertically at spacing indicated on drawings.

H. Align stud web openings horizontally.

I. Secure studs to tracks using crimping method. Do not weld.

J. Fabricate corners using a minimum of three studs.

K. Install double studs at wall openings, door and window jambs, not more than 2 inches (50 mm) from each side of openings.

L. Brace stud framing system rigid.

M. Coordinate erection of studs with requirements of door frames; install supports and attachments.

N. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.

O. Sound Isolation Clips: Mechanically attach to framing or structure with fasteners recommended by clip manufacturer. Install at spacing indicated on drawings.

P. Furring: Coordinate with sound isolation clip spacing and locations. Lap splices a minimum of 6 inches (150 mm).

3.3 CEILING AND SOFFIT FRAMING

A. Comply with requirements of ASTM C754.

B. Install furring after work above ceiling or soffit is complete. Coordinate the location of hangers with other work.

C. Install furring independent of walls, columns, and above-ceiling work.

D. Securely anchor hangers to structural members or embed them in structural slab. Space hangers as required to limit deflection to criteria indicated. Use rigid hangers at exterior soffits.

E. Space main carrying channels at maximum 72 inch (1 800 mm) on center, and not more than 6 inches (150 mm) from wall surfaces. Lap splice securely.

F. Securely fix carrying channels to hangers to prevent turning or twisting and to transmit full load to hangers.

G. Place furring channels perpendicular to carrying channels, not more than 2 inches (50 mm) from perimeter walls, and rigidly secure. Lap splices securely.

H. Reinforce openings in suspension system that interrupt main carrying channels or furring channels with lateral channel bracing. Extend bracing minimum 24 inches (600 mm) past each opening.

I. Laterally brace suspension system.

3.4 TOLERANCES

A. Maximum Variation From True Position: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation From Plumb: 1/8 inch in 10 feet (3 mm in 3 m).

SECTION 09 30 00
TILING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Ceramic accessories.

1.2 RELATED REQUIREMENTS

A. Section 07 92 00 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

B. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

C. Section 09 21 16 - Gypsum Board Assemblies: Tile backer board.

1.3 REFERENCE STANDARDS

A. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2019.

B. ANSI A118.6 - American National Standard Specifications for Standard Cement Grouts for Tile Installation; 2019.

C. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2019.

D. ANSI A118.10 - American National Standard Specifications for Load Bearing, Bonded, Waterproof Membranes For Thin-Set Ceramic Tile And Dimension Stone Installation; 2014.

E. ANSI A118.12 - American National Standard Specifications for Crack Isolation Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation; 2014 (Reaffirmed 2019).

F. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2022.

G. ASTM C373 - Standard Test Methods for Determination of Water Absorption and Associated Properties by Vacuum Method for Pressed Ceramic Tiles and Glass Tiles and Boil Method for Extruded Ceramic Tiles and Non-tile Fired Ceramic Whiteware Products; 2018.

H. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2021.

I. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2016a.

J. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.

K. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2021.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.

D. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Tile: 10 square feet (1 square meters) of each size, color, and surface finish combination.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum five years of documented experience.

B. Installer Qualifications:
1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.6 MOCK-UPs

A. See Section 01 40 00 - Quality Requirements for general requirements for mock-up.

B. Construct tile mock-up where indicated on drawings, incorporating all components specified for the location.
1. Minimum size of mock-up is indicated on drawings.
2. Approved mock-up may remain as part of work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F (10 degrees C) and below 100 degrees F (38 degrees C) during installation and curing of setting materials.

PART 2 PRODUCTS

2.1 TILE

A. Ceramic Mosaic Tile: ANSI A137.1 standard grade.
   1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.

B. Glazed Wall Tile: ANSI A137.1 standard grade.
   1. Moisture Absorption: 7.0 to 20.0 percent as tested in accordance with ASTM C373.

C. Porcelain Tile: ANSI A137.1 standard grade.
   1. Moisture Absorption: 0 to 0.5 percent as tested in accordance with ASTM C373.

2.2 TRIM AND ACCESSORIES

A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.

2.3 SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.
   1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.

2.4 GROUTS

A. Provide setting and grout materials from same manufacturer.

B. Standard Grout: ANSI A118.6 standard cement grout.
   1. Applications: Use this type of grout where indicated and where no other type of grout is indicated.
   2. Use sanded grout for joints 1/8 inch (3.2 mm) wide and larger; use unsanded grout for joints less than 1/8 inch (3.2 mm) wide.
   3. Color(s): As selected by Architect from manufacturer's full line.

2.5 Maintenance Materials

A. Tile Sealant: Gunnable, silicone, siliconized acrylic, or urethane sealant; moisture and mildew resistant type.
   1. Applications: Between tile and plumbing fixtures.
   2. Color(s): As selected by Architect from manufacturer's full line.

2.6 ACCESSORY MATERIALS

A. Concrete Floor Slab Crack Isolation Membrane: Material complying with ANSI A118.12; not intended as waterproofing.
   1. Crack Resistance: No failure at 1/8 inch (3.2 mm) gap, minimum.

B. Waterproofing Membrane at Floors: Specifically designed for bonding to cementitious substrate under thick mortar bed or thin-set tile; complying with ANSI A118.10.
   1. Crack Resistance: No failure at 1/16 inch (1.6 mm) gap, minimum; comply with ANSI A118.12.
   2. Fluid or Trowel Applied Type:
      a. Material: Synthetic rubber or Acrylic.
      b. Thickness: 25 mils (0.6 mm), minimum, dry film thickness.

C. Backer Board: Cementitious type complying with ANSI A118.9; high density, glass fiber reinforced, 1/2 inch (12.7 mm) thick; 2 inch (51 mm) wide coated glass fiber tape for joints and corners.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Cementitious Subfloor Surfaces: Verify that substrates are ready for tiling installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
      b. Internal Relative Humidity: ASTM F2170.
      c. Moisture Vapor Emission: ASTM F1869.
   2. Obtain instructions if test results are not within limits recommended by tiling material manufacturer and setting material manufacturer.
   3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

E. Verify that required floor-mounted utilities are in correct location.

3.2 PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

D. Install backer board in accordance with ANSI A108.11 and board manufacturer's instructions. Tape joints and corners, cover with skim coat of setting material to a feather edge.

E. Prepare substrate surfaces for adhesive installation in accordance with adhesive manufacturer's instructions.

3.3 INSTALLATION - GENERAL

A. Install tile and thresholds and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.20, manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install ceramic accessories rigidly in prepared openings.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.4 INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.
   2. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F131.

3.5 INSTALLATION - FLOORS - MORTAR BED METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F111, with cleavage membrane, unless otherwise indicated.
   1. Where waterproofing membrane is indicated, with standard grout or no mention of grout type, install in accordance with TCNA (HB) Method F121.
   2. Where epoxy bond coat and grout are indicated, install in accordance with TCNA (HB) Method F132, bonded.

B. Cleavage Membrane: Lap edges and ends.

C. Mortar Bed Thickness: 5/8 inch (15.9 mm), unless otherwise indicated.

3.6 INSTALLATION - WALL TILE

A. Over cementitious backer units on studs, install in accordance with TCNA (HB) Method W244, using membrane at toilet rooms and custodial closets.

3.7 CLEANING

A. Clean tile and grout surfaces.

3.8 PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

SECTION 09 51 00
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.2 RELATED REQUIREMENTS

A. Section 26 51 00 - Interior Lighting: Light fixtures in ceiling system.

B. Section 28 46 00 - Fire Detection and Alarm: Fire alarm components in ceiling system.

1.3 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

E. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

C. Samples: Submit two samples 6 inch by 6 inch (____by____ mm) in size illustrating material and finish of acoustical units.

D. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

1.6 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.7 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1 Performance Requirements

2.2 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.
   1. VOC Content: Certified as Low Emission by one of the following:
      a. Product listing in UL (GGG).

B. Acoustical Panels, Type ACP-1: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type III.
   2. Size: 24 by 24 inches (610 by 610 mm).
   3. Thickness: 3/4 inch (19 mm).
   4. Panel Edge: Square.
   5. Color: White.
   6. Suspension System: Exposed grid.

2.3 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2 Preparation

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.3 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

F. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

G. Do not eccentrically load system or induce rotation of runners.

3.4 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Cut to fit irregular grid and perimeter edge trim.
   2. Make field cut edges of same profile as factory edges.

3.5 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

SECTION 09 65 00
RESILIENT FLOORING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.2 RELATED REQUIREMENTS

A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.

C. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

D. Section 09 05 61 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.3 REFERENCE STANDARDS

A. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

D. Verification Samples: Submit two samples, 6 by 6 inch in size illustrating color and pattern for each resilient flooring product specified.

E. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Flooring Material: 20 square feet of each type and color.
   3. Extra Wall Base: 20 linear feet of each type and color.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing specified flooring with minimum three years documented experience.

B. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F (13 degrees C) and 90 degrees F (72 degrees C).

D. Do not double stack pallets.

1.7 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.1 TILE FLOORING

A. Vinyl Tile: Printed film type, with transparent or translucent wear layer; acoustic interlayer or backing.
   1. Minimum Requirements: Comply with ASTM F1700, Class III.
   2. Wear Layer Thickness: 0.020 inch (0.50 mm).
   3. Color: To be selected by Architect from manufacturer's full range.

2.2 ACCESSORIES

A. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
   1. VOC Content Limits: As specified in Section 01 61 16.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test in accordance with Section 09 05 61.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
   3. Follow moisture and alkalinity remediation procedures in Section 09 05 61.

3.2 PREPARATION

A. Prepare floor substrates for installation of flooring in accordance with Section 09 05 61.

3.3 Installation - General

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

3.4 Installation - Tile Flooring

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

3.5 CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.6 PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

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. Resilient Vinyl Base

1.3 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1. Review methods and procedures related to resilient flooring and/or accessories including, but not limited to, the following:

a. Examination and preparation of substrates to receive resilient base and/or accessories.
b. Installation; including seamless installation techniques.

1.4 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings: For each type of base/nosing and locations.
C. Samples: Full-size units of each color.
D. Samples for Initial Selection: For each base and nosing type.
E. Product Schedule: Use same designations indicated on Drawings.

1.5 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

1.6 CLOSEOUT SUBMITTALS

A. Maintenance Data: For each type of resilient flooring to include methods for maintaining installed products and precautions against cleaning materials and methods detrimental to finishes and performance.

1.7 MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Furnish full-size units equal to 10 percent of amount installed for each type indicated.

1.8 QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are competent in techniques required by manufacturer for vinyl base and nosing installation and seaming method indicated.

1.9 DELIVERY, STORAGE & 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. Store floor tiles on flat surfaces.

1.10 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 time 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 resilient products after other finishing operations, including painting, have been completed.

PART 2 - PRODUCTS

2.1 VINYL BASE (COIL)

A. Acceptable Manufacturers
1. BASIS OF DESIGN: Johnsonite/Tarkett (VB-1) see Finish Legend (IN100).
2. Other approved by Architect prior to bidding
3. Refer to Finish Legend (IN100) for complete specifications.

2.2 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.

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 condition.

3.2 PREPARATION

A. Prepare substrates according to 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 floor-covering adhesives and that contain soap, wax, oil or silicone, using mechanical methods recommended by manufacturer. Do not use solvents.
    3. Alkalinity and Adhesion Testing: Perform tests recommended by manufacturer. Proceed with installation only after substrates pass testing.
    4. Moisture Testing: Perform tests recommended by manufacturer and as follows. Proceed with installation only after substrates pass testing.

        a. Perform anhydrous calcium chloride test according to 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.
        b. Perform relative-humidity test using in situ probes according to ASTM F 2170. Proceed with installation only after substrates have maximum 75 percent relative-humidity level measurement.

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 products until they are the same temperature as the 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.

E. Sweep and vacuum substrates to be covered by resilient accessories immediately before installation.

3.3 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, if 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:

    a. Install preformed corners before installing coil pieces.

H. Job-Formed Corners:

    1. Outside Corners: Use coil pieces of maximum lengths possible and form with returns not less than 3 inches in length.
    2. Form without producing discoloration (whitening) at bends.
    3. Inside Corners: Use coil pieces of maximum lengths possible and form with returns not less than 3 inches in length.

3.4 CLEANING & 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 exposed surfaces.
    2. Sweep and vacuum surfaces thoroughly.
    3. Damp-mop 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. Cover resilient products until Substantial Completion.

END OF SECTION

SECTION 09 67 23

RESINOUS FLOORING (SOLID)

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes:
   1. High-performance resinous flooring systems.

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.
B. Installer Certificates for Qualification: Signed by manufacturer stating that installers comply with specified requirements.
C. Material Certificates: For each resinous flooring component, from manufacturer.
D. Maintenance Data: For maintenance manuals.
E. Samples: Submit two 6” X 6” samples of each resinous flooring system applied to a rigid backing. Provide sample which is a true representation of proposed field applied finish. Provide sample color and texture for approval from Owner in writing or approved by General Contractor prior to installation.
F. Product Schedule: For resinous flooring.

1.3 QUALITY ASSURANCE

A. Installer Qualifications: Manufacturer's authorized representative who is trained and approved for installation of flooring systems required for this Project.
   1. Engage an installer who is approved in writing by resinous flooring manufacturer as qualified to apply resinous flooring systems indicated.
B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, grouting coats, and topcoats, from single source from single manufacturer. Provide secondary materials, including patching and fill material, joint sealant, and repair materials, of type and from source recommended by manufacturer of primary materials.
C. Pre-installation Conference: Conduct conference at Project site before work begins.
D. Mock-ups: Apply mockups to verify selections made under sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution. Do not cover up mock-up area.
   1. Apply full-thickness mockups on 16 square foot floor area selected by Architect.
   2. Finish surfaces for verification of products, color, texture, and sheen.
   3. Simulate finished lighting conditions for Designer’s review of mockups.
   4. Approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.
   5. Mockup shall demonstrate desired slip-resistance for review and approval by Owner’s representative in writing.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials in original packages and containers, with seals unbroken, bearing manufacturer's labels indicating brand name and directions for storage and mixing with other components.

1. Maintain containers in clean condition, free of foreign materials and residue.
2. Remove rags and waste from storage areas daily.

1.5 PROJECT CONDITIONS

A. Environmental Limitations: Comply with resinous flooring manufacturer's written instructions for substrate temperature, ambient temperature, moisture, ventilation, and other conditions affecting resinous flooring application.
B. Lighting: Provide permanent lighting or, if permanent lighting is not in place, simulate permanent lighting conditions during resinous flooring application.
C. Close spaces to traffic during resinous flooring application and for not less than 24 hours after application unless manufacturer recommends a longer period.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by:
1. "BASIS OF DESIGN" Sherwin Williams (EP-1).
2. Other approved by Designer prior to Bidding.
3. Refer to Finish Legend (IN100) for complete specifications. Refer to drawings for more details.

4. "BASIS OF DESIGN" (EP-1) Product Requirements (or equivalent):
a. 1st Coat (Primer): GPDFGLZ Resuflor Glaze applied at 200 sq. ft. per gal. If a moisture mitigating primer is needed, Resuprime MVB 3831 Moisture Vapor Barrier Primer can be used.

b. 2nd Coat (Body Coat): GPDFGLZ Resuflor Glaze applied at the following rates: 60 mil Resuflor Gard SL: 1 mix covers 70 square feet, 1 ½ gal. Resulfor Gard, 3 quarts 290 Flour and 3 quarts F-60 sand

c. 3rd Coat (Topcoat): GP4850 Accelera 4850 Polyaspartic SS and 80/120 Mesh Sand with (1) coat of 3746 Epoxy topcoat.

2.2 MATERIALS

A. VOC Content of Resinous Flooring: Provide resinous flooring systems, for use inside the weatherproofing system, that comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24)].
1. Resinous Flooring: 100 g/L.

2.3 HIGH-PERFORMANCE RESINOUS FLOORING

A. Resinous Flooring: Abrasion-, impact- and chemical-resistant, high-performance, resin-based, monolithic floor surfacing designed to produce a seamless floor.
B. System Characteristics:
1. Color and Pattern: As indicated from manufacturers listed above.
2. Slip Resistance: Provide slip resistant finish that ensures commercial slip coefficients are met.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspection: Prior to commencing Work, thoroughly examine all underlying and adjoining work, surfaces and conditions upon which Work is in any way dependent for perfect results. Report all conditions which affect Work. No "waiver of responsibility" for incomplete, inadequate or defective underlaying and adjoining work, surfaces and conditions will be considered, unless notice of such unsatisfactory conditions has been filed and agreed to in writing before Work begins. Commencement of Work constitutes acceptance of surfaces.

B. Surface Preparation: Remove all surface contamination, loose or weakly adherent particles, laitance, grease, oil, curing compounds, paint, dust and debris by blast track method or approved mechanical means (acid etch not allowed). If surface is questionable try a test patch. Create a minimum surface profile for the system specified in accordance with the methods described in ICRI No. 03732 to achieve profile CSP 4-6 as follows:

1. Thin film, to 10 mils CSP-1 to CSP-3
2. Thin and medium films, 10 to 40 mils CSP-3 to CSP-5
3. Self-leveling mortars, to 3/16” CSP-4 to CSP-6
4. Mortars and laminates, to 1/4” or more CSP-5 to CSP-10

C. Verify that concrete substrates are dry and moisture-vapor emissions are within acceptable levels according to manufacturer's written instructions.

1. Moisture Testing: Perform tests indicated below.

a. Calcium Chloride Test: Perform anhydrous calcium chloride test per 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. Perform tests so that each test area does not exceed 1000 sq. ft. and perform 3 tests for the first 1000 sq. ft. and one additional test for every additional 1000 sq ft.

b. In-Situ Probe Test: Perform relative-humidity test using in-situ probes per ASTM F 2170. Proceed with installation only after substrates have a maximum 75 percent relative-humidity-level measurement.

3.2 ENVIRONMENTAL CONDITIONS

A. All applicators and all other personnel in the area of the RF installation shall take all required and necessary safety precautions. All manufacturers’ installation instructions shall be implicitly instructions shall be implicitly followed.

B. Repair damaged and deteriorated concrete according to resinous flooring manufacturer's written instructions.

C. Alkalinity and Adhesion Testing: Verify that concrete substrates have pH within acceptable range. Perform tests recommended by manufacturer. Proceed with application only after substrates pass testing.

D. Resinous Materials: Mix components and prepare materials according to resinous flooring manufacturer's written instructions.

E. Use patching and fill material to fill holes and depressions in substrates according to manufacturer's written instructions.

F. Treat control joints and other nonmoving substrate cracks to prevent cracks from reflecting through resinous flooring according to manufacturer's written instructions.

3.3 APPLICATIONS

A. Install resinous floor over properly prepared concrete surface in strict accordance with the manufacturer's directions.
   1. Install the primer and/or base coats over thoroughly cleaned and prepared concrete.
   2. Install topcoat over flooring after excess aggregate has been removed.
   3. Maintain a slab temperature of 60°F to 80°F for 24 hours minimum before applying floor topping, or as instructed by manufacturer.
B. Apply components of resinous flooring system according to manufacturer's written instructions to produce a uniform, monolithic wearing surface of thickness indicated.
   1. Coordinate application of components to provide optimum adhesion of resinous flooring system to substrate, and optimum intercoat adhesion.
   2. Cure resinous flooring components according to manufacturer's written instructions. Prevent contamination during application and curing processes.
   3. At substrate expansion and isolation joints, comply with resinous flooring manufacturer's written instructions.
C. Sealant: Saw cut resinous floor topping at expansion joints in concrete slab. Fill sawcuts with sealant prior to final seal coat application. Follow manufacturer’s written recommendations.
D. Apply primer over prepared substrate at manufacturer's recommended spreading rate.
E. Slip Resistant Finish: Provide grit for slip resistance that ensures commercial slip-coefficients are met.
F. Apply topcoats in number indicated for flooring system and at spreading rates recommended in writing by manufacturer.

3.4 COMPLETED WORK

A. Cleaning: Upon completion of the Work, clean up and remove from the premises surplus materials, tools, appliances, empty cans, cartons and rubbish resulting from the Work. Clean off all spattering and drippings, and all resulting stains.
B. Protection: Protect Work in accordance with manufacturer's directions from damage and wear during the remainder of the construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.
C. Contractor shall insure that coating is protected from any traffic until it is fully cured to the satisfaction of the coating manufacturer.

END OF SECTION

SECTION 09 84 00

SOUND ABSORBING CEILINGS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general conditions of contract, including general and supplementary conditions and divisions-1 specification sections apply to work of this section.

1.2 SUMMARY

A. Section Includes:
   1. Cementitious wood fiber plank acoustical wall and ceiling system (ACP2)

B. Related Sections:
   1. Section 09 51 13 - Acoustical Panel Ceilings/Aluminum Perimeter Trims
   2. Section 09 53 00 - Acoustical Ceiling Suspension Assembly
   3. Section 09 20 00 - Plaster and Gypsum Board
   4. Divisions 23 (15) Sections - HVAC
   5. Division 26 (16) Sections - Electrical Work

1.3 REFERENCES

A. ASTM International:
   1. ASTM C 423 Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method
   2. ASTM E 84 Standard Test Method for Surface Burning Characteristics of Building Materials
   3. ASTM E2768-11(2018) Standard Test Method for Extended Duration Surface Burning Characteristics of Building Materials
   4. ASTM E 580 Installation of Metal Suspension Systems in Areas Requiring Moderate Seismic Restraint
   5. ASTM C636 / C636M - 19 Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels
   6. ASTM C 754 Installation of Steel Framing Members to Receive Screw-Attached Gypsum Board
   7. ASTM E 1264 Classification for Acoustical Ceiling Products
   8. ASTM D 3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber

B. Hardwood Plywood and Veneer Association (HPVA).

C. International Building Code.
   1. International Code Council-Evaluation Services - AC 156 Acceptance Criteria for Seismic Qualification Testing of Non-structural Components.
   2. International Code Council-Eval. Services Report - Seismic Engineer Report

D. ASHRAE Standard 62 1 2004 Ventilation for Acceptable Indoor Air Quality.

E. NFPA 70 National Electrical Code.

F. ASCE 7 American Society of Civil Engineers, Minimum Design Loads for Buildings and Other Structures.

G. ESR 1308 - Armstrong T-Bar or Dimensional Suspension.

H. Ceilings and Interior Systems Construction Association:
1. CISCA - Acoustical Ceilings: Use and Practice.

I. Underwriters Laboratories Inc.:
1. UL - Fire Resistance Directory.

J. LEED - Leadership in Energy and Environmental Design is a set of rating systems for the design, construction, operation, and maintenance of green buildings.

1.4 PERFORMANCE REQUIREMENTS

A. Direct attach acoustical ceiling systems manufactured from domestic cementitious wood fiber.

1.5 SUBMITTALS

A. Section 01 33 00 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Layout and details/dimensioning of acoustic grid ceilings. Show locations of items that are to be coordinated with or supported by the ceilings. (junctions with other work or ceiling finishes, interrelation of mechanical and electrical items related to system and wall layouts). Indicate method of suspension where interference exists.

C. Installation Instructions: Submit manufacturer’s installation instructions as referenced in part 3, Installation.

D. Product Data: Submit manufacturer’s technical data for each type of ceiling unit and suspension system required.

E. Samples: Submit (2) full size samples, of each item specified, in a 6” x 6” sample or larger, illustrating material and finish of acoustic units for approval by Designer.

F. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, perimeter molding and retention clips.

G. Manufacturer's Installation Instructions: Submit special procedures, perimeter conditions requiring special attention.

1.6 QUALITY ASSURANCE

A. Fire Performance Characteristics: Identify ceiling components with appropriate markings of applicable testing and inspecting organization.

1. Surface Burning Characteristics: As follows, tested per ASTM E-84 and complying with ASTM E 1264 for Class A products.

B. Single-Source Responsibility: Provide perimeter trim components and grid components by a single manufacturer.

C. Coordination of Work: Coordinate ceiling work with installers of related work including, but not limited to building insulation, gypsum board, light fixtures, mechanical systems, electrical systems, and sprinklers.

1.7 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum 3-years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum 5-years documented experience.

C. Provide seismic design of suspended ceiling under direct supervision of Professional Engineer experienced in design of this Work and licensed at Project location.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store ceiling components in a dry interior location in their cartons prior to installation to avoid damage. Store cartons in a flat, horizontal position. The protectors between the panels should not be removed until installation.

B. Do not store in unconditioned spaces with humidity greater than 55 percent or lower than 25 percent relative humidity and temperatures lower than 50 degrees F or greater than 86 degrees F. Panels must not be exposed to extreme temperatures, for example, close to a heating source or near a window with direct sunlight.

C. Before installing components permit them to reach room temperature and a stabilized moisture content.

D. Handle ceiling units carefully to avoid chipped edges or damage to units in any way.

1.7 PROJECT CONDITIONS

A. As interior finish products, the panels are designed for installation in temperature conditions between 32 degrees F and 120 degrees F, in spaces where the building is enclosed, and HVAC systems are functioning and will be in continuous operation. Relative humidity should not fall below 25 percent or exceed 85 percent.

B. Locate materials onsite at least 72 hours before beginning installation to allow materials to reach temperature and moisture content equilibrium.

C. Sequence Work to ensure acoustic ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

D. Install acoustic units after interior wet work is dry.

1.8 WARRANTY

A. Sounds Absorbing Ceilings:

1. Submit a written warranty executed by the manufacturer, agreeing to repair or replace panels that fail within the warranty period. Failures include, but are not limited to:
    a) Panels: Defects in materials or factory workmanship.
2. Warranty Period:
    a) Panels: 30-years from date of installation.

B. The Warranty shall not deprive the Owner of other rights the Owner may have under other provisions of the Contract Documents and will be in addition to and run concurrent with other warranties made by the Contractor under the requirements of the Contract Documents.

1.9 MAINTENANCE

A. Extra Materials/attic stock: Deliver extra materials to Owner. Furnish extra materials described below that match products installed. Packaged with protective covering for storage and identified with appropriate labels.
1. Sound Absorbing Ceilings (ACP) Units: Furnish quality of full-size units equal to 10 percent of amount installed or each type specified.

PART 2 PRODUCTS

2.1 MATERIALS AND MANUFACTURERS

A. Acoustic Ceiling Panels.
1. “BASIS OF DESIGN”: Armstrong World Industries (ACP-2); See Interior Finish Legend (IN100) for additional information.
2. Flame Spread: ASTM E 1264; Class A

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation of Axiom trim edges until all wet work such as concrete, terrazzo, plastering and painting has been completed and thoroughly dried out, unless expressly permitted by manufacturer’s printed recommendations.

3.2 INSTALLATION

A. Install suspension system and panels in compliance with ASTM C636, ASTM E580, with the approval of the authorities having jurisdiction, and in accordance with all the manufacturers Panels Installation Instructions.

B. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.

C. Utilize fasteners and hardware provided by manufacturers.

3.3 CLEANING

A. Replace any damaged and broken panels/units.

B. Clean exposed surfaces of trim, edge moldings, and suspension members. Comply with manufacturer's instructions for cleaning and touch up of minor finish damage. Remove and replace work that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

C. Remove and replace ceiling components that cannot be successfully cleaned and repaired to permanently eliminate evidence of damage.

D. Protect surfaces from damage until date of substantial completion. Repair work or replace damaged work, which cannot be repaired to Designer's satisfaction.

END OF SECTION

SECTION 09 91 13
EXTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

D. Do Not Paint or Finish the Following Items:
1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
2. Items indicated to receive other finishes.
3. Items indicated to remain unfinished.
4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.
5. Floors, unless specifically indicated.
6. Glass.
7. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

1.3 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
2. MPI product number (e.g. MPI #47).
3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
4. Manufacturer's installation instructions.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.6 MOCK-UPS

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 4 feet (____ m) long by 4 feet (____ m) wide, illustrating paint color, texture, and finish.

C. Provide door and frame assembly illustrating paint color, texture, and finish.

D. Mock-up may remain as part of the work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the paint product manufacturer's temperature ranges.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Primer Sealers: Same manufacturer as top coats.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless required to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is described explicitly in manufacturer's product instructions.

2.3 PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including primed metal.
   1. Two top coats and one coat primer.
   2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.

2.4 PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

2.5 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

C. Test shop-applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

SECTION 09 91 23
INTERIOR PAINTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
   1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
   2. Surfaces inside cabinets.

D. Do Not Paint or Finish the Following Items:
   1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
   2. Items indicated to receive other finishes.
   3. Items indicated to remain unfinished.
   4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
   5. Stainless steel, anodized aluminum, bronze, terne-coated stainless steel, and lead items.
   6. Floors, unless specifically indicated.
   7. Glass.
   8. Concrete masonry units in utility, mechanical, and electrical spaces.
   9. Concealed pipes, ducts, and conduits.

1.2 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Shop-primed items.

B. Section 05 51 00 - Metal Stairs: Shop-primed items.

C. Section 09 91 13 - Exterior Painting.

D. Section 21 05 53 - Identification for Fire Suppression Piping and Equipment: Painted identification.

1.3 REFERENCE STANDARDS

A. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

B. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Manufacturer's name, product name and/or catalog number, and general product category (e.g., "alkyd enamel").
   2. MPI product number (e.g., MPI #47).
   3. Manufacturer's installation instructions.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches (216 by 279 mm) in size, illustrating range of colors available for each finishing product specified.
   1. Where sheen is specified, submit samples in only that sheen.
   2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens not required.

D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.

E. Manufacturer's Instructions: Indicate special surface preparation procedures.

F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Paint and Finish Materials: 1 gallon (4 L) of each color; from the same product run, store where directed.
   3. Label each container with color in addition to the manufacturer's label.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum three years experience and approved by manufacturer.

1.6 MOCK-UP

A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.

B. Provide panel, 4 feet (____ m) long by 4 feet (____ m) wide, illustrating paint color, texture, and finish.

C. Mock-up may remain as part of the work.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F (7 degrees C) and a maximum of 90 degrees F (32 degrees C), in ventilated area, and as required by manufacturer's instructions.

1.8 FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent, at temperatures less than 5 degrees F (3 degrees C) above the dew point, or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F (10 degrees C) for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles (860 lx) measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Provide paints and finishes from the same manufacturer to the greatest extent possible.

2.2 PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready-mixed, unless intended to be a field-catalyzed paint.
   1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Supply each paint material in quantity required to complete entire project's work from a single production run.
   3. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content: Comply with Section 01 61 16.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Colors: To be selected from manufacturer's full range of available colors.
   1. Selection to be made by Architect after award of contract.
   2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling under which they are mounted.

2.3 PAINT SYSTEMS - INTERIOR

A. Paint I-OP - Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board and wood.
   1. Two top coats and one coat primer.
   2. Top Coat(s): High Performance Architectural Interior Latex; MPI #138, 139, 140, 141, or 142.

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals:
   1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
   2. Two top coats and one coat primer.
   3. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.

C. Paint GI-OP-2A - Gypsum Board, 3 Coat:
   1. One coat of Latex primer.
   2. Eggshell (walls): One intermediate coat, one top coat; both coats to be same sheen.
   3. Flat (ceilings): One intermediate coat, one top coat; both coats to be same sheen.

2.4 ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin application of paints and finishes until substrates have been adequately prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially affect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

3.2 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

D. Seal surfaces that might cause bleed through or staining of topcoat.

E. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

F. Ferrous Metal:
   1. Solvent clean according to SSPC-SP 1.
   2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
   3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

G. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.3 APPLICATION

A. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

B. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

C. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

D. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

E. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4 FIELD QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.

B. Owner will provide field inspection.

3.5 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.6 PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

SECTION 10 14 00
SIGNAGE

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Room and door signs.

B. Interior directional and informational signs.

C. Emergency evacuation maps.

D. Building identification signs.

1.2 RELATED REQUIREMENTS

A. Section 22 05 53 - Identification for Plumbing Piping and Equipment.

B. Section 26 05 53 - Identification for Electrical Systems.

C. Section 26 51 00 - Interior Lighting: Exit signs required by code.

1.3 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.

C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
   1. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
   2. Submit for approval by Owner through Architect prior to fabrication.

D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.

E. Selection Samples: Where colors are not specified, submit two sets of color selection charts or chips.

F. Manufacturer's Qualification Statement.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Package signs as required to prevent damage before installation.

PART 2 PRODUCTS

2.1 SIGNAGE APPLICATIONS

A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.

B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
   1. Provide "tactile" signage, with letters raised minimum 1/32 inch (0.8 mm) and Grade II braille.
   2. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings.
   3. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
   4. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

C. Interior Directional and Informational Signs:
   1. Sign Type: Same as room and door signs.

D. Emergency Evacuation Maps:
   1. Map content to be provided by Owner.

2.2 SIGN TYPES

A. Color and Font: Unless otherwise indicated:
   1. Character Font: Arial.
   2. Character Case: Upper case only.
   3. Background Color: To be selected by Architect from manufacturer's full line..
   4. Character Color: White color.

2.3 TACTILE SIGNAGE MEDIA

A. Injection Molded Panels: One-piece acrylic plastic, with raised letters and braille. Signage and signage mounting to be ADA Standards compliant.
   1. Total Thickness: 1/8 inch (3 mm).

2.4 ACCESSORIES

A. Concealed Screws: Stainless steel, galvanized steel, chrome plated, or other non-corroding metal.

B. Exposed Screws: Chrome plated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install neatly, with horizontal edges level.

C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.

D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

SECTION 10 26 00
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Corner guards.

1.2 RELATED REQUIREMENTS

A. Section 05 50 00 - Metal Fabrications: Corner guards fabricated from rolled metal sections or bent plate.

B. Section 05 50 00 - Metal Fabrications: Anchors for attachment of work of this section, concealed in wall.

C. Section 09 21 16 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

1.3 REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

C. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2014.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate physical dimensions, features, wall mounting brackets with mounted measurements, anchorage details, and rough-in measurements.

C. Shop Drawings: Include plans, elevation, sections, and attachment details. Show design and spacing of supports for protective corridor handrails, required to withstand structural loads.

D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.
   1. Submit two sections of corner guards, 24 inches (610 mm) long.

E. Manufacturer's Instructions: Indicate special procedures, perimeter conditions requiring special attention.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project:

1. See Section 01 60 00 - Product Requirements, for additional provisions.

H. Maintenance Data: Manufacturer's instructions for care and cleaning of each type of product. Include information about both recommended and potentially detrimental cleaning materials and methods.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.6 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

C. Provide five year manufacturer and installer warranty for metal crash rails.
1. Failures include, but are not limited to, the following:
a. Structural failures, internal connection failures, and/or detachment of rail system from substrates.
b. Deterioration of materials beyond that expected of normal use, as intended by manufacturer.

PART 2 PRODUCTS

2.1 PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

2.2 PRODUCT TYPES

A. Corner Guards - Surface Mounted:
1. Corner guards fabricated from rolled section or bent plate are specified in Section 05 50 00.
2. Material: Type 304 stainless steel, No. 4 finish, 16 gauge, _____ inch (_____ mm) thick.

3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
4. Width of Wings: 3 1/2 inches (89 mm).
5. Corner: Square.
6. Color: As selected from manufacturer's standard colors.
7. Length: One piece.

2.3 FABRICATION

A. Fabricate components with tight joints, corners and seams.

2.4 SOURCE QUALITY CONTROL

A. See Section 01 40 00 - Quality Requirements, for additional requirements.

B. Provide wall and door protection systems of each type from a single source and manufacturer.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

C. Start of installation constitutes acceptance of project conditions.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guard 4 inches (102 mm) above finished floor to 48 inches high (1219 mm high).

3.3 TOLERANCES

A. Maximum Variation From Required Height: 1/4 inch (6 mm).

B. Maximum Variation From Level or Plane For Visible Length: 1/4 inch (6 mm).

3.4 CLEANING

A. Clean wall protection items of excess adhesive, dust, dirt, and other contaminants.

SECTION 10 28 00
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Commercial toilet accessories.

B. Commercial shower and bath accessories.

C. Under-lavatory pipe supply covers.

D. Utility room accessories.

1.2 RELATED REQUIREMENTS

A. Section 08 83 00 - Mirrors: Other mirrors.

B. Section 22 40 00 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a (Reapproved 2019).

C. ASTM C1036 - Standard Specification for Flat Glass; 2021.

D. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

E. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2018.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

G. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015, with Editorial Revision (2021).

H. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.5 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

PART 2 PRODUCTS

2.1 MANUFACTURERS

2.2 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Keys: Provide 3 keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

D. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

2.3 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.4 Commercial Toilet Accessories

A. Toilet Paper Dispenser: Double roll, surface mounted, for coreless type rolls.

B. Paper Towel Dispenser: Electric, roll paper type.
1. Cover: Stainless steel.
2. Paper Discharge: Touchless automatic.
3. Capacity: 6 inch diameter roll.
4. Mounting: Semi recessed.
5. Power: Battery operated.
6. Refill Indicator: Illuminated refill indicator.

C. Combination Towel Dispenser/Waste Receptacle: Recessed flush with wall, stainless steel; seamless wall flanges, continuous piano hinges, ____.
1. Waste receptacle liner: Reusable, heavy-duty vinyl.
2. Towel dispenser capacity: 400 C-fold.
3. Waste receptacle capacity: 4 gallons (15 liters).

D. Automated Soap Dispenser: Liquid soap dispenser, wall-mounted, with stainless steel cover and window to gauge soap level.

E. Mirrors: Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.

F. Grab Bars: Stainless steel, smooth surface.
   1. Standard Duty Grab Bars:
      a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
      b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, exposed flange mounting with cover snaps, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
      c. Finish: Satin.
      d. Length and Configuration: As indicated on drawings.

G. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.

2.5 Commercial Shower and Bath Accessories

A. Robe Hook: Heavy-duty stainless steel, single-prong, rectangular-shaped bracket and backplate for concealed attachment, satin finish.

2.6 UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. Under-Lavatory Pipe and Supply Covers:
   1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
   2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
   3. Construction: 1/8 inch (3.2 mm) flexible PVC.
      a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
      b. Comply with ICC A117.1.
      c. Microbial and Fungal Resistance: Comply with ASTM G21.
   4. Color: White.
   5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.

2.7 Utility Room Accessories

A. Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, hat-shaped channel.
   1. Holders: Three spring-loaded rubber cam holders.
   2. Length: 36 inches (900 mm).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on drawings.

3.2 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.3 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.
   1. Grab Bars: As indicated on drawings.
   2. Other Accessories: As indicated on drawings.

3.4 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 21 12 00 - Fire-Suppression Standpipes: Cabinet enclosure for extinguishers.

1.3 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

B. FM (AG) - FM Approval Guide; Current Edition.

C. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

D. UL (DIR) - Online Certifications Directory; Current Edition.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher operational features.

C. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

1.5 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.
   1. Provide extinguishers labeled by UL (DIR) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Stored Pressure Operated: Deep Drawn.
   2. Class: A:B:C type.
   3. Size: 10 pound (4.54 kg).
   4. Finish: Baked polyester powder coat, color as selected.
   5. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

2.2 FIRE EXTINGUISHER CABINETS

A. Fire Rating: Listed and labeled in accordance with ASTM E814 requirements for fire resistance rating of walls where being installed.

B. Fire Rated Cabinet Construction: One-hour fire rated.
   1. Steel; double wall or outer and inner boxes with 5/8 inch (15.9 mm) thick fire barrier material.

C. Cabinet Configuration: Semi-recessed type.
   1. Size to accommodate accessories.
   2. Trim: Flat rolled edge, with ____ inch (____ mm) wide face.
   3. Provide cabinet enclosure with right angle inside corners and seams, and with formed perimeter trim and door stiles.

D. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with roller type catch. Hinge doors for 180 degree opening with continuous piano hinge.

E. Door Glazing: Polycarbonate plastic, clear, 1/8 inch (3 mm) thick, flat shape and set in resilient channel glazing gasket.

F. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

G. Fabrication: Weld, fill, and grind components smooth.

H. Finish of Cabinet Exterior Trim and Door: No.4 - Brushed stainless steel.

I. Finish of Cabinet Interior: White colored baked enamel.

2.3 ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

B. Cabinet Signage: FIRE EXTINGUISHER.

C. Graphic Identification: Symbol

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 01 30 00 - Administrative Requirements : Coordination and project conditions.

B. Verify rough openings for cabinet are correctly sized and located.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, 54 inches (____ mm) from finished floor to top of cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets and on wall brackets.

E. Position cabinet signage as required by authorities having jurisdiction..

3.3 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

3.4 SCHEDULES

A. Refer to the Drawings for locations.

SECTION 12 21 13
HORIZONTAL LOUVER BLINDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Horizontal slat louver blinds.

B. Operating hardware.

1.2 RELATED REQUIREMENTS

A. Section 06 10 00 - Rough Carpentry: Concealed wood blocking for attachment of headrail brackets.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data indicating physical and dimensional characteristics.

C. Samples: Submit two samples, 6 inch (____ mm) long illustrating slat materials and finish, cord type and color.

D. Manufacturer's Installation Instructions: Indicate special procedures.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Blind Assemblies: One of each size.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

PART 2 PRODUCTS

2.1 BLINDS WITHOUT SIDE GUIDES

A. Description: Horizontal slat louvers hung from full-width headrail with full-width bottom rail.

B. Manual Operation: Control of raising and lowering by lift with full range locking; blade angle adjustable by control wand.

C. Metal Slats: Spring tempered pre-finished aluminum; square slat corners, with manufacturing burrs removed.
   1. Width: 1/2 inch (12 mm).
   2. Thickness: 0.008 inch (0.20 mm).

3. Color: As selected by Architect.

D. Slat Support: Woven polypropylene cord, ladder configuration.

E. Head Rail: Pre-finished, formed aluminum box, with end caps; internally fitted with hardware, pulleys, and bearings for operation; same depth as width of slats.
1. Color: Same as slats.

F. Control Wand: Extruded hollow plastic; hexagonal shape.
1. Non-removable type.

G. Headrail Attachment: Wall brackets.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that openings are ready to receive the work.

3.2 INSTALLATION

A. Install blinds in accordance with manufacturer's instructions.

B. Secure in place with flush countersunk fasteners.

3.3 TOLERANCES

A. Maximum Variation of Gap at Window Opening Perimeter: 1/4 inch (6 mm).

B. Maximum Offset From Level: 1/8 inch (3 mm).

3.4 ADJUSTING

A. Adjust blinds for smooth operation.

3.5 CLEANING

A. Clean blind surfaces just prior to occupancy.

SECTION 12 32 16

MANUFACTURED PLASTIC LAMINATE FACED CASEWORK

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 plastic-laminate-faced casework.

B. Casework hardware and accessories.

C. Related Requirements:

1. Section 06 10 53 “Miscellaneous Rough Carpentry” for wood blocking, for anchoring casework.
2. Section 09 22 16 “Non-Structural Metal Framing” for reinforcements in metal-framed partitions for anchoring casework.
3. Section 09 65 13 “Resilient Base and Accessories” for resilient base applied to plastic-laminate-faced casework.

1.3 DEFINITIONS

A. MDF: Medium-density fiberboard.
B. Hardwood Plywood: A panel product composed of layers or plies of veneer or of veneers in combination with lumber core, hardboard core, MDF core or particleboard core; joined with adhesive and faced both front and back with hardwood veneers.

1.4 PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.
B. Keying Conference: Conduct conference at Project site. Incorporate keying conference decisions into final keying requirements.

1.5 COORDINATION

A. Coordinate sizes and locations of framing, blocking, furring, reinforcements and other related units of Work, specified in other Sections, to ensure that casework can be supported and installed as indicated.

1.6 ACTION SUBMITTALS

A. Product Data: For each type of product.
B. Shop Drawings:
    1. Include plans, elevations, sections, details and attachments to other work.
    2. Indicate types and sizes of casework.

3. Show fabrication details, including types and locations of hardware.
4. Show installation details, including field joints and filler panels.
5. Indicate manufacturer's catalog numbers for casework.
6. Indicate locations of and clearances from adjacent walls, doors, windows, other building components, and equipment.

C. Keying Schedule: include schematic keying diagram, and index each key set to unique designations that are coordinated with the contract documents.
D. Samples: For each of the following products and for each color and texture required. Label each Sample with manufacturer's name, material description, color, finish and designation indicated on Drawings and in schedules.
   1. Plastic Laminate: Provide (3) 8 by 10 inch samples for each type, color, pattern, and surface finish and specified edge material.
   2. 1 sample for each type of hardware, including function, material and finish.

1.7 INFORMATIONAL SUBMITTALS

A. Qualification data: for casework manufacturer and installer.
B. Sample warranty: for special warranty
C. Product certificates: for each type of product, provide the following:
   1. Composite wood and agrifiber products
   2. High-pressure decorative laminate
   3. Chemical-resistant, high-pressure decorative laminate
   4. Adhesives
D. Evaluation reports: for fire-retardant-treated materials, from ICC-ES

1.8 QUALITY ASSURANCE

E. Manufacturer Qualifications: A manufacturer 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.
F. Installer Qualifications: An authorized representative who is trained and approved by manufacturer for installation of units required for this Project.

1.9 DELIVERY, STORAGE AND HANDLING

A. Deliver casework only after painting, utility roughing-in and similar operations that could damage, soil or deteriorate casework have been completed in installation areas. If casework must be stored in other than installation areas, store only in areas where environmental conditions meet requirements specified in “Project Conditions” Article.
B. Keep finished surfaces covered with polyethylene film or other protective covering during handling and installation.

1.10 FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install casework until building is enclosed, wet work is complete and HVAC system is operating and maintaining temperature and relative humidity at occupancy levels during the remainder of the construction period. Maintain temperature and relative humidity during the remainder of the construction period in ranges recommended for Project by location via industry standards.

B. Established Dimensions: Where casework 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. Locate concealed framing, blocking, and reinforcements that support casework by field measurements before being enclosed and indicate measurements on Shop Drawings.

1.11 WARRANTY

A. Special Warranty: Manufacturer agrees to repair or replace components of casework that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Delamination of components or other failures of glue bond.
      b. Warping of components.
      c. Failure of operating hardware.
   2. Warranty Period:
      a. Casework shall be warranted for 10 years against delamination from the date of Substantial Completion.
      b. All products shall be warranted for three (3) years against failure of workmanship and material from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. “BASIS OF DESIGN”: Formica (PL-1).
B. Other approved by Designer prior to Bidding.
C. Refer to Finish Legend (IN100) for complete specifications. Refer to drawings for more details.

2.2 CASEWORK, GENERAL

A. Quality Standard: Unless otherwise indicated, to comply with industry standards, for grades of casework indicated for construction, finishes, installation, and other requirements.

   1. Grade: Custom.
   2. Product Designations: Drawings indicate configurations of manufactured plastic-laminate-faced cabinets.

2.2 PLASTIC LAMINATE CLAD CASEWORK

A. High-Pressure Laminate: Refer to ‘Interior Sections & Details” for complete specifications. Refer to drawings for edge treatment and grain direction on grain specific materials if applicable.
B. Fabrication: Comply with manufacturer’s recommendations for fabrication including the following:
   1. Condition materials to ambient conditions of the surrounding before use. Provide for circulation of air around the components.
   2. Conditioning temperature shall be approx. 75 degrees F (24 degrees C), at 45 to 55 percent relative humidity.

3. Use saws, routers and belt sanders in accordance with manufacturer's recommendations.

2.3 CASEWORK

A. Design:

1. Reveal overlay with recessed finger pulls machined into faces of doors and drawers.

B. Grain Direction for Wood Grain Plastic Laminate:

1. Vertical on both doors and drawer fronts, with continuous vertical matching.
2. Vertical on end panels.
3. Vertical on knee-space panels.

C. Exposed Materials:

1. Plastic Laminate:

a. Colors and Patterns: As selected by Designer; refer to "IN" drawings.

D. Semi-exposed Materials:

1. Plastic Laminate: unless otherwise indicated. Provide plastic laminate for semi-exposed surfaces unless otherwise indicated; refer to "IN" drawings.

a. Provide plastic laminate of same grade as exposed surfaces for interior faces of doors and drawer fronts and other locations where opposite side of component is exposed.

2. Unless otherwise indicated, provide specified edge banding on all semi-exposed edges.

E. Concealed Materials:

1. Particleboard.

2.3 CASEWORK HARDWARE AND ACCESSORIES

A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware that compiles with ADA Guidelines.
3. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

B. Butt Hinges: Stainless steel, semiconcealed, or five-knuckle hinges complying with ANSI/BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two hinges for doors less than 48 inches high, and provide three hinges for doors more than 48 inches high.

C. Pulls: Solid stainless-steel 4" wire pulls, fastened from back with two screws. Provide two pulls for drawers more than 24 inches wide. Ensure ADA Guideline compliance.

D. Door Catches:

1. Dual, self-aligning, permanent magnet catch. Provide two catches on doors more than 48 inches high.

2. Chain Stops shall be zinc plated, looped chain used to limit door swing as specified, mounting plate at each end of chain shall use (4) #7 x 5/8" screws to secure to cabinet door and end panel. They shall be on cabinets at adjoining walls and where casework and countertops can interfere with the door swing of the tall cabinet.

E. Door and Drawer Bumpers: Self-adhering, clear silicone rubber.

1. Doors: Provide one bumper at top and bottom of closing edge of each swinging door.
2. Drawers: Provide one bumper on back side of drawer front at each corner.

F. Drawer Slides: BHMA A156.9, Type B05091, to be self-closing design, full extension, epoxy powder coated, with positive in stop, out stop, and out-keeper. Provide integral adjuster to manually fine tune left-to-right body movement from 0” to 1/8”.

1. Box Drawer Slides: Grade 1HD-100, for drawers not more than 6 inches high and 24 inches wide. Dynamic (operational) load rating to be minimum 100 lbs.

2.4 MATERIALS

A. Low-Emitting Materials: Shall comply with the testing and product requirements of the California Department of Health Services' “Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers”.
B. Maximum Moisture Content for Lumber: 7 percent for hardwood and 12 percent for softwood.
C. Hardwood Plywood: HPVA HP-1, particleboard core except where veneer core is indicated.
D. MDF: ANSI A208.2.
E. Hardboard: ANSI A135.4, Class 1 Tempered.
F. Plastic Laminate: High-pressure, decorative laminate complying with NEMA LD 3.

2.5 FABRICATION

A. Plastic Laminate Faced Cabinet Construction: Refer to Interior Finish drawings for specifications, elevations, additional details and information.

1. Bottoms and Ends of Cabinets, and Tops of Wall Cabinets and Tall Cabinets: ¾ inch particleboard.
2. Shelves: ¾ inch thick particleboard.
3. Backs of Cabinets: ½ inch thick particleboard or MDF where exposed, ¼ inch hardboard dadoed into sides, bottoms and tops where not exposed.
4. Drawer Fronts: ¾ inch particleboard.
5. Drawer Sides and Backs: ½ inch particleboard or MDF, with glued dovetail or multiple-dowel joints.
6. Drawer Bottoms: ¼ inch hardwood plywood glued and dadoed into front, back and sides of drawers. Use ½ inch material for drawers more than 24 inches wide.
7. Drawer Bodies: Steel drawer pans formed from 0.0359 inch thick metal, metallic phosphate treated and finished with manufacturer's standard two-coat, baked-enamel finish consisting of prime coat and thermosetting topcoat with a minimum dry film thickness of 1 mil for topcoat and 2 mils for system.
8. Doors 48 Inches High or Less: ¾ inch thick, with particleboard or MDF cores.

B. Filler Strips: Provide as needed to close spaces between cabinets and walls, ceilings, and indicated equipment. Fabricate from same material and with same finish as cabinets.

2.6 CASEWORK HARDWARE AND ACCESSORIES

A. Hardware, General: Unless otherwise indicated, provide manufacturer's standard satin-finish, commercial-quality, heavy-duty hardware that compiles with ADA Guidelines.

    1. Use threaded metal or plastic inserts with machine screws for fastening to particleboard except where hardware is through-bolted from back side.

B. Butt Hinges: Stainless-steel, semi-concealed, or five-knuckle hinges complying with BHMA A156.9, Grade 1, with antifriction bearings and rounded tips. Provide two hinges for doors less than 48 inches high and provide three hinges for doors more than 48 inches high.
C. Drawer Slides: BHMA A156.9, Type B05091.

    1. Standard Duty (Grades 1, 2, and 3): Side mounted; full -extension type; zinc-plated steel with polymer rollers.
    2. Heavy Duty (Grade 1HD-100 and Grade 1HD-200): Side mounted; full extension type; zinc-plated, steel ball-bearing slides.

D. Adjustable Shelf Supports: Single-pin metal shelf rests complying with BHMA A156.9, Type B04013.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas, with Installer present, for compliance with requirements for installation tolerances, location of framing and reinforcements and other conditions affecting performance of the Work.
B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 CASEWORK INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.
B. Install casework level, plumb and true; shim as required (using concealed shims). Where casework abuts other finished work, apply filler strips and scribe for accurate fit, with fasteners concealed where practical.
C. Base Cabinets: Set cabinets straight, level, and plumb. Adjust sub tops within 1/16 inch of a single plane. Align similar adjoining doors and drawers to a tolerance of 1/16 inch. Bolt adjacent cabinets together with joints flush, tight, and uniform.
D. Wall Cabinets: Hang cabinets straight, level and plumb. Adjust fronts and bottoms within 1/16 inch of a single plane. Fasten to hanging strips, masonry, framing, wood blocking or reinforcements in walls and partitions. Align similar adjoining doors to a tolerance of 1/16 inch.
E. Fasten cabinets to adjacent cabinets and to masonry, framing, wood blocking, or reinforcements in walls and partitions to comply with industry standards.
F. Install hardware uniformly and precisely. Set hinges snug and flat in mortises unless otherwise indicated. Adjust and align hardware so moving parts operate freely and contact points meet accurately. Allow for final adjustment after installation.
G. Adjust casework and hardware so doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

3.3 CLEANING

A. Repair or remove and replace defective work as directed on completion of installation.
B. Clean finished surfaces and touch up as required. Remove or refinish damaged or soiled areas to match original factory finish, as approved by Designer.

END OF SECTION

SECTION 12 36 00
COUNTERTOPS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Countertops for architectural cabinet work.

1.2 RELATED REQUIREMENTS

A. Section 06 41 00 - Architectural Wood Casework.

1.3 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program; Current Edition.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

C. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

D. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

E. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:
   1. Preparation instructions and recommendations.
   2. Storage and handling requirements and recommendations.
   3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation ; combine with shop drawings of cabinets and casework specified in other sections.

D. Selection Samples: For each finish product specified, color chips representing manufacturer's full range of available colors and patterns.

E. Verification Samples: For each finish product specified, minimum size 6 inches (150 mm) square, representing actual product, color, and patterns.

F. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

G. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

H. Installer's qualification statement.

I. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.5 QUALITY ASSURANCE

A. Quality Certification:
1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
2. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
3. Provide designated labels on shop drawings as required by certification program.
4. Provide designated labels on installed products as required by certification program.
5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1 COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Plastic Laminate Countertops: High-pressure decorative laminate (HPDL) sheet bonded to substrate.
1. Laminate Sheet: NEMA LD 3, Grade HGS, 0.048 inch (1.2 mm) nominal thickness.
a. Finish: Matte or suede, gloss rating of 5 to 20.
2. Back and End Splashes: Same material, same construction.

C. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.
1. Flat Sheet Thickness: 3/4 inch (19 mm), minimum.
2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, mineral filler, and pigments; homogenous, non-

porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.
   a. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.
   b. Color and Pattern: As selected by Architect from manufacturer's full line.
3. Other Components Thickness: 1/2 inch (12 mm), minimum.
4. Back and End Splashes: Same sheet material, square top; minimum 4 inches (102 mm) high.
5. Fabricate in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 11 - Countertops, Premium Grade.

2.2 MATERIALS

A. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

B. Joint Sealant: Mildew-resistant silicone sealant, clear.

2.3 FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.
   1. Join lengths of tops using best method recommended by manufacturer.
   2. Fabricate to overhang fronts and ends of cabinets 1 inch (25 mm) except where top butts against cabinet or wall.
   3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back/end splash wherever counter edge abuts vertical surface unless otherwise indicated.
   1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.
   2. Height: 4 inches (102 mm), unless otherwise indicated.

C. Solid Surfacing: Fabricate tops and wall panels up to 144 inches (3,657 mm) long in one piece; join pieces with adhesive sealant in accordance with manufacturer's recommendations and instructions.

PART 3 EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install vanities in accordance with manufacturer's instructions and approved shop drawings

B. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

C. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch (16 mm).

D. Seal joint between back/end splashes and vertical surfaces.

3.4 TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet (3 mm in 3 m), maximum.

B. Offset From Wall, Countertops: 1/8 inch (3 mm) maximum; 1/16 inch (1.5 mm) minimum.

C. Field Joints: 1/8 inch (3 mm) wide, maximum.

3.5 CLEANING

A. Clean countertops surfaces thoroughly.

3.6 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

SECTION 13 34 19
METAL BUILDING SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Manufacturer-engineered, shop-fabricated structural steel building frame.

B. Insulated Metal wall and roof panels including soffits, gutters and downspouts, and roof mounted equipment curbs.

C. Exterior doors, windows, skylights, overhead doors, and louvers.

1.2 RELATED REQUIREMENTS

A. Section 08 11 13 - Hollow Metal Doors and Frames.

B. Section 08 36 13 - Sectional Doors.

C. Section 08 51 13 - Aluminum Windows.

D. Section 08 52 00 - Wood Windows.

1.3 REFERENCE STANDARDS

A. AISC 360 - Specification for Structural Steel Buildings; 2016 (Revised 2021).

B. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

C. IAS AC472 - Accreditation Criteria for Inspection Programs for Manufacturers of Metal Building Systems; 2018.

D. MBMA (MBSM) - Metal Building Systems Manual; 2024.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on profiles, component dimensions, fasteners.

C. Shop Drawings: Indicate assembly dimensions, locations of structural members, connections; wall and roof system dimensions, panel layout, general construction details, anchors and methods of anchorage, and installation; framing anchor bolt settings, sizes, locations from datum, and foundation loads; indicate welded connections with AWS A2.4 welding symbols; indicate net weld lengths; provide professional seal and signature.

D. Samples: Submit two samples of precoated metal panels for each color selected, 12 inch by 12 inch (305 mm by 305 mm) in size illustrating color and texture of finish.

E. Manufacturer's Instructions: Indicate preparation requirements, anchor bolt placement.

F. Erection Drawings: Indicate members by label, assembly sequence, and temporary erection bracing.

G. Designer's Qualification Statement.

H. Manufacturer's Qualification Statement: Provide documentation showing metal building manufacturer is accredited under IAS AC472.
   1. Include statement that manufacturer designs and fabricates metal building system as integrated components and assemblies, including but not limited to primary structural members, secondary members, joints, roof, and wall cladding components specifically designed to support and transfer loads and properly assembled components form a complete or partial building shell.

I. Erector's Qualification Statement.

J. Project Record Documents: Record actual locations of concealed components and utilities.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: Design structural components, develop shop drawings, and perform shop and site work under direct supervision of a Professional Structural Engineer experienced in design of this type of work.
   1. Design Engineer Qualifications: Licensed in the State in which the Project is located.
   2. Comply with applicable code for submission of design calculations as required for acquiring permits.
   3. Cooperate with regulatory agency or authorities having jurisdiction (AHJ), and provide data as requested.

B. Perform work in accordance with AISC 360 and MBMA (MBSM).

C. Manufacturer Qualifications: Company specializing in the manufacture of products similar to those required for this project.
   1. Not less than three years of documented experience.

D. Erector Qualifications: Company specializing in performing the work of this section with minimum three years documented experience.

1.6 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty for the items listed below:.
   1. Include coverage for exterior pre-finished surfaces to cover pre-finished color coat against chipping, cracking or crazing, blistering, peeling, chalking, or fading. Include coverage for weather tightness of building enclosure elements after installation.

PART 2 PRODUCTS

2.1 ASSEMBLIES

A. Tapered beam.

B. Primary Framing: Rigid frame of rafter beams and columns, canopy beams, and wind bracing.

C. Secondary Framing: Purlins, and other items detailed.

2.2 PERFORMANCE REQUIREMENTS

A. Installed Thermal Resistance of Wall System: R-value of ____ (RSI-value of ____).

B. Installed Thermal Resistance of Roof System: R-value of ____ (RSI-value of ____).

C. Design structural members to withstand dead load, applicable snow load, and design loads due to pressure and suction of wind calculated in accordance with applicable code.

D. Provide drainage to exterior for water entering or condensation occurring within wall or roof system.

E. Permit movement of components without buckling, failure of joint seals, undue stress on fasteners or other detrimental effects, when subject to temperature range of ____ degrees F (____ degrees C).

2.3 MATERIALS - FRAMING

2.4 MATERIALS - WALLS AND ROOF

2.5 COMPONENTS

A. Doors and Frames: Specified in Section 08 11 13.

B. Overhead Doors: Specified in Section 08 36 13.

C. Windows: Specified in Section 08 52 00.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that foundation, floor slab, mechanical and electrical utilities, and placed anchors are in correct position

3.2 ERECTION - FRAMING

A. Erect framing in accordance with AISC 360.

B. Provide for erection and wind loads. Provide temporary bracing to maintain structure plumb and in alignment until completion of erection and installation of permanent bracing. Locate braced bays as indicated.

C. Set column base plates with non-shrink grout to achieve full plate bearing.

D. Do not field cut or alter structural members without approval.

E. After erection, prime welds, abrasions, and surfaces not shop primed.

3.3 ERECTION - WALL AND ROOF PANELS

A. Install in accordance with manufacturer's instructions.

B. Exercise care when cutting prefinished material to ensure cuttings do not remain on finish surface.

C. Fasten cladding system to structural supports, aligned level and plumb.

D. Locate end laps over supports. End laps minimum 2 inches (50 mm). Place side laps over bearing.

E. Provide expansion joints where indicated.

F. Use concealed fasteners.

G. Install sealant and gaskets, providing weather tight installation.

3.4 TOLERANCES

A. Framing Members: 1/4 inch (6 mm) from level; 1/8 inch (3 mm) from plumb.

B. Siding and Roofing: 1/8 inch (3 mm) from true position.

SECTION 05 53 05
METAL GRATINGS AND FLOOR PLATES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Formed metal floor, mezzanine, and stair tread gratings.

B. Flat surface floor and stair tread plating.

C. Perimeter closure.

1.2 REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

C. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2021).

D. ASTM A1011/A1011M - 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; 2018a.

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

G. NAAMM MBG 531 - Metal Bar Grating Manual; 2017.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide span and deflection tables.

C. Shop Drawings: Indicate details of component supports, openings, perimeter construction details, and tolerances.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

D. Samples: Submit two samples, 6 by 6 inch (____ by ____ mm) in size illustrating surface finish, color, and texture.

1.4 QUALITY ASSURANCE

A. Designer Qualifications: Design gratings and plates under direct supervision of a Professional Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

PART 2 PRODUCTS

2.1 PERFORMANCE REQUIREMENTS

A. Comply with applicable code for loading requirements.

2.2 MATERIALS

A. Steel Floor Plate: ASTM A786/A786M; manufacturer's standard pattern.

B. Sheet Steel for Die Stamping: ASTM A1011/A1011M Designation CS hot-rolled sheet.

C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.3 ACCESSORIES

A. Fasteners and Saddle Clips: Galvanized steel:

B. Perimeter Closure: Of same material as grating.

2.4 FABRICATION

A. Fabricate grates and plates to accommodate design loads.

2.5 FINISHES

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Galvanizing for Steel Shapes: ASTM A123/A123M.

C. Galvanizing for Steel Hardware: ASTM A153/A153M.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated on drawings.

B. Verify that opening sizes and dimensional tolerances are acceptable.

C. Verify that supports are correctly positioned.

3.2 INSTALLATION

A. Install components in accordance with manufacturer's instructions.

B. Place frames in correct position, plumb and level.

C. Mechanically cut galvanized finish surfaces. Do not flame cut.

D. Anchor by welding.

E. Set perimeter closure flush with top of grating and surrounding construction.

F. Secure to prevent movement.

3.3 TOLERANCES

A. Comply with NAAMM MBG 531.

SECTION 05 12 00

STRUCTURAL STEEL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. All structural steel framing, including connections and accessories, as shown or implied by the Contract Documents.

B. Related Sections:

1. Division 03 Section “Grouting”
2. Division 05 Section “Steel Roof Decking”.
3. Division 05 Section “Composite Metal Decking”.
4. Division 07 Section “Cementitious Fireproofing”.
5. Division 07 Section “Thin-Film Intumescent Fireproofing”.
6. Division 09 Section “Painting”.

C. Allowances: Provide the following under the allowances indicated as specified in Division 01–Allowances:

1. Structural Steel Allowance: include an Allowance of <___> tons of structural steel for use as directed by the Architect/Engineer. Allowance shall include costs for the following:

a. Furnishing the quantity of steel indicated in the sizes selected by the Architect/Engineer.
b. Shop drawing preparation for additional material.
c. Fabrication of steel, ready for installation on site.
d. Priming of steel members.
e. Delivery to site and erection in location directed by Architect/Engineer.
f. Required bolts, welding supplies, shims, and miscellaneous materials or erection aids required for a complete installation.

1.2 QUALITY ASSURANCE

A. Qualifications of Suppliers and Personnel:

1. The steel fabricator and erector shall have successfully completed work of this type and scope. The fabrication facility shall be certified as an AISC Category I facility.
2. All welding shall be performed by operators who have been recently qualified as prescribed in "Structural Welding Code" of the American Welding Society (except for welds which do not carry calculated stress).

B. Codes and Standards:

1. In addition to complying with all pertinent codes and regulations, comply with:
2. "Specifications for Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction
3. "Structural Welding Code" of the American Welding Society
4. "Code of Standard Practice for Steel Buildings and Bridges" of the American Institute of Steel Construction.

C. Conflicting Requirements:

1. In the event of conflict between pertinent codes and regulations and the requirements of the referenced standards or this Section of the Project Manual, the provisions of the more stringent shall govern.

D. Fabricators Shop Testing, Inspection and Quality Control:

1. For AISC certified facilities, submit a written program for the proposed fabrication quality control testing and inspection. After review and acceptance of these documents by the Architect/Engineer, perform all shop testing and inspection as specified herein. If the Fabricator's facility is not AISC certified, the Contractor's independent testing laboratory will perform all shop testing and inspection work, and the fabricators will be backcharged for this work.
2. Structural Steel Fabrication Shop Quality Control Program: As a minimum, perform at least the following shop tests and inspections and submit daily reports of the results of all tests. State in each report whether the tested specimens conform to all requirements of the Contract Documents, and specifically note any discrepancies. If the inspections indicate defects in the Work, increase the degree of testing to ensure that the full extent of defects in the joint are found and that similar defects are not present in similar joints.

    a. Provide evidence that all welders to be employed in the Work hold current AWS certification for the welding procedures that each will perform. If recertification of welders is required, the retesting is the Contractor's responsibility.
    b. Visually inspect all fabrication operations, including dimensional and fit-up/alignment and control.
    c. Visually inspect all plate edges and rolled shape edges for material defects.
    d. High strength bolted connections:

        1) Check all bolted connections in accordance with the procedures outlined in the RCSC "Specification for Structural Joints Using ASTM A325 or A490 Bolts", latest edition.

    e. Welding visual inspection:

        1) Inspect all welding operations and welds, including edge preparation, fit-up, preheat, and adherence to welding procedures.

            a) Inspect welds prior to shop painting of steel.
            b) Measure the weld profiles for 15 percent of the length of each weld, at random.

f. Welding magnetic particle testing: Test in accordance with ASTM E109 for a minimum of:

1) 20 percent of all shear plate fillet welds at random, final pass only.
2) 20 percent of all continuity plate and bracing gusset plate fillet welds, at random, final pass only.
3) 100 percent of tension member fillet welds (i.e., hanger connection plates and other similar connections) for root and final passes.
4) 20 percent of length of built-up column member partial penetration and fillet welds at random for root and final passes.
5) 100 percent of length of built-up girder member partial penetration and fillet welds for root and final passes.

g. Welding ultrasonic testing: Test in accordance with ASTM E164 and AWS D1.1 for 100 percent of all full penetration welds, braced and moment frame column splices, and a minimum of 20 percent of all other partial penetration column splices, at random.

h. Schedule all work to allow the testing requirements listed above to be completed.

1.3 SUBMITTALS

A. Shop Drawings:

1. Prior to the bulk of shop drawing preparation, submit to the Architect/Engineer shop drawings of "typical conditions" and connections to assure that the fabricators assumptions are correct as to type of connection and other pertinent details.
2. Before any structural steel is fabricated, submit shop drawings to the Architect/Engineer for review and receive approval of same in accordance with Division 01 of this Project Manual.
3. Show all shop and erection details including cuts, copes, connections, holes, threaded fasteners, and welds.
4. Show all welds, both shop and field by the currently recommended symbols of the American Welding Society.

B. Proof of Qualification:

1. Submit to the Architect/Engineer evidence satisfactory to him that the steel fabricator and steel erector are qualified for the Work in accordance with the requirements of this Section of the Project Manual.

C. Certification:

1. Submit to the Architect/Engineer a certification that the materials supplied are in accordance with the requirements of this Section of the Project Manual.

1.4 PROJECT CONDITIONS

A. Field Verification:

1. Confirm all dimensions necessary to make the framing assembly fit accurately.
2. Do not fabricate materials until field dimensions have been confirmed.

PART 2 - PRODUCTS

2.1 STRUCTURAL STEEL

A. Steel Shapes and Plates:

1. All steel w-shapes shall meet the requirements of ASTM A992 or ASTM A572, Grade 50 except plates, angles and channels shall meet the requirements of ASTM A36.

B. Hollow Structural Section (HSS):

1. Round, square and rectangular HSS sections shall meet the requirements of ASTM A500, Grade B.

C. Pipes:

1. Steel pipes shall meet the requirements of ASTM A501 or ASTM A53, Grade B, Type E or S.

2.2 CONNECTIONS

A. Materials:

1. High-strength bolts for shop and field connections: ASTM A325, 3/4 inch minimum diameter.
2. Anchor bolts, nuts and washers: ASTM F1554, Class **[36] [55]**, Grade 2A
3. Machine bolts for minor connections: ASTM A307
4. Shear studs: ASTM A108, Grades 1015 through 1020, Headed-stud type, cold finished carbon steel; AWS D1.1, Type B.
5. Welding electrodes: ASTM A233, Series E70XX

B. All shop connections shall be accomplished using high strength bolts or by welding at the Contractor's option.

C. Use high strength bolts for field connections.

D. Bolted connections shall be bearing type connections with threads in the shear plane.

E. Moment connections as detailed in the Contract Documents are designed as welded connections.

F. All connections shall be consistent with the design assumptions associated with Type "2" or Type "3" construction defined by the American Institute of Steel Construction.

G. Minimum thickness of connection material shall be 5/16".

2.3 PRIMER PAINT

A. General:

1. All primer paint for structural steel shall be compatible with the finish coatings described in Division 09 of this Project Manual.
2. Omit paint from structural steel encased in concrete or designated to receive fireproofing, and from all faying surfaces.
3. Omit paint on all non-corrodible finished angles.

2.4 OTHER MATERIALS

A. All other materials not specifically described but required for a complete and proper installation of structural steel, shall be new, free from rust, first quality of their respective kinds, and subject to the acceptance of the Architect/Engineer.

PART 3 - EXECUTION

3.1 SURFACE CONDITIONS

A. Inspection:

1. Prior to installation of the Work of this Section, carefully inspect the installed Work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that existing conditions will permit the structural steel to be fabricated and erected in strict accordance with the original design, the shop drawings, and the referenced standards.

B. Discrepancies:

1. Do not proceed with fabrication or installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 FABRICATION

A. General:

1. Fabricate all structural steel in strict accordance with the shop drawings and the referenced standards.

B. Shop Cleaning and Priming:

1. Shop cleaning shall meet recommendations of the final finish manufacturer.
2. Shop paint all structural steel one coat where priming is required.
3. Thoroughly clean all steel that is not to be painted.

C. Milling:

1. Mill the bearing surfaces of all columns/compression members.

D. Leveling Nuts:

1. All column base plates shall be supported on leveling nuts unless noted otherwise. The area between the base plate and concrete shall be grouted in accordance with Division 03 Section “Grouting”.

3.3 WELDING

A. General:

1. For details of joints, comply with requirements for AWS joints accepted with qualification tests.
2. Use ASTM A233, E-70 series electrodes.
3. Follow applicable sections of AWS specifications.

B. Types of Welds:

1. Unless otherwise noted:

a. Make all fillet welds 3/16" minimum.
b. Make all butt welds full penetration welds, using back-up or chip and back-weld.

3.4 ERECTION

A. General:

1. Erect all structural steel in strict accordance with the drawings, the shop drawings, and all pertinent regulations and standards.

B. Bolted Connections:

1. Accomplish high-strength bolted connections in accordance with the American Institute of Steel Construction's publication, "Specifications for Structural Joints Using ASTM A325 or A490 Bolts."
2. All bolts in bolted connections shall be tightened to the “snug tight condition” unless noted otherwise on the drawings.

C. Touch-Up:

1. After erection is complete:

a. Touch-up all shop priming coats damaged during transportation and erection.
b. Prime all field welds on members that have been welded, and paint all field bolts using the priming paint specified for shop priming.

D. Bracing:

1. Furnish, design, and install all temporary erection bracing.

2. Leave such bracing in place until the structure is stabilized by walls, slabs, decks and permanent bracing.

3.5 INSPECTION AND QUALITY ASSURANCE

A. The Testing Laboratory will conduct a program of testing and inspection for both shop fabrication and field erection. During shop fabrication, the program will consist of monitoring the structural steel Contractor's quality control and testing program. If the fabrication facility does not qualify as a certified AISC Category I facility, the Testing Laboratory will perform all shop testing and inspection work. During field erection, the program will consist of all field testing and inspection as specified.

B. Shop Quality Control by Testing Laboratory: Provide periodic monitoring of the Contractor's quality control testing and inspection program. Include the following as a minimum degree of monitoring:

1. Verify all welder qualification, and monitor welding procedures and welding processes.
2. Monitor all fabrication operations.
3. Verify and monitor all shop testing and inspection, including review of the Contractor's testing and inspection records.
4. Perform inspection as necessary on those portions of the structural steel not in evidence of complying with the Contract Documents.

C. Field Quality Control by Testing Laboratory: Perform the following quality control tests and inspections. Interpret test results, submit daily reports and monthly summary reports.

1. Examine the Manufacturer's test certificates for all materials provided. Verify that the lot numbers of the tested material coincides with the lot numbers of the material used on-site.
2. Visually inspect all anchor-bolt nut installation and tightening.
3. High strength bolted connections:

    a. Observe the job site calibration of each size bolted fastener assembly and installation technique in the calibrated tension measuring device. Verify that the proper bolt pretension listed in Table 4 of the RCSC "Specification" is achieved and that installation equipment is of sufficient capacity.
    b. Routinely monitor field bolting procedures during bolt installation. Verify that all bolts in all connections are brought to a "snug tight" condition with all plies of the connection in firm contact. Verify that bolts in connections identified as either slip-critical or direct tension connections are being additionally tightened by the proper technique(s) determined in the tension testing device described above.
    c. Check that all bolted connections are being installed in accordance with the procedures outlined in the RCSC "Specification."

4. Welded connections:

    a. Obtain qualifications of all welders and verify all welding procedures, including the Contractor's compliance with preheat, weather-protection, electrodes, and welding surface preparation requirements.
    b. Visually inspect all field welding operations and welds.

5. Magnetic particle testing: Test in accordance with ASTM E109 for a minimum of:

    a. 20 percent of the length of all field fillet welds, at random, final pass only.
    b. 25 percent of the length of all field partial penetration welds, except column splices, at random, root and final passes.

6. Ultrasonic testing: Test in accordance with ASTM E164 and AWS D1.1 for a minimum of:

    a. 100 percent of all field full penetration welds.
    b. 100 percent of the length of 25 percent of all field partial penetration column splices, at random.

7. Schedule all work to allow the testing requirements listed above to be completed.
8. Testing and inspection do not relieve the Contractor of the responsibility for providing materials and fabrication procedures in compliance with the specified requirements.

D. Following procedure shall be followed for inspection and testing of all joints of the seismic force resisting systems:

1. The testing agency responsible for quality assurance shall submit the following documents to the A/E and the owner:

    a. Qualifications of the management and quality assurance personnel designated for the project.
    b. Qualification records for the inspectors and non destructive testing technicians designated for the project.
    c. Daily or weekly inspection reports including the nonconformance reports.

2. Inspection points and frequencies of quality assurance task and documentation for the seismic load resisting system shall be as explained below:

    a. Observe (O): Observe these on a random, daily basis.
    b. Perform (P): Perform these functions prior to final acceptance of the item.
    c. Document (D): The inspector shall prepare reports indicating that the work meets the requirements of the contract documents. The report shall indicate the deficiencies and whether the noncompliance has been satisfactorily repaired or not. Inspect after repair and provide a report.

3. Visual welding inspection shall be the primary method to confirm the procedure materials and the workmanship are as specified and approved. Minimum inspection tasks shall be as follows:

    a. Observe and perform material identification, joint preparation, dimensions, cleanliness tack weld quality and location, backing type, configuration of the access holes, dimensions and cleanliness of the fillet welds and the field welding process.
    b. Document visual inspection of the weld for crack, weld/base metal fusion, crater cross-section, weld profile, weld size, undercut, porosity placement of the reinforcement fillets, backing bars/weld tabs removed and finished (if required) and the repair activities.

c. Perform and document all repair or corrective work activities.

4. Nondestructive testing of the welds shall be performed by ultrasonic or magnetic particle testing (MT) as follows:

   a. MT inspection for cracks at welding of doubler plates, continuity plates or stiffeners in the k-area base metal within 3” of weld. Document the findings until accepted.
   b. Ultrasonic testing shall be performed for all complete joint penetration (CJP) groove weld in materials 5/16” or thicker. Perform MT inspection on 25 percent of all beam-to-column CJP groove welds. Document the findings until accepted.
   c. Ultrasonic testing for Lamellar Tearing for base metal thicker than 1-1/2”. Document the findings until accepted.
   d. MT inspection of beam cope and access hole for beams with 1-1/2” or thicker flange. Document the findings until accepted.
   e. MT inspection of reduced beam section repair and web tab removal sites. Document the findings until accepted.

5. Observation of bolting operations shall be the primary method to confirm the materials procedure and workmanship.

   a. Verify materials and procedure prior to installation and document the findings until accepted.
   b. Document data of all rejected connections until accepted.

END OF SECTION 05 12 00

SECTION 05 36 00

COMPOSITE METAL DECKING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Composite metal decking and accessories necessary to complete the structure and appurtenances as indicated or implied by the Contractor Documents.

B. Related Sections:

1. Division 03 Section “Concrete Formwork”
2. Division 03 Section “Concrete Reinforcement”
3. Division 03 Section “Cast-in-Place Concrete”
4. Division 05 Section “Structural Steel Framing”
5. Division 05 Section “Steel Roof Decking”
6. Division 05 Section “Metal Fabrications”
7. Division 07 Section “Cementitious Fireproofing”

1.2 SUBMITTALS

A. Product Data: Manufacturer’s standard printed product information, indicating compliance with requirements.

B. Shop Drawings:

1. Submit shop drawings showing deck layout, projections, openings, framing and supports, type and location of welds, and details of accessories.
2. Shop Drawing shall include:

a. Deck type, gage, and finish.
b. Connections of deck to framing members, indicating type and locations.
c. Connections of deck to adjacent deck pieces, indicating type and locations.
d. Shop and erection details.
e. Markings, quantities, and locations of all deck sheets.
f. Details of all deck accessories.
g. Locations and dimensions of all shop cut openings.
h. Details showing method of framing openings less than 12 inches square.

3. Fabrication shall not begin until shop drawings have been reviewed.

C. Welding certificates.

D. Field quality-control test and inspection reports.

1.3 QUALITY ASSURANCE

A. Material, Fabrication and Erection: Comply with the following standards:

1. AISI – Specifications for the Design of Cold Formed Steel Structural Members.
2. Steel Deck Institute – Design Manual for Composite Decks, Form Decks, and Roof Decks.

B. Erector Qualifications:

1. Erector: Approved by the fabricator.
2. Welders: AWS qualified according to AWS D1.3, "Structural Welding Code - Sheet Steel" and hold a current and valid certificate.

C. Fire-Test-Response Characteristics: Where indicated, provide steel deck units identical to those tested for fire resistance per ASTM E 119 by an independent testing and inspecting agency acceptable to authorities having jurisdiction.

1. Fire-Resistance Ratings: Provide units tested and labeled for use in indicated assembly for fire resistance rating indicated.
2. Label steel deck units with appropriate markings of applicable testing and inspecting agency.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Delivery and Handling: Protect steel deck and accessories to prevent damage during delivery, storage and handling.

B. Storage:

C. Store all materials on sills off the ground in such a manner that pieces lie flat without Storage:

1. Store steel deck at the project site off the ground with one end elevated to provide drainage, and s covered with a ventilated, waterproof cover.
2. Clean steel deck that has become soiled prior to installation.

1.5 PROJECT CONDITIONS

A. Verifying Conditions:

1. Take all necessary field measurements to make all work fit accurately. Do not fabricate any materials until such verification has been made.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Composite Steel Deck:

1. Galvanized sheet steel: ASTM A 653, Structural Steel (SS) Grade 33 or higher, G60 zinc coating.

    a. Gage and size as indicated on the Drawings.
    b. Units installed in fire rated assemblies: 20 gage, minimum

B. Galvanizing Repair Paint: High-zinc-dust-content paint for regalvanizing welds in steel, complying with SSPC-Paint 20.

C. Fire Rated Assemblies:

1. Unit shall be classified for use in UL assembly rating No. D925, or equivalent according to the hourly fire resistance rating required, manufacturer and products selected for fireproofing, and structural member sizes indicated.

2.2 COMPOSITE DECK

A. Fabricate composite deck with section properties computed in accordance with AISI "Specification for the Design of Cold-Formed Steel Structural Members".

1. Formed in fluted sections with interlocking side laps and embossments or other means to provide bond between concrete and deck units.
2. Form deck units in lengths to span three or more support spacing, with flush ends and nesting side laps.

B. Cover Plates:

1. Sheet steel of same quality as deck units
2. Gage to match steel deck before coating
3. Configure to match contour of floor deck units

C. Closure Strips:

1. Sheet steel of same quality as deck units
2. Gage to match steel deck before coating
3. Configure to provide tight-fitting closures at open ends of cells or flutes and sides of floor decking.

2.3 ACCESSORIES

A. Provide closures, reinforcing channels, and related accessories in sheet steel with same finish and gage as steel roof deck, 20 gage minimum.

1. Closures: Formed channel equal to deck depth, with 1 inch flanges, or as indicated.

B. Pour Stops: Form pour stops from galvanized steel to slab thickness indicated.

1. Hem top edge of pour stop with 1/2 inch return turned down 45 degrees from horizontal.
2. Provide pour stops in steel thickness indicated, or if not indicated, in thickness recommended in the SDI "Pour Stop Selection Table".

C. Metal fasteners for fastening side laps: Self-drilling, No. 10 minimum steel-to-steel screws.

1. Reference standard: ITW Buildex; Light-Duty Teks with Hex Washer Head

D. Opening reinforcement: 16 gage galvanized steel sheet, for penetration openings through deck with dimensions between 8 inches and 12 inches.

E. Flexible Closure Strips:

1. Non-fire-rated assemblies: Vulcanized, closed-cell, synthetic rubber.
2. Fire-rated assemblies: Mineral wool safing insulation. Refer to Division 07 Section "Firestopping".

PART 3 - EXECUTION

3.1 EXAMINATION

A. Check supporting members for correct layout and alignment.

B. Verify that surfaces to receive floor deck are free of debris.

C. Beginning of installation means installer accepts existing conditions.

3.2 INSTALLATION

A. General:

1. Install deck units and accessories in accordance with manufacturer's recommendations and shop drawings.
2. Install deck after structural support is in place, plumb and true.

B. Placing Floor Deck Units:

1. Position deck units with ends bearing a minimum of 1-1/2 inches on supporting members.
2. Align cells over entire length of run.
3. Provide support angles and closure plates at columns as required to provide adequate support for deck units and to contain the concrete.
4. Do not stagger joints between panels, except where necessary to maintain multiple spans.

C. Cutting and Fitting:

1. Cut and fit deck units and accessories around projections through floor.
2. Make cuts neat, square, and trim.
3. Install pour stops at floor edge and openings, upturned to top surface of slab.

a. Provide stops of sufficient strength to remain stationary without distortion.
b. Do not use pour stops as screeds.
c. Provide closure strip at end of deck where deck changes direction.

4. Provide angle frame supports at all penetrations through the deck larger than 12 inches in either direction.

D. Fastening Deck Units:

1. Secure floor deck units to supporting members with shear connectors or 3/4 inch minimum diameter fusion welds at 12 inches maximum spacing.

    a. Minimum of two welds per unit at each support.

2. Lock side laps between adjacent deck units at intervals not over 2 feet on center maximum with 5/8 inch diameter puddle welds, 1 inch fillet welds, or self-drilling screws.
3. Tack weld end closures at 2 feet on center maximum
4. Tack weld side closures at 2 feet on center maximum.
5. Welds shall be free of sharp points and edges.

E. Touch-Up Painting:

1. Wire brush, clean, and paint scarred areas, welds, and rust spots on top and bottom surfaces of deck units.
2. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.
3. Apply galvanizing repair paint immediately after welded surfaces have cooled.

3.3 PROTECTION

A. Do not use deck units for storage or working platforms until permanently secured in position.

B. Ensure that construction loads do not exceed carrying capacity of deck.

END OF SECTION 05 36 00

SECTION 05 50 00
METAL FABRICATIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Shop fabricated steel and aluminum items.

B. Downspout boots.

C. Cast iron trench castings.

1.2 RELATED REQUIREMENTS

A. Section 05 51 00 - Metal Stairs.

B. Section 05 52 13 - Pipe and Tube Railings.

C. Section 07 71 23 - Manufactured Gutters and Downspouts: Downspout boots.

D. Section 32 33 00 - Site Furnishings: Steel pipe bollards to match other site furnishings.

1.3 REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2020.

B. ASTM A276/A276M - Standard Specification for Stainless Steel Bars and Shapes; 2017.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2022.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

G. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

H. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2021.

I. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

J. ASTM A554 - Standard Specification for Welded Stainless Steel Mechanical Tubing; 2021.

K. ASTM A1011/A1011M - 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; 2018a.

L. ASTM B210/B210M - Standard Specification for Aluminum and Aluminum-Alloy Drawn Seamless Tubes; 2019a.

M. ASTM B209/B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2021.

N. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

O. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

P. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

Q. AWS D1.2/D1.2M - Structural Welding Code - Aluminum; 2014, with Errata 2020.

R. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

S. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

T. SSPC-Paint 20 - Zinc-Rich Coating (Type I - Inorganic, and Type II - Organic); 2019.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

C. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

1.5 QUALITY ASSURANCE

A. Design _____ under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

PART 2 PRODUCTS

2.1 MATERIALS - STEEL

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A501/A501M hot-formed structural tubing.

C. Plates: ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Stainless Steel, General: ASTM A666, Type 304.

F. Stainless Steel Tubing: ASTM A554, Type 304, 16 gauge, 0.0625 inch (1.59 mm) minimum metal thickness, 1-1/2 inch (38 mm) diameter.

G. Stainless Steel Bars, Shapes and Moldings: ASTM A276/A276M, Type 304.

H. Slotted Channel Fittings: ASTM A1011/A1011M.

I. Mechanical Fasteners: Same material as or compatible with materials being fastened; type consistent with design and specified quality level.

J. Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

K. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.

L. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

M. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

N. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.2 MATERIALS - ALUMINUM

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.

B. Sheet Aluminum: ASTM B209/B209M, 5052 alloy, H32 or H22 temper.

C. Aluminum-Alloy Drawn Seamless Tubes: ASTM B210/B210M, 6063 alloy, T6 temper.

D. Bolts, Nuts, and Washers: Stainless steel.

E. Welding Materials: AWS D1.2/D1.2M; type required for materials being welded.

2.3 FABRICATION

A. Fit and shop assemble items in largest practical sections, for delivery to site.

B. Fabricate items with joints tightly fitted and secured.

C. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.

D. Furnish components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

2.4 FABRICATED ITEMS

A. Bollards: Schedule 40 steel pipe, concrete filled, crowned cap, as detailed; prime paint finish.

B. Ledge Angles, Shelf Angles, Channels, and Plates Not Attached to Structural Framing: For support of metal decking; prime paint finish.

C. Lintels: As detailed; prime paint finish.

D. Door Frames for Overhead Doors, Wall Openings: Channel sections; prime paint finish.

2.5 DOWNSPOUT BOOTS

A. Downspout Boots: Smooth interior without boxed corners or choke points; include integral lug slots, integral cleanout, cleanout cover, and tamper proof fasteners.
   1. Configuration: Angular.
   2. Material: Cast iron; ASTM A48/A48M; casting thickness 3/8 inch (9.5 mm), minimum.
   3. Finish: Manufacturer's standard factory applied powder coat finish.
   4. Color: To be selected by Architect from manufacturer's standard range.
   5. Accessories: Manufacturer's standard stainless steel fasteners, stainless steel building wall anchors, integral neoprene gaskets, and rubber coupling.

2.6 CAST IRON TRENCH CASTINGS

A. Cast Iron Trench Castings:
   1. Material: Cast iron; ASTM A48/A48M, Class 35 B (heavy duty).
   2. Grate Type: Manufacturer's standard Type A.

2.7 FINISHES - STEEL

A. Prime paint steel items.
   1. Exceptions: Galvanize items to be embedded in concrete, items to be embedded in masonry, and items specified for _____ finish.
   2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.

B. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

C. Prime Painting: One coat.

D. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements. Provide minimum 1.7 oz/sq ft galvanized coating. (Provide minimum 530 g/sq m galvanized coating.)

2.8 FINISHES - ALUMINUM

A. Exterior Aluminum Surfaces: Class I color anodized.

B. Class I Natural Anodized Finish: AAMA 611 AA-M12C22A41 Clear anodic coating not less than 0.7 mils (0.018 mm) thick.

C. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils (0.018 mm) thick; light bronze.

D. Class I Color Anodized Finish: AAMA 611 AA-M12C22A44 Electrolytically deposited colored anodic coating not less than 0.7 mils (0.018 mm) thick; light bronze.

2.9 FABRICATION TOLERANCES

A. Squareness: 1/8 inch (3 mm) maximum difference in diagonal measurements.

B. Maximum Offset Between Faces: 1/16 inch (1.5 mm).

C. Maximum Misalignment of Adjacent Members: 1/16 inch (1.5 mm).

D. Maximum Bow: 1/8 inch (3 mm) in 48 inches (1.2 m).

E. Maximum Deviation From Plane: 1/16 inch (1.5 mm) in 48 inches (1.2 m).

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

3.3 INSTALLATION

A. Install items plumb and level, accurately fitted, free from distortion or defects.

B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Obtain approval prior to site cutting or making adjustments not scheduled.

SECTION 05 51 00
METAL STAIRS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Stairs with grating treads.

B. Prefabricated stairs.

C. Structural steel stair framing and supports.

D. Handrails and guards.

1.2 REFERENCE STANDARDS

A. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.

B. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2021.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2019.

D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2022.

E. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

F. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.

H. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2021.

I. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

J. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015 (Reapproved 2021).

K. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2021a.

L. ASTM A1011/A1011M - 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; 2018a.

M. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2022.

N. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

P. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

Q. NAAMM AMP 510 - Metal Stairs Manual; 1992.

R. NAAMM MBG 531 - Metal Bar Grating Manual; 2017.

S. NAAMM MBG 532 - Heavy Duty Metal Bar Grating Manual; 2019.

T. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

U. SSPC-SP 2 - Hand Tool Cleaning; 2024.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.
   1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
   2. Include the design engineer's seal and signature on each sheet of shop drawings.

C. Design Data: As required by authorities having jurisdiction.

D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is certified under AISC 201.

1.4 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Fabricator Qualifications:
   1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.
   2. A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
   3. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.1 METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.
   1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.
   2. Handrails: Comply with applicable accessibility requirements of ADA Standards.
   3. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.
      a. Stair Capacity: Uniform live load of 100 lb/sq ft (4.7 kPa) and a concentrated load of 300 lb (and a concentrated load of 14.4 kg) with deflection of stringer or landing framing not to exceed 1/360 of span.
      b. Railing Assemblies: Comply with applicable local code.
   4. Dimensions: As indicated on drawings.
   5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.
   6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.
   7. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:
   1. Industrial: All joints made neatly.
      a. Welded Joints: Welded on back side wherever possible.
      b. Welds Exposed to Touch: Ground smooth.
      c. Bolts Exposed to Touch in Travel Area: No nuts or screw threads exposed to touch.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.2 METAL STAIRS WITH GRATING TREADS

A. Jointing and Finish Quality Level: Industrial, as defined above.

B. Risers: Open.

C. Treads: Steel bar grating.
   1. Grating Type: Welded.
   2. Bearing Bar Depth: 3/4 inch (19 mm), minimum.
   3. Top Surface: Standard.
   4. Nosing: Checkered plate.
   5. Nosing Width: 1-1/4 inch (32 mm), minimum.
   6. Anchorage to Stringers: End plates welded to grating, bolted to stringers.

D. Stringers: Rolled steel channels.

1. Stringer Depth: 10 inches (250 mm).
2. End Closure: Sheet steel, 14 gauge, 0.075 inch (1.9 mm) minimum; welded across ends.

E. Railings: Steel pipe railings.

F. Finish: Shop- or factory-prime painted.

2.3 HANDRAILS AND GUARDS

A. Guards: Pipe railings, see Section 05 52 13.

2.4 MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

D. Pipe: ASTM A53/A53M Grade B Schedule 40, black finish.

E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.
1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).
2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

F. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230 with G40/Z120 coating.

G. Checkered Plate: ASTM A786/A786M, rolled steel floor plate; manufacturer's standard pattern.

H. Gratings: Bar gratings that comply with NAAMM MBG 531 or NAAMM MBG 532, whichever applies based on bar sizes.

2.5 ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

B. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

C. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

2.6 SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.
1. Preparation of Steel: In accordance with SSPC-SP 2 Hand Tool Cleaning.

2. Number of Coats: Two.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

3.3 INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Provide anchors, plates, angles, hangers, and struts required for connecting stairs to structure.

C. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

D. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

E. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

F. Obtain approval prior to site cutting or creating adjustments not scheduled.

G. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

SECTION 05 52 13
PIPE AND TUBE RAILINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Stair railings and guardrails.

B. Balcony railings and guardrails.

1.2 RELATED REQUIREMENTS

A. Section 05 51 00 - Metal Stairs: Handrails other than those specified in this section.

1.3 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.

C. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2021a.

D. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2021.

E. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2020.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020, with Errata (2022).

G. AWS D1.6/D1.6M - Structural Welding Code - Stainless Steel; 2017, with Amendment (2021).

H. AWS C3.4M/C3.4 - Specification for Torch Brazing; 2016.

I. AWS C3.5M/C3.5 - Specification for Induction Brazing; 2016, with Amendment (2017).

J. AWS C3.9M/C3.9 - Specification for Resistance Brazing; 2020.

K. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel AC172; 2019.

L. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 2004.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

C. Samples: Submit two, 12 inch (____ mm) long samples of handrail. Submit two samples of elbow, wall bracket, and end stop.

D. Fabricator's Qualification Statement.

1.5 QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

B. Welder Qualifications: Welding processes and welding operators qualified within previous 12 months.

C. Fabricator Qualifications:
1. A qualified steel fabricator that is certified by the American Institute for Steel Construction (AISC) under AISC 201.
2. A qualified steel fabricator that is accredited by the International Accreditation Service (IAS) Fabricator Inspection Program for Structural Steel in accordance with IAS AC172.
3. A company specializing in manufacturing products specified in this section, with not less than ten years of documented experience.

PART 2 PRODUCTS

2.1 RAILINGS - GENERAL REQUIREMENTS

A. Design, fabricate, and test railing assemblies in accordance with the most stringent requirements of applicable local code.

B. Distributed Loads: Design railing assembly, wall rails, and attachments to resist distributed force of 75 pounds per linear foot (1095 N/m) applied to the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

C. Concentrated Loads: Design railing assembly, wall rails, and attachments to resist a concentrated force of 200 pounds (890 N) applied at any point on the top of the assembly and in any direction, without damage or permanent set. Test in accordance with ASTM E935

D. Allow for expansion and contraction of members and building movement without damage to connections or members.

E. Dimensions: See drawings for configurations and heights.
1. Top Rails and Wall Rails: 1-1/2 inches (38 mm) diameter, round.
2. Intermediate Rails: 1-1/2 inches (38 mm) diameter, round.
3. Posts: 1-1/2 inches (38 mm) diameter, round.

F. Provide anchors and other components as required to attach to structure, made of same materials as railing components unless otherwise indicated; where exposed fasteners are unavoidable provide flush countersunk fasteners.

G. Provide slip-on non-weld mechanical fittings to join lengths, seal open ends, and conceal exposed mounting bolts and nuts, including but not limited to elbows, T-shapes, splice connectors, flanges, escutcheons, and wall brackets.

H. Welded and Brazed Joints: Make visible joints butt tight, flush, and hairline; use methods that avoid discoloration and damage of finish; grind smooth, polish, and restore to required finish.
   1. Ease exposed edges to a small uniform radius.
   2. Welded Joints:
      a. Carbon Steel: Perform welding in accordance with AWS D1.1/D1.1M.
      b. Stainless Steel: Perform welding in accordance with AWS D1.6/D1.6M.
   3. Brass/Bronze Brazed Joints:
      a. Perform torch brazing in accordance with AWS C3.4M/C3.4.
      b. Perform induction brazing in accordance with AWS C3.5M/C 3.5.
      c. Perform resistance brazing in accordance with AWS C3.9M/C3.9.

2.2 STEEL RAILING SYSTEM

A. Steel Tube: ASTM A500/A500M Grade B cold-formed structural tubing.

B. Non-Weld Mechanical Fittings: Slip-on, galvanized malleable iron castings, for Schedule 40 pipe, with flush setscrews for tightening by standard hex wrench, no bolts or screw fasteners.

C. Exposed Fasteners: Flush countersunk screws or bolts; consistent with design of railing.

D. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

2.3 FABRICATION

A. Accurately form components to suit specific project conditions and for proper connection to building structure.

B. Fit and shop assemble components in largest practical sizes for delivery to site.

C. Fabricate components with joints tightly fitted and secured. Provide spigots and sleeves to accommodate site assembly and installation.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2 PREPARATION

A. Clean and strip primed steel items to bare metal where site welding is required.

B. Supply items required to be cast into concrete or embedded in masonry with setting templates, for installation as work of other sections.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install components plumb and level, accurately fitted, free from distortion or defects, with tight joints.

C. Install railings in compliance with ADA Standards for accessible design at applicable locations.

D. Anchor railings securely to structure.

3.4 TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch (6 mm) per floor level, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch (6 mm).

C. Maximum Out-of-Position: 1/4 inch (6 mm).

SECTION 210501
COMMON WORK RESULTS FOR FIRE PROTECTION

PART 1 GENERAL

1.01 REFERENCES

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

B. INDIANA CODES
   1. General Administration Rules: Amended 12/01/2014
   2. Building Code: Effective 12/01/2014
   3. Fire Code: Effective 12/01/2014
   4. Plumbing Code: Effective 12/24/2012
   5. Electrical Code: Effective 08/26/2009
   6. Mechanical Code: Effective 12/01/2014
   7. Handicapped Accessibility Code: 2014
   8. Energy Code: Effective 05/07/2010
   9. Elevator Safety Code: 2011:
   10. Fuel Gas Code: Effective 12/01/2014
   11. NFPA 10
   12. NFPA 13
   13. NFPA 20
   14. NFPA 25
   15. NFPA 72

1.02 QUALITY ASSURANCE

A. Regulations and Standards: All equipment, apparatus, and systems are to be fabricated and installed in complete accordance with fire and insurance rules and regulations, the Life Safety Code, and the latest edition or revision of the following applicable regulations, standards, and codes:
   1. AIA American Institute of Architects
   2. ASME American Society of Mechanical Engineers
   3. ASTM American Society for Testing and Materials
   4. NFPA National Fire Protection Association
   5. NEC National Electric Code
   6. OSHA Occupational Safety and Health Administration
   7. UL Underwriter's Laboratories, Inc.
   8. MCAA Mechanical Contractors Association of America, Inc.
   9. ANSI American National Standard Institute
   10. MSSV Manufacturer's Standardization Society of the Valve and Fitting Industry
   11. AWWA American Water Works Association
   12. State of Indiana, Indiana Fire Code and Local Fire Marshal Requirements
   13. Owner's Fire Insurance Agency requirements
   14. Division 01 Sections “Regulatory Requirements: and “Reference Standards” of the Project Specifications
   15. References on the Drawings or in the Specifications to "code" or "building code" not otherwise identified shall mean the specific codes applicable to this Project location, together with all additions, amendments, changes, and interpretations adopted by code authorities having jurisdiction over this Project.
   16. The applicable edition of all codes shall be that adopted at the time of issuance of permits by the authorities having jurisdiction and shall include all modifications and additions adopted by that jurisdiction.
   17. Give all required notices so as to comply with, and meet, all inspections required by the Federal, State, and Local authorities.

18. It is not the intent herewith to modify, reduce, or change any rules, standards, regulations, or requirements that are applicable under local, state and federal codes, ordinances, or regulations of the various authorities having jurisdiction. Where the standards differ among the various authorities, the most restrictive shall apply. Where the requirements shown on the Drawings or called for in the Specifications exceed code requirements, these Drawings and Specifications shall take precedence. Where the requirements within the specifications of this division of work and the Drawings conflict with the referenced Divisions, Sections, and other documents, the documents having the most restrictive and the higher cost requirements shall apply.

1.03 SCOPE:

A. Perform all Work required to provide and install pipe, fittings, valves, connections, hangers, supports, sleeves and appurtenances for new, rework and/or expansion of existing wet-pipe sprinkler system with supplementary items necessary for complete, code compliant and approved installation.

B. Where piping and sprinklers are shown on drawings, such representation is for estimating and planning purposes only. It shall be the responsibility of this Contractor conduct his own flow test, establish his own layout, prepare shop drawings, furnish and install any additional piping or sprinklers which might be required to meet the requirements or approval of the authority having jurisdiction. Such additional installations shall be made without any additional cost to the Owner.

C. Size all branches and mains by hydraulic calculations. Contractor shall conduct a water flow test to obtain water supply information to determine actual available volume and pressures as a design basis for the system. Provide a 10 psi cushion for all hydraulic designs when possible. Hazard classifications for fire protection system design, installation and water supplies shall be in accordance with NFPA Standards. Include hose stream demand based on hazard classification.

D. Sprinkler head locations and spacing for Light Hazard Occupancies shall be in accordance with NFPA 13 requirements.

E. Interface all new flow and valve supervisory switches with building fire and smoke alarm systems.

1.04 JOB CONDITIONS AND COORDINATION

A. Local Conditions
   1. Each Trade Contractor is to inform himself of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work to be done.
   2. Contractors shall coordinate, and review indicated utility data with the local utility companies.

B. Present Job Site Inspection
   1. Contractor is to investigate for any existing conditions and responsibilities which are not clearly defined by the Drawings and Specifications. If any such conditions exist, they shall bring them to the attention of the A/E in writing. The A/E will then make the required written clarification. The absence of questions before the opening of bids shall indicate a clear understanding of the scope of work and the Contractor's responsibility.

C. Permits and Fees: This Contractor is to obtain all permits and pay all fees required for the work under Divisions 21 of the Work.

D. Royalties and Patents
   1. The Trade Contractor is to pay all royalties and license fees. They shall defend, indemnify, and hold the Owner and A/E harmless from any and all suits, demands or claims for infringement of any patent rights.

2. The review by A/E or Owner of any method of construction, invention, appliance, process, article, device or material of any kind is to be for adequacy of work, and is not to be construed as an approval of the use thereof by the Contractor in violation of any patent or other rights of any third person.

E. Wiring and Conduit Requirements: In general, most wiring and conduit requirements are addressed, either upon the Drawings as a part of a packaged equipment assembly specifications, or within Divisions 26, 27 and 28 of the Specifications. However, should an equipment component, panel, or system device need additional wiring and conduit so as to be complete, approved and fully operational, the Contractor who supplied the equipment component, panel or system device shall be responsible for the required wiring and conduit as well as circuit disconnect and protection for same when it is not otherwise covered by the Project Drawings and Specifications.

F. Coordination: Coordinate the exact location of this work with the work of other trades prior to fabrication or installation of same. Verify all dimensions and elevations. Provide additional offsets and sections of material as may be required to meet the applicable job condition requirements. Coordinate with and review all related construction Drawings and Shop Drawings of all equipment suppliers prior to start of work.

G. Post Indicating Valve: Furnished and Installed by the Civil Contractor.

H. Fire Pump: If a fire pump IS NOT indicted on the project documents and the bidding contractor determines that a fire pump is required to meet code compliance. Such Contractor shall immediately notify the Architect /Engineer to resolve the issue and to include such determination in the next addendum. If the Contractor discovers the need for a fire pump after the last issuance of the addendum, the Contractor shall clearly qualify his bid prior to bids being received.

1.05 SPECIFICATIONS AND DRAWINGS

A. These specifications and Drawings are intended to describe and provide for a complete and finished project. They are intended to be complementary. All items of work called for by either shall be as binding as if called for by both. The work described shall be complete in every detail, notwithstanding the fact that every item necessarily involved is not particularly mentioned or shown. If the Bidder, Supplier or Contractor sees anything to question, it must be brought to the attention of the A/E immediately.

B. Minor Deviations: The Drawings accompanying these Specifications indicate the general design and arrangement of equipment, apparatus, fixtures, accessories and piping necessary to complete the installation of the system. The exact location or arrangement of the apparatus and equipment, unless otherwise dimensioned, is subject to minor changes necessitated by field conditions and shall be required without additional cost to the Owner. Measurements shall be verified through actual observation at the construction site. Each Trade Contractor shall be responsible for fitting all of their work into place in a satisfactory and workmanlike manner, to the approval of the A/E and Owner.

C. Provide all labor and materials necessary for the completion of the work described. Referenced codes and industry standards and methods shall apply when no other specifics are indicated. Bring questions relating to this paragraph to the attention of the A/E for resolution prior to the receipt of Bids.

D. All Work indicated on Drawings, diagrams, or details in part only are to continue throughout unless distinctly marked otherwise. The same applies to other parts of the project where merely a typical reference plan, diagram, or section of the drawing is complete. The balance is intended to be the same as the typical plan, section, or diagram as shown and is to be figured accordingly.

E. The specifications are divided into trades and divisions only for the distinct purpose of facilitating the work. However, the Trade Contractor will become responsible for furnishing all labor and materials necessary to complete the project as contemplated by the Drawings and

Specifications. Any item mentioned under any heading of the Specifications must be supplied even though it is not called for again under the heading for the respective work.

F. Should discrepancies occur within the Contract Documents, the more stringent and more costly approach shall apply for bidding purposes. The Contractor is to notify the A/E of discrepancies for clarification. Clarifications issued after the Contract is awarded shall be incorporated by the Contractor at no additional costs and shall be reviewed by the A/E to determine if a reduction in cost is justified.

G. Typically, the Fire Protection Contractor is to begin his work at the piping blind-flange located at 18" A.F.F. The blind-flange is to be provided and installed by the Plumbing Contractor.

1.06 OPERATIONAL AND MAINTENANCE INSTRUCTIONS

A. All operational and maintenance instructions that are provided to various Owner-selected members of the facility engineering and/or maintenance staff are, at the same time presented, to be fully recorded on DVD by the Contractor so that all such sessions can be later reviewed by the Owner's staff on a retraining basis as needed. All such DVDs are to become the property of the Owner at the end of each applicable training period, with one copy of each also being supplied to the A/E for the A/E project files.

PART 2 PRODUCTS

2.01 MANUFACTURERS/PRODUCTS/SUBMITTALS

A. Under the Base Bid, no other manufacturers except those indicated on the Drawings or those listed within the Sections of this Division, that are, in turn, able to comply with the contract document requirements and minimum standards of these specifications, will be acceptable. In addition to specific required "Alternates," proposed substitutions that may or may not be acceptable to the Owner may be submitted by the Contractor only at the time of initial base bid submittal.

B. Although design-based models of various manufacturers may be indicated within the various schedules, it is the responsibility of the various equipment manufacturers to verify the model selections so that all items of equipment comply with the minimum standards of performance that are indicated within the schedules, as well as the requirements within various sections of the specifications under which the equipment is also specified.

C. All submittals shall conform completely to the requirements of the Contract Documents, including all requirements set forth in Division 01 Section "Submittals".

D. Shop Drawing are to be submitted on each item of specified or scheduled equipment, valves, specialties, insulation, fixtures, drains, controls and related accessories. All control submittals must include a typed sequence of control for each system.

2.02 ACCESS DOORS AND PANELS

A. Unless otherwise indicated, each Trade Contractor is to locate and furnish all access doors required for non-accessible surfaces (such as ceilings, walls, chases, and similar locations), so that all valves and similar items are easily accessible for operation, inspection and maintenance. Access doors for ceiling, walls, chases, etc. are to be installed by the General Contractor. The Trade Contractor is to bear the costs of the installation of the access doors.

B. See Division 08 Section "Access Doors and Frames" for access door types and specifications. Minimum size to be 12 inch x 12 inch, or as indicated or required to allow inspection of items served.

2.03 SLEEVES

A. Each Contractor is to provide properly sized, secured and firestopped sleeves for all of their piping systems at all penetrations of walls, foundations, partitions, floors and roofs throughout the entire facility.

PART 3 EXECUTION

3.01 GENERAL

A. Provide all materials, labor, equipment, and services necessary for a complete and operable installation as specified and shown on the Drawings. The word "Provide" shall mean "Furnish and install."

B. Provide new material and equipment in strict accordance with these Specifications and the Project Drawings.

C. At all times, take such precautions as are necessary to protect materials from damage. Close all pipe openings to prevent obstructions and contamination.

3.02 CUTTING AND PATCHING IN BUILDINGS

A. Each Contractor is responsible for all costs associated with the necessary cutting and patching as required for the installation of their work, unless otherwise indicated.

B. Patching is to be performed by the trade proper for each material to be patched. Patching shall leave premises and finishes in a complete and neat condition comparable to the original. Painting of patched surfaces to be by the painting sub-contractor of the General Contractor, unless otherwise specifically indicated or the plumbing/fire protection contractor is the prime contractor for the project. Maintain the fire integrity of all walls, floors, ceilings, and partitions.

3.03 PROTECTION

A. Protect equipment and trim against damage and injury due to building materials, acid, tools, equipment and any causes incidental to construction. Cover the finished surface of each piece of equipment with building paper or similar protection. Replace all equipment damaged by any cause and any trim with marred or scratched finish at no cost to the Owner, upon receipt of written notification from the A/E.

B. Where materials to be installed are being stored at or near the project during construction, arrange such materials so as to minimize the possibility of contamination, corrosion and damage. Keep ends of pipe, equipment, and specialties properly closed during construction and installation to avoid the possibility of miscellaneous materials being placed in the openings.

C. Protect sprinklers from dust, dirt and paint spray during construction with temporary sprinkler covers.

3.04 PAINTING

A. See Division 09 Sections.

3.05 ADJUST AND CLEAN

A. Inspect all equipment and put in satisfactory working order.
   1. Clean specialties and devices.
   2. Clean all covers.
   3. Clean exposed piping.
   4. Remove temporary sprinkler covers and clean sprinklers.

3.06 OPERATIONAL TEST

A. Upon completion of and prior to acceptance of the installation, the Contractor shall subject the fire protection system to operating tests in accordance with NFPA.

END OF SECTION

SECTION 210529
HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 DESCRIPTION OF WORK

A. Work of this Section includes, but not limited to: Pipe hanger and supports, Pipe and equipment anchors, Pipe sleeves.

1.03 QUALITY ASSURANCE

A. Pipe Hanger Standards: Manufacturers Standardization Society (MSS) SP-58, SP-89, and SP-69, as referenced.

B. SMACNA.

C. NFPA

1.04 SUBMITTALS

A. Shop Drawings: Miscellaneous steel layout. Indicate all point loads where miscellaneous steel is supported by structural members, Brace spacing, layout, connection method and details.

B. Product Data: Catalog cuts and performance data.

C. Samples: Not required for review.

D. Contract Closeout Information: Operating and maintenance data, Warranty.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Pipe Hangers: Argo, Tolco, Erico, Globe, B-Line Systems Inc., Anvil, All America Threaded Products, Powers Fasteners.

B. Concrete Anchors: Hanger Mate, Tolco, Dewalt, , Hilti, ITW Construction Products (Sammys).

C. Sleeves: Shamrock Industries, "Crete-sleeve" plastic hole forms, Proset Systems Inc., Hilti.

D. Sleeves, Pre-Manufactured Fire and Smoke Wall Barrier: Pipe Shields, Inc.

2.02 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Pre-galvanized steel, Pre-Galvanized stainless steel, Cadmium plated carbon steel, adjustable swivel split ring. Use PVC coated or copper plated for copper piping.

B. Hangers for Pipe Sizes 2 to 6 Inches and Over: Pre-galvanized steel, Pre-Galvanized stainless steel Carbon steel, adjustable, clevis type. Use copper plated for copper piping.

C. Hanger for fire protection piping shall be UL listed and FM approved.

D. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over.

F. Vertical Support: Steel riser clamp.

G. Floor Support for Pipe Sizes to 8 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

2.03 HANGER RODS AND ATTACHMENTS

A. Steel Hanger Rods: Threaded both ends, threaded one end, or continuous threaded. Use cadmium plated rods where unconcealed or exposed to the elements.

B. Minimum pipe hanger rod sizes are as follows:

Pipe Size	Rod Diameter
4 Inches and less	3/8 Inch
6 to 8 Inches	1/2 Inch
8 to 12 Inches	3/4 Inch

C. For fire sprinkler systems, conform to latest NFPA standards required by OBC.

D. Beam Clamps (up to 8-inch diameter pipe): Top beam clamp, steel jaw, hook rod with nut and spring washer steel eye-bolt. C-clamps by themselves are expressly prohibited unless otherwise approved by Structural Engineer

2.04 INSERTS

A. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.05 PIPE SLEEVES AND SEALANTS

A. Sleeves – General: Sleeve or provide necessary clearance for all piping passing through walls, fire separation walls, floors, roofs, foundations, footings and grade beams sufficient to allow free movement of piping. Box out openings larger than 14 inch diameter.

B. Sleeves, Steel Pipes: Use in following locations:
   1. Fire-rated and smoke-rated construction.
   2. Structural steel members (when approved by A/E).
   3. Floors: Galvanized.
   4. Concrete walls.
   5. Mechanical rooms, tunnels, and stairwells.
   6. Polyethylene hole forms (Crete-Sleeve): Optional use in poured concrete walls and floors.

C. Sleeves, pre-manufactured fire and smoke wall barrier: Optional, similar to Pipe Shields, Inc. Bare Pipe through Fire Walls and Floors: Model WFB, DFB, or QDFB.

D. Sleeve Sizes: Length: Ends flush with finished surfaces, Diameter: Minimum 3 inch, Minimum 1 inch larger than pipe and pipe insulation, In concrete, 1-1/2 inch larger than pipe, Diameter suitable for construction tolerances and to receive sealant, when indicated. Sleeves for seismic flexibility for pipe sizes less than 4 inches provide a pipe sleeve 2 inches larger in nominal diameter and for pipe sizes 4 inches and larger provide a pipe sleeve 4 inches larger in diameter.

E. Sealants: Seal annular space around piping.
   1. For fire- and smoke-rated floors, walls and partitions: Use UL-listed firestopping material that maintains fire-rated wall and floor integrity. Provide proper material for each typical application as described by manufacturer.
   2. Acceptable Manufacturers: Dow Corning "Fire Stop", Nelson "Flameseal", 3M "Fire Barrier", Pipe Shields Inc., Model WFB, DFB, or QDFB Series, Proset Systems.
   3. For Non-Rated Walls and Partitions: Use mineral or glass fiber insulation.
   4. For Exterior and Foundation Walls: Use synthetic rubber seals, "Link-Seal" waterproof material or system.

PART 3 EXECUTION

3.01 GENERAL

A. Structural Considerations: Steel or concrete roof/floor system, including slabs or roof deck shall be in place and complete before installation of any mechanical piping system. Space hangers so maximum individual hanger load will not exceed values listed in NFPA 13. A hanger shall be provided for each branch line. Unsupported ends of lines shall be provided with hangers according to NFPA 13. A hanger shall be provided on mains between each branch line. Pipe hangers shall be attached to structural members. For pipes over 1 inch in diameter, do not

attach hangers to steel roof deck. Do not attach hangers to bottom of concrete filled floor deck, except by permission of A/E. Attach hangers to beams whenever possible.

B. Install piping systems with approved hangers and supports to prevent sagging, warping and vibration of piping systems. Install pipe hangers and supports to allow for expansion, contraction, and drainage of piping. Place hangers and supports close to valves, vertical riser drops, heavy equipment, specialties, and each piping change of direction.

C. Connect hanger rods to approved "I" beams or channel clamps, concrete inserts or expansion shields. Provide all concrete inserts and structural members required for the proper support of the piping systems with proper approved distribution of weight.

D. Do not weld to structural steel without special permission of the A/E. Do not use wooden plugs for any form of fastening.

E. Space pipe hangers for horizontal piping as indicated, required by NFPA 13 or unless otherwise directed. Provide pipe hangers with the minimum rod sizes shown, complete with full length machined threads, and adjusting and lock nuts.

F. Install piping substantially as shown on the Drawings. Install pipe as directly as possible, avoiding unnecessary offsets and interferences, maintaining maximum headroom and concealed in all rooms or areas, except mechanical equipment rooms, unless otherwise noted. Coordinate exact locations of mains, risers and runouts in the field with the various Trade Contractors and the A/E. Install pipe above finished ceilings. Install piping in heated areas so that water temperature in the pipe will not drop below 40 degrees.

G. Assemble and install piping without undue strain and stress and with provision for expansion, contraction and structural settlement. Do not cut or notch structural members unless adequate provision is made with the approval of the A/E. Anchors shall be approved by the A/E before they are used.

3.02 PIPE HANGERS AND SUPPORTS

A. Provide hangers at distances not exceeding NFPA 13. Hangers and piping shall not be used to support non fire protection equipment. If spacing between horizontal elbows (or plugged tees used as elbows) is less than six (6) feet, provide only one (1) hanger located between the elbows. No hanger size or requirements shall ever be less than the minimum recommended by the Mechanical Contractor's Association of America, Inc.

B. For fire protection piping, space according to NFPA 13.

C. For piping of other materials, space hangers according to manufacturer's recommendations.

D. Trapeze Hangers: Suspend trapeze hangers from concrete inserts of approved structural clips. Construct trapeze hangers of galvanized angle iron, channels or other structural shapes with flat surfaces for point of support or support with piping according to NFPA 13.

E. Vertical Pipe Supports: Support all vertical pipe runs in pipe chases at base of riser. Support pipes for lateral movement with clamps or brackets.

F. Concrete Inserts: Provide individual or continuous slot concrete inserts for use with hangers for piping and equipment exposed in finished areas, and as required. Provide concrete inserts in time for installation in concrete.

3.03 ANCHORS

A. All connections to the structure shall be sized according to actual applied load plus any seismic vertical component increase.

B. Pipe Anchors: Provide as indicated and required to permit complete installation of system. Do not anchor piping to plaster or gypsum wallboard partition walls. Provide anchoring devices at locations indicated. Do not use powder driven fasteners, expansion nails, or friction spring clamps.

3.04 SLEEVES

A. Coordinate location of any opening in structural systems with A/E and other trade contractors.

B. Maintain rating of fire- and smoke-rated construction.

C. Set sleeves plumb or level, in proper position, tightly fitted into the work.

D. Set all sleeves with ends flush with finished wall and ceiling surfaces.

E. Seal around all pipes and use firestopping for all mechanical penetrations through floor slabs, fire rated walls and partitions, and at each floor level in vertical mechanical service shafts. Install firestopping as described in manufacturer's installation instructions.

F. Seal around all sleeves.

G. Fill openings made by others for piping penetrations, with same construction as work opening is in, or construction of equivalent fire or smoke rating.

3.05 MISCELLANEOUS STEEL

A. Piping Contractor (or Fire Protection Contractor, as applicable) to provide all miscellaneous steel as required to accommodate pipe supports and hangers.

B. Provide Shop Drawings detailing miscellaneous steel layout and connection to structural members. Indicate all point loads where miscellaneous steel is supported by structural members.

C. All miscellaneous steel to be galvanized steel. Repair galvanized steel at field cuts and connections. Points of connection to structural members shall be within the distances specified by the structural engineer

END OF SECTION

SECTION 210553
PIPE AND EQUIPMENT IDENTIFICATION

PART 1 GENERAL

1.01 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 DESCRIPTION OF WORK

A. Work of this Section includes, but is not limited to: Piping identification, Valve identification, Equipment identification.

1.03 QUALITY ASSURANCE

A. Piping System Identification: ANSI A13.1-2015, "Scheme for the Identification of Piping Systems."

1.04 SUBMITTALS

A. Shop Drawings: Not required for review.

B. Product Data: Manufacturer's cut sheets and/or literature.

C. Samples: Not required for review.

D. Reference Submittals: Not required for review.

E. Contract Closeout Information: Valve chart showing valve numbers, type, and location and identification for valve to be in the open or closed position when fire protection system is operational

PART 2 PRODUCTS

2.01 PIPE MARKERS

A. Conform to ANSI A13.1-2015.
   1. Pressure-sensitive vinyl (self-sticking) material.
   2. Mechanically Fastened Type: Snap-on or strap-on. For dirty greasy, oily pipe where pressure-sensitive markers may not perform satisfactorily.
   3. Provide with direction of flow arrows.
   4. Size of Letters Legend

Outside Diameter of Pipe or Pipe Covering	Length of Color Field	Size of Letters and Arrows
3/4 to 1-1/4 inch	8 inch	1/2 inch
1-1/2 to 2 inch	8 inch	3/4 inch
2-1/2 to 6 inch	12 inch	1-1/4 inch
8 to 10 inch	24 inch	2-1/2 inch
Over 10 inch	32 inch	3-1/2 inch

2.02 VALVE TAGS

A. TO INCLUDE: DOUBLE CHECK VALVE ASSEMBLY, ALARM CHECK VALVES, DRY-PIPE VALVES, FLOOR CONTROL VALVES, CHECK VALVES AND DRAIN VALVES.

B. Brass or Anodized Aluminum Type
   1. Brass: Minimum 19 ga, polished, 1-1/2-inch diameter with following lettering: Service: 1/4 inch stamped black filled letters. Valve numbers: 1/2 inch stamped black filled letters.
   2. Aluminum: 2-inch diameter, 0.032 inch thick, with following lettering: Service: 1/4 inch engraved letters. Valve numbers: 1/2 inch engraved letters.

C. Valve Tag Fasteners: 4-ply 0.018 copper or monel wire meter seals, brass "S" hooks or No. 16 brass jack chain.

2.03 EQUIPMENT NAME PLATES

A. 1/16-inch rigid plastic "Setonply," "Emedolite," or bakelite with 4 edges beveled, or engraved aluminum with black enamel background and natural aluminum border and letters. Two 3/8-inch mounting holes. Lettering size: Minimum 1/2-inch high. Fasteners: Commercial quality, rust-resisting nuts and bolts with backwashers and self-tapping screws or rivets.

2.04 VALVE CHART AND DIAGRAM FRAMES

PART 1 - EXTRUDED ALUMINUM FRAME WITH PLEXIGLASS COVER. INDICATE TYPE OF VALVE, MANUFACTURER, VALVE SIZE AND LOCATION (ROOM NAME & NUMBER) OF VALVE. VALVES ON CHART MUST MATCH VALVES IDENTIFIED DURING THE EQUIPMENT SUBMITTAL AND APPROVAL PROCESS.

3.01 ACCEPTABLE MANUFACTURERS

A. Pipe, Valve, and Equipment Markers: Craftmark Identification Systems, W. H. Brady Co., EMED Company, Inc., Kolbi Industries, Inc., 3M Co., Seton Name Plate Corp., Globe, NIBCO, Victaulic, EMC, AGF, APC

PART 3 EXECUTION

4.01 VALVE AND EQUIPMENT IDENTIFICATION

A. Designate all equipment and valves by distinguishing numbers and letters on charts and/or diagrams. Tag and locate following equipment items: Valves, All items indicated on drawing equipment schedules. Caution signs shall be attached to all valves stating this valve controls the fire protection equipment. Do not close until after fire has been extinguished. Use auxiliary valves when necessary to shut off supply to auxiliary equipment. CAUTION: Automatic alarm may be sounded if valve is closed and emergency responders may be notified.

B. Install tags on all devices with numbers and letters corresponding to charts.

C. Fasten tags securely to devices with tag fasteners in manner for easy reading.

D. Attach equipment nameplates in conspicuous location on item of equipment or apparatus such as starters, pumps, and control panels. Secure nameplates with self-tapping screws, or nuts and bolts.

E. For unsuitable conditions, such as high temperature or lack of space, use copper or brass rings or chains to attach tags.

F. Furnish 4 charts including device number, location (room number, department) and purpose. Describe area or system served by the device. Mount 1 chart in frame and secure on wall in location directed by Owner. Include remaining 3 sets in "Operation and Maintenance Manuals."

G. Provide all devices located above ceilings with additional identification. Use access panel markers (metal-tack-style) for acoustical tile ceilings, or engraved plastic style, 3/4 inch square, for mounting on panel door. Coordinate with Owner on identification method and color codes.

4.02 PIPE IDENTIFICATION

A. Locate pipe markers as follows:
   1. Next to each valve and fitting, except on equipment.
   2. At each branch or riser take-off.
   3. At each passage through walls, floors, and ceilings.
   4. At each pipe passage to underground.
   5. On all horizontal pipe runs every 20 feet, at least once in each room and each story traversed by piping system.
   6. Identify piping contents, flow direction.

B. Install markers with tape color bands over each end of marker, extending around pipe and overlapping a minimum of 30 degrees.

4.03 SERVICE ABBREVIATIONS

A. General

1. S Sprinklers
2. F Fire Protection

END OF SECTION

SECTION 211316
DRY-PIPE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 SUMMARY

A. Section includes dry-pipe sprinkler system, system design, installation, and certification. Fire protection system to provide coverage for entire building, or as noted on “P7” drawings.

B. Related Sections:
   1. Section 210500 - Common Work Results for Fire Protection.
   2. Section 211313 - Wet-Pipe Sprinkler Systems
   3. Section 283100 - Fire Detection and Alarm

1.02 REFERENCES

A. National Fire Protection Association:
   1. NFPA 13 - Installation of Sprinkler Systems.

1.03 JOB SITE CONDITIONS

A. Flow Test: Contractor shall provide his own flow test(s) (using acceptable and recognized methods and procedures as defined in NFPA 13), upon which his design shall be based. If flow test data is indicated on plans or specs, this information is for reference only.

B. **Prior To Submitting Bids:** the system contractor shall review available water supply characteristics (source(s), flow(s), pressure(s), etc.) and compare them to the system demands. “System demands” shall be defined as “Source, flow and pressure requirements (including main and/or service size) as indicated in the bid documents, or as required by any authority having jurisdiction, whichever is more stringent.” Results of the above comparison shall be understood as being acceptable to the Contractor, unless he notifies Architect/Engineer in writing by mail (faxes must be followed up by mail or e-mail) (and an addendum is issued) or his bid shall be qualified (indicating otherwise) as described below:

   NOTE TO CONTRACTOR: If during bidding phase the Contractor suspects or determines inadequate water supply exists, he shall:
   1. Notify project Architect/Engineer immediately, such issues will be addressed in addendum.
   2. If resolution of issue cannot be determined and /or an addendum cannot be issued in a timely fashion addressing such (prior to receiving bids), Contractor shall clearly qualify his bid, stating specific exceptions taken to the bid documents.
   3. The connection to or extension of the water supply or source shall be considered a suggested and preferred method, but shall be confirmed and or modified as required during the layout and design by this Contractor. Modifications shall be approved by all authorities having jurisdiction and by the Architect/Engineer.

1.04 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Shop Drawings: Indicate layout of finished ceiling areas indicating sprinkler locations coordinated with ceiling installation. Indicate detailed pipe layout, hangers and supports, sprinklers, components and accessories. Indicate system controls.

C. Product Data: Submit data on sprinklers, valves, pumps, compressors and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

D. Design Data: Submit design calculations.

E. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

1.05 CLOSEOUT SUBMITTALS

A. Section 017000 - Execution and Closeout Requirements: Closeout procedures.

B. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations.

C. Operation and Maintenance Data: Submit components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

1.06 QUALITY ASSURANCE

A. Perform Work according to NFPA 13, Indiana Fire Code and local fire department requirements.

B. Maintain one copy of each document on site.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum of three years' experience.

B. Installer: Company specializing in performing Work of this section with minimum of three years' experience

C. Design: The fire protection system to be designed by a qualified NICET technician with a minimum Level 3 certification, or plans and data stamped by a Professional Engineer (PE).

1.08 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Store products in shipping containers until installation.

C. Furnish temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.09 WARRANTY

A. Section 017000 - Execution and Closeout Requirements: Product warranties and product bonds.

B. Furnish five year manufacturer warranty for air compressor.

1.10 EXTRA MATERIALS

A. Section 017000 - Execution and Closeout Requirements: Spare parts and maintenance products.

B. Furnish extra sprinklers under provisions of NFPA 13.

C. Furnish suitable wrenches for each sprinkler type.

D. Furnish metal storage cabinet adjacent to alarm valve.

PART 2 - PRODUCTS

2.01 SPRINKLERS

A. Manufacturers:
   1. Sprinklers: Tyco, Viking, Reliable.
   2. Pressure Switches: Notifier, Potter-Roemer, System Sensor.
   3. Tamper Switches: Notifier, Potter-Roemer, System Sensor.
   4. Gate Valves: Mueller, Nibco, Stockham, Kennedy.
   5. Butterfly Valves: Milwaukee, Nibco, Grinnell, Victaulic, Kennedy.
   6. Ball Valves: Milwaukee, Nibco, Stockham, Victaulic.
   7. Check Valves: Mueller, Nibco, Stockham, Grinnell, Victaulic.
   8. Grooved Fittings and Couplings: Grinnell, Anvil, Victaulic.
   9. Fire Department Connections: Elkhart, Larsen, Potter-Roemer.
   10. Electric or Water Motor Alarm Bells: Potter-Roemer, Reliable, Grinnell, and Viking.
   11. In-Building Water Supply Backflow Preventors: Ames.

B. Sprinkler Piping and Fittings

1. Galvanized Pipe: Nominal pipe sizes 4 inches or smaller shall be Schedule 40 meeting ASTM A-53.
2. Galvanized Pipe: Nominal pipe sizes 4 inches and larger shall be Schedule 40 or 10 meeting ASTM A-53.

C. Sprinklers General:
1. Sprinklers within smoke compartments containing sleeping rooms shall be quick-response type.
2. Finished Ceilings: Provide semi-recessed ceiling sprinklers with factory chrome plated cover plates, unless noted otherwise on drawings.
3. Unfinished Areas without Ceilings: Provide bronze upright. Protect sprinkler against mechanical injury with standard guards where required.

D. Suspended Ceiling Type:
1. Type: Semi-recessed pendant type with matching push on escutcheon plate.
2. Finish: Chrome plated.
3. Escutcheon Plate Finish: Chrome plated.
4. Fusible Link: Fusible-solder link type temperature rated for specific area hazard.

E. Exposed Area Type:
1. Type: Standard upright type.
2. Finish: Brass
3. Fusible Link: Fusible-solder link type, temperature rated for specific area hazard.

F. Guards: Finish to match sprinkler finish.

2.02 PIPING SPECIALTIES

A. Dry Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber faced clapper to automatically actuate electric alarm, with accelerator, test and drain.

B. Electric Alarm: Electrically operated red enameled gong with pressure alarm switch. Located exterior bell on wall near fire service into building.

C. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts.

D. Piping shall be filled with Nitrogen.

2.03 AIR COMPRESSOR

A. Manufacturers:
1. General
2. Champion

B. Compressor: Single unit, electric motor driven, motor, motor starter, safety valves, check valves, air maintenance device incorporating electric pressure switch and unloading valve.

C. Air Compressor to be furnished, installed and sized by the fire protection contractor.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install according to NFPA 13.

B. Install Work according to State of Indiana standards.

C. Jointing compound for pipe threads shall be polytetrafluoroethylene (PTFE) pipe thread tape only, applied on male threads.

D. Use of pipe dope is not permitted.

E. Install buried shut-off valves in valve box. Install with post indicator.

F. Install approved detector back-flow preventer assembly at sprinkler system water source connection.

G. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent Siamese connectors to allow full swing of fire department wrench handle.

H. Install outside alarm-gong on building wall as indicated on Drawings.

I. Install piping to minimize obstruction with other work.

J. Install piping in concealed spaces above finished ceilings.

K. Center sprinklers in two directions in ceiling tile and install piping offsets.

L. Install guards on all sprinklers located inside mechanical equipment rooms and/or as indicated on drawings.

M. Install air compressor on vibration isolators. Refer to Section 210548.

N. Hydrostatically test entire system.

O. Require test be witnessed by owner's representative and the project Architect/Engineer.

P. Interface system with building fire alarm system.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Verify devices are installed and connected to fire alarm system.

3.03 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Final cleaning.

B. Flush entire piping system of foreign matter.

3.04 PROTECTION OF INSTALLED CONSTRUCTION

A. Section 017000 - Execution and Closeout Requirements: Protecting installed construction.

B. Apply masking tape or paper cover to sprinklers, cover plates, and sprinkler escutcheons not receiving field painted finish. Remove after painting. Replace painted sprinklers with new.

3.05 ATTACHMENTS

A. System Hazard Designations:
   1. Offices: Light Hazard.
   2. Warehouse: Ordinary Hazard, Group 2.
   3. Computer Room: Light Hazard, Pre-action.

END OF SECTION

SECTION 220501
COMMON WORK RESULTS FOR PLUMBING

PART 1 GENERAL

1.01 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

B. INDIANA CODES
   1. General Administration Rules (675 IAC 12): Amended 12/01/2014
   2. Building Code: Effective 12/01/2014
   3. Fire Code: Effective 12/01/2014
   4. Plumbing Code: Effective 12/24/2012
   5. Electrical Code: Effective 08/26/2009
   6. Mechanical Code: Effective 12/01/2014
   7. Handicapped Accessibility Code: 2014
   8. Energy Code: Effective 05/07/2010
   9. Elevator Safety Code: 2011:
   10. Fuel Gas Code: Effective 12/01/2014

1.02 GUARANTEE

A. In entering into a contract covering this work, the Contractor accepts the Specifications and Drawings and guarantees that the work will be carried out in accordance with the requirements of the Specifications and Drawings or such authorized modifications as may be made in the Contract Documents. Contractor further guarantees that the workmanship and material will be first class and that only experienced workers, familiar with each particular class of work, will be employed. Contractor further guarantees to replace and make good at their own expense any defects due to faulty workmanship or material which may develop within one (1) year after final payment and acceptance by the Owner, upon receipt of written notification of defect from the Owner.

1.03 QUALITY ASSURANCE

A. Regulations and Standards: All equipment, apparatus, and systems are to be fabricated and installed in complete accordance with fire and insurance rules and regulations, the Life Safety Code, and the latest edition or revision of the following applicable regulations, standards, and codes:
   1. AIA American Institute of Architects
   2. ASME American Society of Mechanical Engineers
   3. ASTM American Society for Testing and Materials
   4. NFPA National Fire Protection Association
   5. NEC National Electric Code
   6. OSHA Occupational Safety and Health Administration
   7. UL Underwriter's Laboratories, Inc.
   8. MCAA Mechanical Contractors Association of America, Inc.
   9. ANSI American National Standard Institute
   10. AWWA American Water Works Association
   11. AGA American Natural Gas Association
   12. PDI Plumbing and Drainage Institute
   13. NACE National Association of Corrosion Engineers
   14. State and Local Inspection Authorities
   15. Division 01 Sections “Regulatory Requirements: and “Reference Standards” of the Project Specifications
   16. References on the Drawings or in the Specifications to "code" or "building code" not otherwise identified shall mean the specific codes applicable to this Project location,

together with all additions, amendments, changes, and interpretations adopted by code authorities having jurisdiction over this Project.

17. The applicable edition of all codes shall be that adopted at the time of issuance of permits by the authorities having jurisdiction, and shall include all modifications and additions adopted by that jurisdiction.
18. Give all required notices so as to comply with, and meet, all inspections required by Federal, State, and Local authorities.
19. It is not the intent herewith to modify, reduce, or change any rules, standards, regulations, or requirements that are applicable under local, state and federal codes, ordinances, or regulations of the various authorities having jurisdiction. Where the standards differ among the various authorities, the most restrictive shall apply. Where the requirements shown on the Drawings or called for in the Specifications exceed code requirements, these Drawings and Specifications shall take precedence. Where the requirements within the specifications of this division of work and the Drawings conflict with the referenced Divisions, Sections, and other documents, the documents having the most restrictive and the higher cost requirements shall apply.

1.04 JOB CONDITIONS AND COORDINATION

A. Local Conditions
   1. Each Trade Contractor is to inform himself of the conditions under which the work is to be performed, the site of the work, the structure of the ground, the obstacles that may be encountered, the availability and location of necessary facilities and all relevant matters concerning the work to be done.
   2. Utility Coordination: Contractors shall contact, coordinate, and review indicated utility data with the local utility companies. Verify existing utility locations, verify new pipe tap locations and piping routes with the utility.
      a. Water: Contractor to verify water meter and backflow requirements.
      b. Gas: Contractor to verify meter requirements.
      c. Sewer: Contractor to verify all proposed sewer connection points.

B. Present Job Site Inspection
   1. Each contractor shall schedule through the Construction Manager a visit to the present site proposed for the work before presenting a Bid and shall make a careful inspection of the existing conditions.
   2. During the site visit, each Trade Contractor is to investigate for any existing conditions and responsibilities which are not clearly defined by the Drawings and Specifications. If any such conditions exist, they shall bring them to the attention of the A/E in writing. The A/E will then make the required written clarification. The absence of questions before the opening of bids shall indicate a clear understanding of the scope of work and the Contractor's responsibility.

C. Concrete Housekeeping Pads and Supporting Foundations
   1. Unless otherwise specified or noted on the Drawings, the Concrete Contractor is to provide concrete pads and foundations as indicated on the Drawings for all mechanical equipment.
   2. Unless otherwise specified or noted on the Drawings, the Contractor or Subcontractor whose equipment the concrete pad or foundation services is to locate, size, and pay the Concrete Contractor to provide concrete pads and foundations as indicated on the Drawings for all of their equipment.
   3. Concrete pads as may be indicated are based upon the design and layout-based manufacturer and model of equipment and devices as specified or as scheduled or noted on the Drawings.
   4. The individual Trade Contractor furnishing the equipment or devices is to verify and coordinate all concrete pad sizes so as to have same of proper size to serve the equipment or device supplied and verify the position of all anchor bolts.

5. Any additional cost for larger than indicated pad or foundation sizes to fit the approved manufacturer and model of the equipment or devices is to be borne by the Trade Contractor who supplies such equipment or devices.
6. Concrete equipment pads shall extend a minimum of 6” beyond the equipment of product mounted thereon.
7. Contractor shall verify equipment pad size and locations with nearby floor drain locations.

D. Permits and Fees: This Contractor is to obtain all permits and pay all fees required for the work under Division 22 of the Work.

E. Royalties and Patents
1. The Trade Contractor is to pay all royalties and license fees. They shall defend, indemnify, and hold the Owner and A/E harmless from any and all suits, demands or claims for infringement of any patent rights.
2. The review by A/E or Owner of any method of construction, invention, appliance, process, article, device or material of any kind is to be for adequacy of work, and is not to be construed as an approval of the use thereof by the Contractor in violation of any patent or other rights of any third person.

F. Wiring and Conduit Requirements: In general, most wiring and conduit requirements are addressed, either upon the Drawings as a part of a packaged equipment assembly specifications, or within Divisions 26, 27 and 28 of the Specifications. However, should an equipment component, panel, or system device need additional wiring and conduit so as to be complete, approved and fully operational, the Contractor who supplied the equipment component, panel or system device shall be responsible for the required wiring and conduit as well as circuit disconnect and protection for same when it is not otherwise covered by the Project Drawings and Specifications.

G. Coordination: Coordinate the exact location of this work with the work of other trades prior to fabrication or installation of same. Verify all dimensions and elevations. Provide additional offsets and sections of material as may be required to meet the applicable job condition requirements. Coordinate with and review all related construction Drawings and Shop Drawings of all equipment suppliers prior to start of work.

1.05 SPECIFICATIONS AND DRAWINGS

A. These specifications and Drawings are intended to describe and provide for a complete and finished project. They are intended to be complementary. All items of work called for by either shall be as binding as if called for by both. The work described shall be complete in every detail, notwithstanding the fact that every item necessarily involved is not particularly mentioned or shown. If the Bidder, Supplier or Contractor sees anything to question, it must be brought to the attention of the A/E immediately.

B. Minor Deviations: The Drawings accompanying these Specifications indicate the general design and arrangement of equipment, apparatus, fixtures, accessories and piping necessary to complete the installation of the system. The exact location or arrangement of the apparatus and equipment, unless otherwise dimensioned, is subject to minor changes necessitated by field conditions and shall be required without additional cost to the Owner. Measurements shall be verified through actual observation at the construction site. Each Trade Contractor shall be responsible for fitting all of their work into place in a satisfactory and workmanlike manner, to the approval of the A/E and Owner.

C. Provide all labor and materials necessary for the completion of the work described. Referenced codes and industry standards and methods shall apply when no other specifics are indicated. Bring questions relating to this paragraph to the attention of the A/E for resolution prior to the receipt of Bids.

D. All Work indicated on Drawings, diagrams, or details in part only are to continue throughout unless distinctly marked otherwise. The same applies to other parts of the project where merely a typical reference plan, diagram, or section of the drawing is complete. The balance is

intended to be the same as the typical plan, section, or diagram as shown and is to be figured accordingly.

E. The specifications are divided into trades and divisions only for the distinct purpose of facilitating the work. However, the Trade Contractor will become responsible for furnishing all labor and materials necessary to complete the project as contemplated by the Drawings and Specifications. Any item mentioned under any heading of the Specifications must be supplied even though it is not called for again under the heading for the respective work.

F. Should discrepancies occur within the Contract Documents, the more stringent and more costly approach shall apply for bidding purposes. The Contractor is to notify the A/E of discrepancies for clarification. Clarifications issued after the Contract is awarded shall be incorporated by the Contractor at no additional costs and shall be reviewed by the A/E to determine if a reduction in cost is justified.

1.06 TRADE CONTRACTORS, SUBCONTRACTORS AND SUPPLIERS

A. The Trade Contractor is any person or organization who contracts to perform work for the Project. Wherever the word "Contractor" is used on the Drawings or in the Specifications, it shall be construed to mean the Trade Contractor applicable to the Title Division of these specifications.

B. A Sub-Contractor is a person or organization who has a direct contract with a Trade Contractor to perform any of the Work at the site and includes all who furnish material worked to a special design in accordance with the Drawings and Specifications, but excludes suppliers or persons furnishing material not specially designed. Wherever the term "Sub-Contractor" is encountered in the Contract Documents, it shall mean the Sub-Contractor and/or their Sub-Sub-Contractors and/or their Material Suppliers.

C. A Sub-Sub-Contractor is a person or organization who has a direct or indirect contract with a Sub-Contractor to perform any of the Work at the project site or for the subject project.

D. A Material Supplier is a person or organization who has a direct contract with a Trade Contractor to furnish material not specially designed.

E. It shall be the responsibility of each Trade Contractor to be fully familiar with various local trade jurisdictional requirements and to engage the services of any other Sub-Contractors as may be required within the various trades to complete all of the work as indicated upon the Drawings and within the Specifications under their respective division or section. Only Trade Sub-Contractors with established knowledge and skills of their specific trade shall be used, so that all work is performed in a complete, finished, and professional manner.

F. Whenever any provisions of the Specifications conflict with any agreements or regulations in force among members of any Trade Associations, Unions, or Councils which regulate or distinguish what work shall or shall not be included in the work of any particular trade, the Trade Contractor shall make all necessary efforts to reconcile any such conflict without delay, damage or cost to the Owner.

G. If the progress of the work is affected by any undue delay in furnishing or installing any items of material or equipment required under the contract because of a conflict involving any such agreement or regulation, the A/E may require that other material or equipment of equal kind and quality be provided at no additional cost to the Owner.

H. Any Trade Contractor, subcontractor, or material supplier not normally employing union labor shall make all provisions necessary to avoid any resulting disputes with labor unions and shall be responsible for any delays, damages or extra cost caused by employment of such non-union labor, except as otherwise governable by state or federal rules and regulations.

I. Each Trade Contractor shall pay for all applicable Federal, State and local taxes on all materials, labor or services furnished by him, and all taxes arising out of their operations under the Contract Documents which may be imposed upon or collectable from the Owner or become a lien against their property. Such taxes shall include, but not be limited to, Occupational, Sales, Use, Excise, Social Security and Unemployment Taxes, customs duties, and all income

taxes and other taxes now in force or enacted prior to final acceptance of the work. The Trade Contractor shall assume all liability for the payment of and shall pay any unemployment benefits payable under any Federal or State law to individuals employed by him during the progress of the work covered by the Contract.

J. It is the responsibility of each Trade Contractor to coordinate the various related equipment requirements between their subcontractors, suppliers, and other trade contractors, and to also follow the approved manufacturer's installation instructions.

1.07 OPERATIONAL AND MAINTENANCE INSTRUCTIONS

A. All operational and maintenance instructions that are provided to various Owner-selected members of the facility engineering and/or maintenance staff are, at the same time presented, to be fully recorded on DVD by the Contractor so that all such sessions can be later reviewed by the Owner's staff on a retraining basis as needed. All such DVDs are to become the property of the Owner at the end of each applicable training period, with one copy of each also being supplied to the A/E for the A/E project files.

PART 2 PRODUCTS

2.01 MANUFACTURERS/PRODUCTS/SUBMITTALS

A. Under the Base Bid, no other manufacturers except those indicated on the Drawings or those listed within the Sections of this Division, that are, in turn, able to comply with the contract document requirements and minimum standards of these specifications, will be acceptable. In addition to specific required "Alternates," proposed substitutions that may or may not be acceptable to the Owner may be submitted by the Contractor only at the time of initial base bid submittal.

B. Although design-based models of various manufacturers may be indicated within the various schedules, it is the responsibility of the various equipment manufacturers to verify the model selections so that all items of equipment comply with the minimum standards of performance that are indicated within the schedules, as well as the requirements within various sections of the specifications under which the equipment is also specified.

C. All submittals shall conform completely to the requirements of the Contract Documents, including all requirements set forth in Division 01 Section “Submittals”.

D. Shop Drawings are to be submitted on each item of specified or scheduled equipment, valves, specialties, insulation, fixtures, drains, controls and related accessories. All control submittals must include a typed sequence of control for each system.

2.02 ACCESS DOORS AND PANELS

A. Unless otherwise indicated, each Trade Contractor is to locate and furnish all access doors required for non-accessible surfaces (such as ceilings, walls, chases, and similar locations), so that all valves and similar items are easily accessible for operation, inspection and maintenance. Access doors for ceiling, walls, chases, etc. are to be installed by the General Contractor. The Trade Contractor is to bear the costs of the installation of the access doors.

B. See Section 08 3113 for access door types and specifications. The size of the access doors shall provide proper access for service, routine maintenance, removal and replacement of the product. Minimum size to be 12 inch x 12 inch, or as indicated or required to allow inspection of items served.

C. LAY-IN CEILING: Removable lay-in ceiling tiles in 2 X 2 foot or 2 X 4 foot configuration, provided under Lay-Section 09500, are sufficient to use as access panels no additional access provisions are required unless specifically indicated.

D. Concealed Spline Ceilings: Removable sections of ceiling tile held in position with metal slats or tabs compatible with the ceiling system used will be provided under Section 09500.

E. Plaster Walls and Ceilings: 16-gauge frame with not less than a 20-gauge hinged door panel, prime coated steel for general applications, stainless steel for use in toilets, showers, and similar wet areas, concealed hinges, screwdriver operated cam latch for general applications,

key lock for use in public or secured areas, UL listed for use in fire rated partitions if required by the application. Use the largest size access opening possible, consistent with the space and the item needing service; minimum size is 12" by 12"

2.03 EXCAVATION AND BACKFILL

A. See Civil Specifications for all additional requirements.

B. Perform all excavation and backfill work necessary to accomplish indicated plumbing systems installation. Excavate to bottom of pipe and structure bedding, 4" in stable soils, 6" in rock or wet trenches and 8" in unstable soil. Finish bottoms of excavations to true, level surface.

C. At no time place excavated materials where they will impede surface drainage unless such drainage is being safely rerouted away from the excavation.

D. Excavate whatever materials are encountered as required to place at the elevations shown, all pipe, manholes, and other work. Remove debris and rubbish from excavations before placing bedding and backfill material.

E. Remove surplus excavated materials from site.

F. Verify the locations of any water, drainage, gas, sewer, electric, telephone or steam lines which may be encountered in the excavation. Underpin and support all lines. Cut off service connections encountered which are to be removed at the limits of the excavation and cap.

G. Provide and maintain all fencing, barricades, signs, warning lights, and/or other equipment necessary to keep all excavation pits and trenches and the entire subgrade area safe under all circumstances and at all times. No excavation shall be left unattended without adequate protection.

H. Elevations shown on the plans are subject to such revisions as may be necessary to fit field conditions. No adjustment in compensation will be made for adjustments up to two (2) feet above or below the grades indicated on the plans.

I. Install lines passing under foundations with minimum of 1-1/2 inch clearance to concrete and insure there is no disturbance of bearing soil.

J. Bed pipe up to a point 12" above the top of the pipe. Take care during bedding, compaction and backfill not to disturb or damage piping.

K. Mechanically compact bedding and backfill to prevent settlement. The initial compacted lift to not exceed 24" compacted to 95% density per Modified Proctor Test (ASTM D-1557). Subsequent lifts under pavements, curbs, walks and structures are not to exceed 12" and be compacted to 95% density per Modified Proctor Test. In all other areas where construction above the excavation is not anticipated within 2 years, mechanically compact backfill in lifts not exceeding 24" to 90% density per Modified Proctor Test. Route the equipment over each lift of the material so that the compaction equipment contacts all areas of the surface of the lift.

2.04 SHEETING, SHORING AND BRACING

1. Provide shoring, sheet piling and bracing in conformance with State and Local codes to prevent earth from caving or washing into the excavation. Shore and underpin to properly support adjacent or adjoining structures. Abandon in place shoring, sheet piling and underpinning below the top of the pipe, or, if approved in advance by the engineer, maintained in place until other permanent support approved by the engineer is provided.

2.05 DEWATERING

A. See dewatering requirements in specification 22 05 07, 3.2

2.06 EQUIPMENT NOISE AND VIBRATION

A. Vibration from equipment shall not be apparent in occupied areas of the building,

B. Measured sound levels exceeding design criteria is grounds for modification as required to comply with manufacturers recommendations at no additional cost to the Owner.

2.07 BUILDING ACCESS

A. Arrange for the necessary openings in the building to allow for admittance or removal of all apparatus. When the building access was not previously arranged and must be provided by this contractor, restore any opening to its original condition after the apparatus has been brought into the building.

2.08 EQUIPMENT ACCESS

A. Install all piping, conduit and accessories to permit access to equipment for maintenance and service. Coordinate the exact location of wall and ceiling access panels and doors with the General Contractor, making sure that access is available for all equipment and specialties. Access doors in general construction are to be furnished by the Plumbing Contractor and installed by the General Contractor.

2.09 COORDINATION

A. Coordinate all work with other contractors prior to installation. Any work that is not coordinated and that interferes with other contractor's work shall be removed or relocated at the installing contractor's expense.

B. Verify that all devices are compatible for the type of construction and surfaces on which they will be used.

2.10 PIPE SLEEVES

A. Provide galvanized, schedule 40 pipe sleeves for pipe penetrations through interior and exterior walls to provide a backing for sealant or firestopping. Patch wall neatly around sleeve to match adjacent wall construction and finish. Grout area around sleeve in masonry construction. In finished spaces where pipe penetration through wall is exposed to view, sheet metal sleeve shall be installed flush with face of wall. Install sleeves for piping passing through penetrations in floors, partitions and walls.

B. Install vertical sleeves in concrete floors and concrete walls as new slabs and walls are constructed.
   1. Cut sleeves to length for mounting flush with both surfaces.
      a. Exception: Extend sleeves installed in floors of mechanical equipment areas or other wet areas 2 inches above finished floor level.
   2. Using grout, seal the space outside of sleeves in slabs and walls without sleeve-seal system.

C. Install sleeves for pipes passing through interior partitions.
   1. Cut sleeves to length for mounting flush with both surfaces.
   2. Install sleeves that are large enough to provide 1/4-inch annular clear space between sleeve and pipe or pipe insulation.
   3. Seal annular space between sleeve and piping or piping insulation; use joint sealants appropriate for size, depth.

D. Fire-Barrier Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pipe penetrations. Seal pipe penetrations with firestop materials.

E. Pipe penetrations in areas subject to public view shall have an escutcheon plate.

2.11 SPACE REQUIREMENTS FOR EQUIPMENT

A. Equipment has been selected to fit into physical space provided, while allowing room for access, servicing, removal and replacement of parts. Typically allow a minimum of 24” clear space between pieces of equipment.

B. Since space requirements and equipment arrangements vary according to manufacturer, the responsibility for apace and access requirements, is the responsibility of the installing contractor.

C. Contractor shall provide proper space and access for equipment in accordance with code requirements and the requirements of the local inspection department and the recommendations of the equipment manufacturer.

D. Contractor shall verify the size and weight limitations of the space in which it is to be installed and that doors or other building openings are adequate size to permit the entry of the equipment without alterations to the building. The cost of such alterations caused by failure to comply with these instructions shall be borne by the Contractor.

PART 3 EXECUTION

3.01 GENERAL

A. Provide all materials, labor, equipment, and services necessary for a complete and operable installation as specified and shown on the Drawings. The word "Provide" shall mean "Furnish and install."

B. Provide new material and equipment in strict accordance with these Specifications and the Project Drawings.

C. At all times, take such precautions as are necessary to protect materials from damage. Close all pipe openings to prevent obstructions and contamination.

3.02 CUTTING AND PATCHING IN BUILDINGS

A. Each Contractor is responsible for all costs associated with the necessary cutting and patching as required for the installation of their work, unless otherwise indicated.

B. Patching is to be performed by the trade proper for each material to be patched. Patching shall leave premises and finishes in a complete and neat condition comparable to the original. Painting of patched surfaces to be by the painting sub-contractor of the General Contractor, unless otherwise specifically indicated or the plumbing/fire protection contractor is the prime contractor for the project. Maintain the fire integrity of all walls, floors, ceilings, and partitions.

3.03 PROTECTION

A. Protect equipment and trim against damage and injury due to building materials, acid, tools, equipment and any causes incidental to construction. Cover the finished surface of each piece of equipment with building paper or similar protection. Replace all equipment damaged by any cause and any trim with marred or scratched finish at no cost to the Owner, upon receipt of written notification from the A/E.

B. Where materials to be installed are being stored at or near the project during construction, arrange such materials so as to minimize the possibility of contamination, corrosion and damage. Keep ends of pipe, equipment, and specialties properly closed during construction and installation to avoid the possibility of miscellaneous materials being placed in the openings.

3.04 PAINTING

A. See Division 09 Section “Interior Painting”.

3.05 ADJUST AND CLEAN

A. Inspect all equipment and put in satisfactory working order.
   1. Clean all exposed and concealed items.
   2. Clean floor drains, cleanouts, and plumbing fixtures.
   3. Clean specialties.
   4. Clean all covers.
   5. Clean exposed piping.
   6. Adjust pumps, balancing valves, and faucets for proper flow rates.
   7. Adjust water heaters and thermostatic mixing valves for required temperatures.

END OF SECTION

SECTION 220507
EXCAVATION AND BACKFILL

PART 1 GENERAL

1.01 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 1, General Requirements.

1.02 DESCRIPTION OF WORK

A. Each Trade Contractor is to provide all excavating, trenching, sheeting, bracing, pumping, and backfilling as required for the installation of his work.

1.03 QUALITY ASSURANCE

A. Testing
   1. All testing is to be done by an independent testing laboratory employed by this Contractor and approved by the Owner and A/E.
   2. Conduct up to 10 tests per Trade per 40,000 gross square foot of compacted surface serving each Trade's specific area of work to determine the compaction density of backfill.

PART 2 PRODUCTS

2.01 SOIL MATERIALS

A. General: Provide borrow soil materials when sufficient satisfactory soil materials are not available from excavations.

B. Subbase Material: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

C. Base Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 95 percent passing a 1-1/2-inch sieve and not more than 8 percent passing a No. 200 sieve.

D. Engineered Fill: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; with at least 90 percent passing a 1-1/2-inch sieve and not more than 12 percent passing a No. 200 sieve.

E. Bedding Course: Naturally or artificially graded mixture of natural or crushed gravel, crushed stone, and natural or crushed sand; ASTM D 2940; except with 100 percent passing a 1-inch sieve and not more than 8 percent passing a No. 200 sieve.

F. Drainage Course: Narrowly graded mixture of washed crushed stone, or crushed or uncrushed gravel; ASTM D 448; coarse-aggregate grading Size 57; with 100 percent passing a 1-1/2-inch sieve and 0 to 5 percent passing a No. 8 sieve.

G. Filter Material: Narrowly graded mixture of natural or crushed gravel, or crushed stone and natural sand; ASTM D 448; coarse-aggregate grading Size 67; with 100 percent passing a 1-inch sieve and 0 to 5 percent passing a No. 4 sieve.

H. Sand: ASTM C 33; fine aggregate, natural, or manufactured sand.

I. Impervious Fill: Clay gravel and sand mixture capable of compacting to a dense state.

2.02 ACCESSORIES

A. Detectable Warning Tape: Acid- and alkali-resistant polyethylene film warning tape manufactured for marking and identifying underground utilities, a minimum of 6 inches wide and 4 mils thick, continuously inscribed with a description of the utility, with metallic core encased in a protective jacket for corrosion protection, detectable by metal detector when tape is buried up to 30 inches deep; colored as follows:
   1. Yellow: Gas, oil, and dangerous materials.
   2. Blue: Water systems.
   3. Green: Sewer systems.

PART 3 EXECUTION

3.01 GENERAL

A. Protect structures, utilities, sidewalks, pavements, and other facilities from damage caused by settlement, lateral movement, undermining, washout, and other hazards created by earthwork operations.

B. Provide protective insulating materials to protect subgrades and foundation soils against freezing temperatures or frost.

3.02 DEWATERING

A. Prevent surface water and ground water from entering interior of building excavations, from ponding on prepared subgrades, and from flooding Project site and surrounding area.

B. Protect subgrades from softening, undermining, washout, and damage by rain or water accumulation.
   1. Reroute surface water runoff away from excavated areas. Do not allow water to accumulate in excavations. Do not use excavated trenches as temporary drainage ditches.
   2. If necessary, install a temporary submersible pump and basin to keep subgrades dry and convey ground water away from excavations. Maintain until dewatering is no longer required.

3.03 EXCAVATION, GENERAL

A. Rock Excavation: Excavate to subgrade elevations regardless of the character of surface and subsurface conditions encountered. Unclassified excavated materials may include rock, soil materials, and obstructions. No changes in the Contract Sum or the Contract Time will be authorized for rock excavation or removal.
   1. If excavated materials intended for fill and backfill include unsatisfactory soil materials and rock, replace with satisfactory soil materials.
   2. Remove rock to lines and grades indicated to permit installation of permanent construction.
   3. Earth excavation includes excavating visible rocks on surface and below surfaces. Intermittent drilling, ram hammering or ripping of material shall be included with the contractor’s project bid.
   4. Rock excavation includes removal and disposal of rock. Remove rock to lines and subgrade elevations indicated to permit installation of permanent construction.
   5. Pipe trench widths to provide the following clearance on each side of pipe. Excavate trench walls vertically from trench bottom to 12 inches higher than top of pipe, unless otherwise indicated. Clearance: 12 inches each side of pipe.
   6. Trench Bottom Excavate trenches 6 inches deeper than bottom of pipe elevation to allow for bedding course.

3.04 BACKFILL

A. Place and compact backfill in excavations promptly, but not before completing the following:
   1. Construction below finish grade including, where applicable, sub-drainage, damp-proofing, waterproofing, and perimeter insulation.
   2. Surveying locations of underground utilities for Record Documents.
   3. Testing and inspecting underground utilities.
   4. Removing concrete formwork.
   5. Removing trash and debris.
   6. Removing temporary shoring and bracing, and sheeting.
   7. Installing permanent or temporary horizontal bracing on horizontally supported walls.

B. Place backfill on subgrades free of mud, frost, snow, or ice.

3.05 UTILITY TRENCH BACKFILL

A. Place backfill on subgrades free of mud, frost, snow, or ice.

B. Place and compact bedding course on trench bottoms and where indicated. Shape bedding course to provide continuous support for bells, joints, and barrels of pipes and for joints, fittings, and bodies of conduits.

C. Backfill trenches excavated under footings and within 18 inches of bottom of footings with satisfactory soil; fill with concrete to elevation of bottom of footings.

D. Provide 4-inch thick, concrete-base slab support for piping or conduit less than 30 inches below surface of roadways. After installing and testing, completely encase piping in a minimum of 4 inches of concrete before backfilling or placing roadway subbase.

E. Place and compact initial backfill of satisfactory soil, free of particles larger than 1 inch in any dimension, to a height of 12 inches over the utility pipe. 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. Coordinate backfilling and compaction at each 6" layer.

F. Backfill voids with satisfactory soil while installing and removing shoring and bracing.

G. Place and compact final backfill of satisfactory soil to final subgrade elevation.

H. Install warning tape directly above utilities, 12 inches below finished grade, except 6 inches below subgrade under pavements and slabs.

3.06 SOIL FILL

A. Plow, scarify, bench, or break up sloped surfaces steeper than 1 vertical to 4 horizontal so fill material will bond with existing material.

B. Place and compact fill material in layers to required elevations as follows:
   1. Under steps and ramps, use engineered fill.
   2. Under building slabs, use engineered fill.
   3. Under footings and foundations, use engineered fill.

C. Place soil fill on subgrades free of mud, frost, snow, or ice.

3.07 SOIL MOISTURE CONTROL

A. Uniformly moisten or aerate subgrade and each subsequent fill or backfill soil layer before compaction to within 2 percent of optimum moisture content.
   1. Do not place backfill or fill soil material on surfaces that are muddy, frozen, or contain frost or ice.
   2. Remove and replace, or scarify and air dry otherwise satisfactory soil material that exceeds optimum moisture content by 2 percent and is too wet to compact to specified dry unit weight.

3.08 COMPACTION OF SOIL BACKFILLS AND FILLS

A. Place backfill and fill soil materials in layers not more than 8 inches loose depth for material compacted by heavy compaction equipment, and not more than 4 inches in loose depth for material compacted by hand-operated tampers.

B. Place backfill and fill soil materials evenly on all sides of structures to required elevations, and uniformly along the full length of each structure.

C. Compact soil materials to not less than the following percentages of maximum dry unit weight:
   1. Under structures, building slabs, steps, and pavements, scarify and recompact top 12 inches of existing subgrade and each layer of backfill or fill soil material at 95 percent.
   2. For utility trenches, compact each layer of initial and final backfill soil material at 85 percent.

3.09 GRADING

A. General: Uniformly grade areas to a smooth surface, free of irregular surface changes. Comply with compaction requirements and grade to cross sections, lines, and elevations indicated.
   1. Provide a smooth transition between adjacent existing grades and new grades.

2. Cut out soft spots, fill low spots, and trim high spots to comply with required surface tolerances.

B. Grading inside Building Lines: Finish subgrade to a tolerance of 1/2 inch when tested with a 10-foot straightedge.

3.10 PROTECTION

A. Protecting Graded Areas: Protect newly graded areas from traffic, freezing, and erosion. Keep free of trash and debris.

B. Repair and reestablish grades to specified tolerances where completed or partially completed surfaces become eroded, rutted, settled, or where they lose compaction due to subsequent construction operations or weather conditions. Scarify or remove and replace soil material to depth as directed by A/E; reshape and recompact.

C. Where settling occurs before Project correction period elapses, remove finished surfacing, backfill with additional soil material, compact, and reconstruct surfacing. Restore appearance, quality, and condition of finished surfacing to match adjacent work, and eliminate evidence of restoration to greatest extent possible.

3.11 DISPOSAL OF SURPLUS AND WASTE MATERIALS

A. Disposal: Remove surplus satisfactory soil and waste material, including unsatisfactory soil, trash, and debris, and legally dispose of it off Owner's property.

END OF SECTION

SECTION 220508
PIPING EXPANSION COMPENSATION

PART 1 – GENERAL

1.01 SUMMARY:

Note: Contractor shall furnish and install necessary seismic isolation, bracing and supports in accordance with Zone “D” Rating.

A. Section includes:
1. Flexible pipe connectors.
2. Expansion joints.
3. Expansion compensators.
4. Pipe alignment guides.
5. Swivel joints.
6. Pipe anchors.

B. Related Sections:
1. Section 13910 – Basic Fire Suppression Materials and Methods: Products and installation requirements for piping used in fire protection systems.
2. Section 15060 – Hangers and Supports: Product and installation requirements for piping hangers and supports.
3. Section 15070 – Mechanical Sound, Vibration, Seismic Control: Product and installation requirements for vibration isolators used in piping systems.
4. Section 15140 – Domestic Water Piping: Product and installation requirements for ping used in domestic water systems.
5. Section 15180 – Heating and Cooling Piping: Product and installation requirements for piping used fin heating and cooling systems.

1.02 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.1 – Power Piping.
2. ASME B31.5 – Refrigeration Piping.
3. ASME B31.9 – Building Services Piping.

B. American Welding Society:
1. AWS D1.1 – Structural Welding Code – Steel.

1.03 DESIGN REQUIREMENTS

A. Provide structural work and equipment required for expansion and contraction of piping.

B. Expansion Compensation Design Criteria:
1. Installation Temperature: 50 degrees F.
2. Hot Water Heating System Temperature: 210 degrees F.
3. Domestic Hot Water: 140 degrees F.
4. Safety Factor: 30 percent.

1.04 SUBMITTALS

A. Shop Drawings: Indicate layout of piping systems, including flexible connectors, expansion joints, expansion compensators, loops, offsets and swing joints.

B. Product Data:
1. Flexible Pipe Connectors: Indicate maximum temperature and pressure rating, face-to-face length, live length, hose wall thickness, hose convolutions per foot and per assembly, fundamental frequency of assembly, braid structure, and total number of wires in braid.
2. Expansion Joints: Indicate maximum temperature and pressure rating, and maximum expansion compensation.

C. Manufacturer’s Installation Instructions: Submit special procedures.

D. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

E. Manufacturer's Field Reports: indicate results of inspection by manufacturer's representative.

1.05 CLOSEOUT SUBMITTALS

A. Project Record Documents: Record actual locations of flexible pipe connectors, expansion joints, anchors and guides.

B. Operation and Maintenance Data: Submit adjustment instructions.

1.06 QUALITY ASSURANCE

A. PERFORM Work in accordance with ASME b31.9 code for installation of piping systems.

1.07 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Section 01600 – Product Requirements: Product storage and handling requirements.

B. Accept expansion joints on site in factory packing with shipping bars in positioning devices intact. Inspect for damage.

C. Protect equipment from exposure by leaving factory coverings, pipe end protection, and packaging in place until installation.

PART 2 - PRODUCTS

2.01 FLEXIBLE PIPE CONNECTORS

A. Steel Piping:
   1. Inner Hose: Stainless Steel.
   2. Exterior Sleeve: Double braided stainless steel.
   3. Pressure Rating: 125 psig WSP and 450 degrees F.
   4. Joint: As specified for pipe joints.
   5. Size: Use pipe-sized units.
   6. Maximum offset: 2/4 inch on each side of installed center line.

B. Copper Piping:
   1. Inner Hose: Bronze
   2. Exterior Sleeve: Braided Bronze.
   3. Pressure Rating: 125 psig WSP and 450 degrees F.
   4. Joint: As specified for pipe joints.
   5. Size: Use pipe sized units.
   6. Maximum offset: ¾ inch on each side of installed center line.

2.02 EXPANSION JOINTS

A. Stainless Steel Bellows Type:
   1. Pressure Rating: 125 psig WSP and 400 degrees F.
   2. Maximum Compression: 1 2/4 inch.
   3. Maximum Extension: ¼ inch.
   4. Joint: As specified for pipe joints.
   5. Size: Use pipe sized units.
   6. Application: Steel piping 3 inch and smaller.

B. External Ring Controlled Stainless Steel Bellows Type:
   1. Pressure Rating: 125 psig WSP and 400 degrees F.
   2. Maximum Compression: 15/16 inch.
   3. Maximum Extension: 5/16 inch.

4. Maximum Offset: 1/8 inch.
5. Joint: Flanged.
6. Size: Use pipe sized units.
7. Accessories: internal flow liner.
8. Applications: Steel piping 3 inch and larger.

C. Double Sphere, Flexible Compensators:
1. Body: Neoprene and nylon.
2. Working Pressure: 150 psi.
3. Maximum Temperature: 250 degrees F.
4. Maximum Compression: ¾ inch 1 inch.
5. Maximum Elongation: ½ inch.
6. Maximum Offset: ½ inch
7. Maximum Angular Movement: 30 degrees.
8. Joint: Tapped steel flanges.
9. Size: Use pipe sized units.
10. Accessories: Control rods.
11. Application; Steel piping 2 inch and larger.

D. Two-ply Bronze Bellows Type:
1. Construction: Bronze with anti-torque device, limit stops, internal guides.
2. Pressure Rating: 125 psig WSP and 400 degrees F.
3. Maximum Compression: 1 ¾ inch.
4. Maximum Extension: ¼ inch.
5. Joint: As specified for pipe joints.
6. Size: Use pipe sized units.
7. Application: Copper piping.

E. Low Pressure Compensators with two-ply Bronze Bellows:
1. Working Pressure: 75 psig.
2. Maximum Temperatures: 250 degrees F.
3. Maximum Compression: ½ inch.
4. Maximum Extension: 5/32 inch.
5. Joint: Soldered.
6. Size: Use pipe sized units.
7. Application: Copper or steel piping 2 inch and smaller.

F. Copper with Packed Sliding Sleeve:
1. Maximum Temperature: 250 degrees F.
2. Joint: As specified for pipe joints.
3. Size: Use pipe sized units.
4. Copper or steel piping 2 inches and larger.
5. Application: Copper or steel piping 2 inch and larger.

2.03 ACCESSORIES

A. Pipe Alignment Guides: Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum 1 inch thick insulation, minimum 3 inch travel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install Work in accordance with ASME B31.1, ASME B31.5, or ASME B31.9.

B. Install flexible pipe connectors on pipes connected to equipment supported by vibration isolation. Refer to Section 15070. Provide line size flexible connectors.

C. Install flexible connectors at right angles to displacement. Install one end immediately adjacent to isolated equipment and anchor other end. Install in horizontal plane unless indicated otherwise.

D. Rigidly anchor pipe to building structure. Provide pipe guides to direct movement only along axis of pipe. Erect piping so strain and weight is not on cast connections or apparatus.

E. Provide support and anchors for controlling expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required. Refer to Section 15060 for pipe hanger installation requirements.

F. Provide grooved piping systems with minimum one joint per inch pipe diameter instead of flexible connector supported by vibration isolation. Grooved piping systems need not be anchored.

3.02 MANUFACTURER'S FIELD SERVICE

A. Furnish inspection services by flexible pipe manufacturer's representative for final installation and certify installation is in accordance with manufacturer's recommendations and connectors are performing satisfactorily.

END OF SECTION

SECTION 220519
METERS AND GAUGES

PART 1 GENERAL

1.01 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 SUMMARY

A. This Section the includes the following types of meters and gauges: Temperature gauges and fittings. Pressure gauges and fittings.

B. Meters and gauges furnished as part of factory-fabricated equipment are specified as part of equipment assembly in other Division 22 specifications.

1.03 QUALITY ASSURANCE

A. UL Compliance: Comply with applicable UL standards pertaining to meters and gauges.

B. ASME and ISA Compliance: Comply with applicable portions of ASME and Instrument Society of America (ISA) standards pertaining to construction and installation of meters and gauges.

1.04 SUBMITTALS

A. Shop Drawings: Each equipment and material item specified.

B. Product Data: Product data for each type of meter and gauge. Include scale range, ratings, and calibrated performance curves, certified where indicated. Submit meter and gauge schedule showing manufacturer's figure number, scale range, location, and accessories for each meter and gauge.

C. Samples: Not required for review.

D. Contract Close-Out Information: Maintenance data for each type of meter and gauge in each building for inclusion in Operating and Maintenance Manuals specified in Division 01, and Division 22. Portable test plug test kit and portable meter receipts as described in this Section.

PART 2 PRODUCTS

2.01 THERMOMETERS, GENERAL

A. Accuracy: Plus or minus 1% of range span or plus or minus one scale division to maximum of 1.5% of range span. Scale Range: Temperature ranges for services listed as follows: Domestic Hot Water: 30 deg to 240 deg with 2 deg scale divisions (0 deg to 115deg C with 1 deg scale divisions). Domestic Cold Water: 0 deg to 100 deg F with 2 deg scale divisions (minus 18 deg to 38 deg C with 1 deg scale divisions).

2.02 THERMOMETERS

A. Weiss Model DVU35 digital self powered, glass passivated thermistor, internal potentiometer with 6” stem. Thermometer wells to be brass or stainless steel, 2” extension in insulated piping. Provided threaded cap nut and cap.

B. Manufacturers: Weiss, Ashcroft, Weksler, Trerice, Miljoco, or Marshalltown.

2.03 DIAL-TYPE INSERTION THERMOMETERS

A. Type: Bimetal stainless steel case and stem, 1-inch diameter dial, dust and leakproof, 1/8-inch diameter tapered-end stem with nominal length of 5 inches.

B. Manufacturers: Ashcroft Dresser Industries/Instrument Div., Trerice (H.O.) Co., Weiss Instruments, Inc., Weksler.

2.04 SOLAR DIGITAL THERMOMETERS

A. Type: Bi-directional digital display, high impact ABS black plastic case.
1. Stem 3-1/2” zinc.
2. Range: -58 deg. to 302 deg.F

B. Manufacturers: Weksler.

2.05 THERMOMETER WELLS

A. Brass or stainless steel, pressure-rated to match piping system design pressure; with 2-inch extension for insulated piping and threaded cap nut with chain permanently fastened to well and cap.

B. Manufacturers: Marshalltown Instruments, Inc., Trerice (H.O.) Co., Weiss Instruments, Inc., Weksler.

2.06 PRESSURE GAUGES

A. Type: General use, ASME B40.1, Grade A, phosphor bronze bourdon-tube-type, bottom connection.

B. Case: Drawn steel or brass, glass lens, 4-1/2-inch diameter.

C. Connector: Brass, 1/4-inch NPS.

D. Scale: White coated aluminum, with permanently etched markings.

E. Accuracy: Plus or minus 1% of range span.

F. Range: Conform to the following: Vacuum: 30 inch Hg to 15 psi, All fluids: 2 times operating pressure

G. Manufacturers: Ametek, U.S. Gauge Div., Ashcroft Dresser Industries/Instrument Div., Marsh Instrument Co., Unit of General Signal, Marshalltown Instruments, Inc., Trerice (H.O.) Co., Weiss Instruments, Inc., Weksler.

2.07 PRESSURE GAUGE ACCESSORIES

A. Siphon: 1/4-inch NPS straight coil constructed of brass tubing with threads on each end.

B. Snubber: 1/4-inch NPS brass bushing with corrosion-resistant porous metal disc. Disc material shall be suitable for fluid served and rated pressure.

C. Manufacturers: Ametek, U.S. Gauge Div., Ashcroft Dresser Industries/Instrument Div., Marsh Instrument Co., Unit of General Signal, Marshalltown Instruments, Inc., Trerice (H.O.) Co., Weiss Instruments, Inc., Weksler.

2.08 TEST PLUGS

A. Test plugs shall be nickel-plated brass body, with 1/2-inch NPS fitting and two self-sealing valve-type core inserts suitable for inserting a 1/8 inch O.D. probe assembly from a dial-type thermometer or pressure gauge. Test plug shall have gasketed and threaded cap with retention chain and body of length to extend beyond insulation. Pressure rating shall be 500 psig.

B. Core Material: Conform to the following for fluid and temperature range: Air, Water, Oil, and Gas, 20 deg to 200 deg F (minus 7 deg to 93 deg C): Neoprene, Air and Water, minus 30 deg to 275 deg F (minus 35 deg to 136 deg C): EPDM

C. Ranges of pressure gauge and thermometers shall be approximately two times systems operating conditions.

D. Manufacturers: MG Piping Products Co., Peterson Equipment Co., Inc., Sisco, A Spedco, Inc. Co., Trerice (H.O.) Co., Watts Regulator Co., Flow Design, Inc.

PART 3 EXECUTION

3.01 THERMOMETER INSTALLATION

A. Install thermometers in vertical and tilted positions to allow reading by observer standing on floor.

B. Thermometer Wells: Install in piping tee where thermometers are indicated, in vertical position. Fill well with oil or graphite and secure cap.

3.02 INSTALLATION OF PRESSURE GAUGES

A. Install pressure gauges in piping tee with pressure gauge valve, located on pipe at most legible position.

B. Pressure Gauge Needle Valves: Install in piping tee with snubber. Install siphon in lieu of snubber for steam pressure gauges.

C. Install pressure gauges on the inlet side and outlet side of all Backflow Preventers.

3.03 INSTALLATION OF TEST PLUGS

A. Test Plugs: Install in piping tee where indicated, located on pipe at most legible position. Secure cap. Install test plugs adjacent to each piping point where a temperature sensing device is required by control specifications.

B. Test Kit: Provide test kit consisting of one pressure gauge, gauge adapter with probe, two bimetal dial thermometers, and carrying case. Turn over to Owner at completion of job and obtain written receipt. Forward copy of receipt to A/E as part of close-out documents.

3.04 ADJUSTING AND CLEANING

A. Adjusting: Adjust faces of meters and gauges to proper angle for best visibility.

B. Cleaning: Clean windows of meters and gauges and factory-finished surfaces. Replace cracked and broken windows and repair scratched and marred surfaces with manufacturer's touch-up paint.

3.05 CONNECTIONS

A. Piping installation requirements are specified in other sections of Division 22. The drawings indicate the general arrangement of piping, fittings, and specialties. The following are specific connection requirements:

B. Install meters and gauges to allow for easy visual observation.

END OF SECTION

SECTION 220523
DUTY VALVES

PART 1 GENERAL

1.01 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 QUALITY ASSURANCE

A. Valve Bodies, Shells and Seats: Factory-tested.

B. Standard for 125 psi and 150 psi saturated steam rated valve pressure containing parts: ASTM B62.

C. Standard for 200 psi and 300 psi valves with metallic seats: ASTM B61.

D. Iron Body Valves: Pressure-Containing Parts: ASTM A126, Grade B, Face-to-Face and End-to-End Dimensions: ANSI B16.10, Design, Workmanship, Materials, Testing: MSS-SP-70, 71, Use domestically manufactured valves where required by a Buy American Plan.

E. Butterfly Valves: Face-to-Face and End-to-End Dimensions: MSS-SP-67.

F. Valve Stems: ASTM B371, Alloy C69400; ASTM B371, Alloy C65100H04 (rolled silicon brass); or other material equally resistant to dezincification.

G. Pressure Castings: Free of impregnating materials.

H. Manufacturer's name or trademark and working pressure stamped or cast into body.

1.03 SUBMITTALS

A. Shop Drawings: Schedule indicating proposed valve for each application.

B. Product Data: Manufacturer's cut sheets and/or literature, Performance data.

C. Samples: Not required for review.

D. Reference Submittals: Not required for review.

E. Contract Closeout Information: Valve chart indicating valve identification number, valve type, service, manufacturer and model number, and location of valve, Operating and maintenance manuals.

1.04 JOB CONDITIONS

A. Coordinate the exact application and location of this work with the work of other trades prior to installation within various piping systems. Verify all positions and elevations. Provide additional offsets and section of piping as required to position valves for equipment clearance and accessibility as well as system and valve operational conditions.

B. Valve manufacturer to verify indicated figure or model numbers so that selection meets required description and conditions specified. Specified data for valve shall take precedence over indicated figure or model number. Provide proper seat and seal material for applicable temperature, pressure and service indicated for each valve application.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Gate, Butterfly, Check & Ball Valves: Jomar, Nibco, Hammond, Crane, Jenkins, Milwaukee, Apollo, Mueller, Viega.

2.02 DOMESTIC WATER VALVES

A. For gauge valves within steel or copper lines of 1/8 inch or 1/4 inch size, threaded or solder, 150 psig steam or 300 psig w.o.g., union bonnet, integral seat, renewable seat and disc, bronze globe valve conforming to MSS-SP-80, ASTM B-62.

B. For service valves within steel piping of 1/4 inch through 2 inch size; two-piece ball valve with bronze solder ends, lever handle, stainless steel ball and stem, Class 150 SWP-600 w.o.g.

C. For service valves in copper piping 2-1/2 inch through 4 inch size; 200 psi w.o.g. butterfly valve, wafer body, suitable for dead-end and isolation service.

D. For service valves within steel piping of 3 inch or above; 200 psig w.o.g butterfly valves, installed between standard ANSI Class 125/150 flanges, suitable for dead-end and isolation service without use of downstream flanges. 3 inch through 6 inch size valves to have manual stem position, lock to prevent tampering, notched plate and latching handle while valves of 8 inch size and above shall have manual enclosed weatherproof handwheel actuators with gear box and position indicator window, and all meeting the following criteria.

	Part	Specifications
1.	Stem	Stainless Steel, ASTM A-582 Type 410
2.	Collar Bushing	Brass, ASTM B-124
3.	Stem Seal	Teflon or Vitron
4.	Body Seal	Teflon or Vitron
5.	Nameplate	Aluminum
6.	Upper Bushing	Copper CDA 122
7.	Liner	Teflon or Vitron
8.	Disc	Al. Bronze, ASTM B-148 Alloy 954/955
9.	Lower Bushing	Copper CDA 122
10.	Body (Lug)	Ductile iron, ASTM A-536

E. For check valves within horizontal steel or copper lines through 2 inch size, bronze check valve with teflon disc, threaded ends, Class 150 swp-300 w.o.g., as follows:

	Part	Specifications
1.	Body	Bronze, ASTM B62
2.	Cap	Bronze, ASTM B62
3.	Lever	Bronze, Commercial
4.	Disc	Teflon
5.	Disc Holder	Brass, ASTM B16 1/4 inch & 1/2 inch Bronze, ASTM B62 3/4 inch to 2 inch included
		Bronze, ASTM B62 3/4 inch to 2 inch included
6.	Pin	Stainless Steel, Commercial
7.	Plug	Bronze, ASTM B16
8.	Retaining Ring	Stainless Steel, Commercial
9.	Disc Nut	Bronze, Commercial

F. Optional check valves for vertical type of installation within steel or copper lines, similar to that of above sub-paragraph G, except vertical lift up-flow, bronze with threaded ends.

G. For check valves within steel piping of 2-1/2 inch size and above, for vertical up-flow applications, Class 250 w.o.g flanged iron body flat style silent check; and for horizontal applications, Class 125 w.o.g flanged iron body horizontal swing check.

H. For check valves within copper piping of 2-1/2 inch through 4 inch size, Class 300 w.o.g bronze for horizontal or vertical installation with solder ends.

2.03 NATURAL GAS SYSTEM

A. All types of valves used shall be local utility company as well as AGA approved for the service and pressure intended.

B. Refer to Section 22 20 00 “Natural Gas Systems”.

PART 3 EXECUTION

3.01 INSTALLATION

A. Installation shall be in accordance with manufacturer's written instructions, and all valves must be suitable for the service intended.

B. Provide service (isolation) valve at every piece of equipment. Service valves to be positioned in a manner to allow for ease of service and removal of equipment with minimum disruption of the piping system.

C. All shut-off valves in plumbing water systems 2 inch and smaller shall be ball-type.

END OF SECTION

SECTION 220529
HANGERS AND SUPPORTS

PART 1 GENERAL

1.01 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 DESCRIPTION OF WORK

A. Work of this Section includes, but is not limited to: Pipe hanger and supports, Pipe and equipment anchors, Pipe sleeves.

1.03 QUALITY ASSURANCE

A. Pipe Hanger Standards: Manufacturers Standardization Society (MSS) SP-58, SP-89, and SP-69, as referenced.

B. SMACNA.

C. NFPA

1.04 SUBMITTALS

A. Shop Drawings: Miscellaneous steel layout. Indicate all point loads where miscellaneous steel is supported by structural members, Brace spacing, layout, connection method and details.

B. Product Data: Catalog cuts and performance data.

C. Samples: Not required for review.

D. Reference Submittals: Not required for review.

E. Contract Closeout Information: Operating and maintenance data, Warranty.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Pipe Hangers: Elcen Metal Products Co., B-Line Systems Inc., Carpenter and Paterson Inc., Anvil.

B. Concrete Anchors: Phillips, Hilti.

C. Insulated Pipe Supports: Pipe Shields Inc., Anvil, Power Piping.

D. Pipe and Equipment Anchors: Shop-fabricated, Field-fabricated.

E. Sleeves: Shamrock Industries, "Crete-sleeve" plastic hole forms, Proset Systems Inc., "Proset" fire-safe pipe penetrations, Shop for field fabricated.

F. Sleeves, Pre-Manufactured Fire and Smoke Wall Barrier: Pipe Shields, Inc.

G. Roof Piping Supports: Miro, Dura-Blok

2.02 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 Inch: Cadmium plated carbon steel, adjustable swivel split ring. Use PVC coated or copper plated for copper piping.

B. Hangers for Pipe Sizes 2 and Over: Carbon steel, adjustable, clevis type. Use copper plated for copper piping.

C. Hangers for piping that gets insulated shall be sized to allow insulation to be continuous through hangers.

D. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.

E. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp; adjustable steel yoke and cast iron roll for hot pipe sizes 6 inches and over.

F. Vertical Support: Steel riser clamp.

G. Floor Support for Pipe Sizes to 8 Inches: Cast iron adjustable pipe saddle, locknut nipple, floor flange, and concrete pier or steel support.

H. Shield for Insulated Piping 2 Inches and Smaller: 18 gage galvanized steel shield over insulation in 180 degree segments, minimum 12 inches long at pipe support.

I. Shields for insulated piping 2 1/2 inches and larger shall be waterproof hydrous calcium silicate, encased in 360o galvanized steel shield.

J. Roof Piping Supports shall be pre-manufactured devices. Wood block supports will not be acceptable.

2.03 HANGER RODS AND ATTACHMENTS

A. Steel Hanger Rods: Threaded both ends, threaded one end, or continuous threaded. Use cadmium plated rods where unconcealed or exposed to the elements.

B. Minimum pipe hanger rod sizes are as follows:

Pipe Size	Rod Diameter
Up to 2 Inches	3/8 Inch
2-1/2 Inches & 3 Inches	1/2 Inch
4 Inches	5/8 Inch
6 Inches	3/4 Inch
8 Inches to 12 Inches	7/8 Inch

C. Beam Clamps (up to 8-inch diameter pipe): Top beam clamp, steel jaw, hook rod with nut and spring washer steel eye-bolt. C-clamps by themselves are expressly prohibited unless otherwise approved by Structural Engineer

2.04 INSERTS

A. Inserts: Malleable iron case of steel shell and expander plug for threaded connection with lateral adjustment, top slot for reinforcing rods, lugs for attaching to forms; size inserts to suit threaded hanger rods.

2.05 PIPE SLEEVES AND SEALANTS

A. Sleeves – General: Sleeve all piping passing through walls, floors, roofs, foundations, footings and grade beams sufficient to allow free movement of piping. Box out openings larger than 14 inch diameter.

B. Sleeves, Steel Pipes: Use in following locations:
   1. Fire-rated and smoke-rated construction.
   2. Structural steel members (when approved by A/E).
   3. Floors: Galvanized.
   4. Concrete walls.
   5. Mechanical rooms, tunnels, and stairwells.
   6. Polyethylene hole forms (Crete-Sleeve): Optional use in poured concrete walls and floors.

C. Sleeves for Plastic Piping
   1. Provide pipe sleeves for all plastic-type piping (PVC, CPVC and polypropylene) at fire-rated assembly and floor slab penetrations.
   2. Size sleeves per following schedule:

Pipe Size (In.)	Sleeve Size (In.)	Extension Beyond Barrier (Ft.)
1 or less	3	2
1-1/4 to 2	4	2
3	5	3
4	6	4

   3. Extend sleeve listed distance beyond wall or floor on both sides.

4. Insulate plastic pipe with minimum 1 inch thick calcium silicate or 2400 deg F aluminasilica within sleeve length.

D. Sleeves, pre-manufactured fire and smoke wall barrier: Optional, similar to Pipe Shields, Inc.
   1. Bare Pipe through Fire Walls and Floors: Model WFB, DFB, or QDFB.
   2. Insulated Pipe through Fire Walls and Floors: Model WFB, DFB, or QDFB.
      a. Insulated chilled water and DX lines: Type CS-CW.
      b. Other insulated pipes: Type CS.
   3. Plastic Pipe through Fire Walls and Floors: Type WFB with 1-inch-thick calcium silicate insulation encased in metal sleeve extension 2 ft. either side of fire-rated walls or floor.

E. Sleeve Sizes
   1. Length: Ends flush with finished surfaces.
   2. Diameter
      a. Minimum 3 inch.
      b. Minimum 1 inch larger than pipe and pipe insulation.
      c. In concrete, 1-1/2 inch larger than pipe.
      d. Diameter suitable for construction tolerances and to receive sealant, when indicated.

F. Sealants: Seal annular space around piping.
   1. For fire- and smoke-rated floors, walls and partitions: Use UL-listed firestopping material that maintains fire-rated wall and floor integrity. Provide proper material for each typical application as described by manufacturer.
   2. Acceptable Manufacturers: Dow Corning "Fire Stop", Nelson "Flameseal", 3M "Fire Barrier", Pipe Shields Inc., Model WFB, DFB, or QDFB Series, Proset Systems.
   3. For Non-Rated Walls and Partitions: Use mineral or glass fiber insulation.
   4. For Exterior and Foundation Walls: Use synthetic rubber seals, "Link-Seal" waterproof material or system.

PART 3 EXECUTION

3.01 GENERAL

A. Structural Considerations
   1. Steel or concrete roof/floor system, including slabs or roof deck shall be in place and complete before installation of any mechanical piping system.
   2. Space hangers so maximum individual hanger load will not exceed values listed in paragraph "Pipe Hanger Loading."
   3. Do not attach hangers to steel roof deck.
   4. Do not attach hangers to bottom of concrete filled floor deck, except by permission of A/E.
   5. Attach hangers to beams whenever possible.

B. Install piping systems with approved hangers and supports to prevent sagging, warping and vibration of piping systems. Install pipe hangers and supports to allow for expansion, contraction, and drainage of piping. Place hangers and supports close to valves, vertical riser drops, heavy equipment, specialties, and each piping change of direction.

C. Connect hanger rods to approved "I" beams or channel clamps, concrete inserts or expansion shields. Provide all concrete inserts and structural members required for the proper support of the piping systems with proper approved distribution of weight.

D. Do not weld to structural steel without special permission of the A/E. Do not use wooden plugs for any form of fastening.

E. Space pipe hangers for horizontal piping as indicated, unless otherwise directed. Provide pipe hangers with the minimum rod sizes shown, complete with full length machined threads, and adjusting and lock nuts.

F. Run piping substantially as shown on the Drawings. Run pipe as directly as possible, avoiding unnecessary offsets and interferences, maintaining maximum headroom and concealed in all rooms or areas, except mechanical equipment rooms, unless otherwise noted. Coordinate

exact locations of mains, risers and runouts in the field with the various Trade Contractors and the A/E.

G. Arrange pipe lines to give ample room for pipe insulation. Run piping parallel to or at right angles with the lines of the building.

H. Assemble and install piping without undue strain and stress and with provision for expansion, contraction and structural settlement. Do not cut or notch structural members unless adequate provision is made with the approval of the A/E. Anchors shall be approved by the A/E before they are used.

3.02 PIPE HANGERS AND SUPPORTS

A. For standard steel and copper piping, locate hangers at each change of direction as well as within remaining lengths spaced at or within following maximum limits:

Pipe Diameter	Standard Liquid	Steel Vapor	Copper Liquid	Copper Vapor
1/2 - 1 inch	7 ft.	8 ft.	5 ft.	6 ft.
1-1/4 - 2 inch	7 ft.	9 ft.	7 ft.	9 ft.
2-1/2 - 3 inch	11 ft.	14 ft.	9 ft.	13 ft.
3-1/2 - 4 inch	13 ft.	16 ft.	11 ft.	15 ft.
5 - 6 inch	16 ft.	19 ft.	13 ft.	18 ft.
8 - 14 inch	16 ft.	24 ft.	16 ft.	16 ft.
	16 in		20 ft.	24 ft.

B. For Schedule 40 or Schedule 80 PVC piping, locate hangers at each change of direction and space at or within the following maximum limits:

Schedule 40 or 80 PVC		
Pipe Diameter	Liquid	Vapor
1/2 - 1 inch	3 Ft.	3 Ft.
1-1/4 - 2 inch	3 Ft.	3 Ft.
2-1/2 - 3 inch	6 Ft.	6 Ft.
3-1/2 - 4 inch	7 Ft.	7 Ft.
5 - 6 inch	8 Ft.	8 Ft.
8 - 14 inch	12 Ft.	12 Ft.

C. Provide a hanger within one (1) foot or less of each horizontal elbow and valves that are above three (3) inches in size. If spacing between horizontal elbows (or plugged tees used as elbows) is less than six (6) feet, provide only one (1) hanger located between the elbows. No hanger size or requirements shall ever be less than the minimum recommended by the Mechanical Contractor's Association of America, Inc.

D. For cast iron pressure piping, space maximum 12 feet o.c. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.

E. For cast iron soil piping, space maximum 10 feet o.c. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.

F. For piping of other materials, space hangers according to manufacturer's recommendations.

G. Pipe Hanger Loading

1. Total hanger rod load (including piping, insulation, and fluid) not exceeding following limits:

Nominal Rod Diameter	Maximum Load
3/8 inch	610 lb.
1/2 inch	1,130 lb.
5/8 inch	1,810 lb.

3/4 inch	2,710 lb.

2. Do not exceed manufacturer's recommended maximum safe load if smaller than above.

H. Trapeze Hangers: Suspend trapeze hangers from concrete inserts of approved structural clips. Construct trapeze hangers of galvanized angle iron, channels or other structural shapes with flat surfaces for point of support.

I. Vertical Pipe Supports: Support all vertical pipe runs in pipe chases at base of riser. Support pipes for lateral movement with clamps or brackets.

J. Concrete Inserts: Provide individual or continuous slot concrete inserts for use with hangers for piping and equipment exposed in finished areas, and as required. Provide concrete inserts in time for installation in concrete.

3.03 ANCHORS

A. All connections to the structure shall be sized according to actual applied load plus any seismic vertical component increase.

B. Pipe Anchors: Provide as indicated and required to permit complete installation of system. Do not anchor piping to plaster or gypsum wallboard partition walls. Provide anchoring devices at locations indicated. Do not use powder driven fasteners, expansion nails, or friction spring clamps.

3.04 MISCELLANEOUS STEEL

A. Piping Contractor (or Plumbing Contractor, as applicable) to provide all miscellaneous steel as required to accommodate pipe supports and hangers.

B. Provide Shop Drawings detailing miscellaneous steel layout and connection to structural members. Indicate all point loads where miscellaneous steel is supported by structural members.

C. All miscellaneous steel to be galvanized steel. Repair galvanized steel at field cuts and connections.

END OF SECTION

SECTION 220553
PIPE AND EQUIPMENT IDENTIFICATION

PART 1 GENERAL

1.01 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 DESCRIPTION OF WORK

A. Work of this Section includes, but is not limited to: Piping identification, Valve identification, Equipment identification.

1.03 QUALITY ASSURANCE

A. Piping System Identification: ANSI A13.1-1981, "Scheme for the Identification of Piping Systems."

1.04 SUBMITTALS

A. Shop Drawings: Not required for review.

B. Product Data: Manufacturer's cut sheets and/or literature.

C. Samples: Not required for review.

D. Reference Submittals: Not required for review.

E. Contract Closeout Information: Valve chart showing valve numbers, type, and location.

PART 2 PRODUCTS

2.01 PIPE MARKERS

A. Conform to ANSI A13.1-81.
   1. Pressure-sensitive vinyl (self-sticking) material.
   2. Mechanically Fastened Type: Snap-on or strap-on. For dirty greasy, oily pipe where pressure-sensitive markers may not perform satisfactorily.
   3. Provide with direction of flow arrows.
   4. Pipe Labeling Color Schedule
      a. Domestic Cold Water Piping:
         1) Background Color: Green.
         2) Letter Color: White.
      b. Soft Cold Water Piping:
         1) Background Color: Green.
         2) Letter Color: White.
      c. Domestic Hot Water Piping:
         1) Background Color: Yellow.
         2) Letter Color: Black

   5. Size of Letters Legend

Outside Diameter of Pipe or Pipe Covering	Length of Color Field	Size of Letters and Arrows
3/4 to 1-1/4 inch	8 inch	1/2 inch
1-1/2 to 2 inch	8 inch	3/4 inch
2-1/2 to 6 inch	12 inch	1-1/4 inch
8 to 10 inch	24 inch	2-1/2 inch
Over 10 inch	32 inch	3-1/2 inch

2.02 VALVE TAGS

A. Brass or Anodized Aluminum Type

1. Brass: Minimum 19 ga, polished, 1-1/2-inch diameter with following lettering:
    a. Service: 1/4 inch stamped black filled letters.
    b. Valve numbers: 1/2 inch stamped black filled letters.
2. Aluminum: 2-inch diameter, 0.032 inch thick, with following lettering:
    a. Service: 1/4 inch engraved letters.
    b. Valve numbers: 1/2 inch engraved letters.

B. Valve Tag Fasteners: 4-ply 0.018 copper or monel wire meter seals, brass "S" hooks or No. 16 brass jack chain.

2.03 EQUIPMENT NAME PLATES

A. 1/16-inch rigid plastic "Setonply," "Emedolite," or bakelite with 4 edges beveled, or engraved aluminum with black enamel background and natural aluminum border and letters.
1. Two 3/8-inch mounting holes.
2. Lettering size: Minimum 1/2-inch high.
3. Fasteners: Commercial quality, rust-resisting nuts and bolts with backwashers and self-tapping screws or rivets.

2.04 CHART AND DIAGRAM FRAMES

A. Extruded aluminum with plexiglass or glass windows.

2.05 ACCEPTABLE MANUFACTURERS

A. Pipe, Valve, and Equipment Markers: Craftmark Identification Systems, W. H. Brady Co, EMED Company, Inc., Kolbi Industries, Inc., 3M Co., Seton Name Plate Corp.

PART 3 EXECUTION

3.01 VALVE AND EQUIPMENT IDENTIFICATION

A. Designate all equipment and valves by distinguishing numbers and letters on charts and/or diagrams. Tag and locate following equipment items: Valves, All items indicated on drawing equipment schedules.

B. Install tags on all devices with numbers and letters corresponding to charts.

C. Fasten tags securely to devices with tag fasteners in manner for easy reading.

D. Attach equipment nameplates in conspicuous location on item of equipment or apparatus such as starters, pumps, and control panels. Secure nameplates with self-tapping screws, or nuts and bolts.

E. For unsuitable conditions, such as high temperature or lack of space, use copper or brass rings or chains to attach tags.

F. Furnish 4 charts including device number, location (room number, department) and purpose. Mount 1 chart in frame and secure on wall in location directed by Owner. Include remaining 3 sets in "Operation and Maintenance Manuals."

G. Provide all devices located above ceilings with additional identification. Use access panel markers (metal-tack-style) for acoustical tile ceilings, or engraved plastic style, 3/4 inch square, for mounting on panel door. Coordinate with Owner on identification method and color codes.

3.02 PIPE IDENTIFICATION

A. Soil, waste, and vent piping do not require color coded paint or bands.

B. Locate pipe markers as follows:
1. Next to each valve and fitting, except on plumbing fixtures and equipment.
2. At each branch or riser take-off.
3. At each passage through walls, floors, and ceilings.
4. At each pipe passage to underground.
5. On all horizontal pipe runs every 20 ft., at least once in each room and each story traversed by piping system.
6. Identify piping contents, flow direction, supply and return.

C. Install markers with tape color bands over each end of marker, extending around pipe and overlapping a minimum of 30 degrees.

D. Where supplementary color identification of medical gas piping is used, paint in accordance with gases and colors indicated in CGA Pamphlet C-9.

3.03 SERVICE ABBREVIATIONS

A. General

1.	H-CW	Hard Domestic Cold Water
2.	S-CW	Soft Domestic Cold Water
3.	HW (120°F)	Domestic Hot Water Supply (120°F)
4.	G	Natural Gas

END OF SECTION

SECTION 220561
PREPARATION OF PLUMBING SYSTEMS

PART 1 GENERAL

1.01 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CLEANING AND PREPARATION FOR SERVICE

A. Flushing Mains. Immediately upon completion of the water distribution system, test valves to ensure their full opening. Flush the system as follows: Open valve and permit the flow to continue until the water runs clear. Repeat the operation at the next valve and proceed in order to the valve farthest from the source of supply. Use outlets in building to flush the upper ends of mains and service lines. During such flushing operation, the A/E may test the flows from valves and, before final acceptance of the work, make further tests of flows to ascertain that lines are clear.

B. Interior and Exterior Sterilization of Water Distribution System. After the water distribution system has been flushed, sterilize the system by the following or other, more rigid methods satisfactory to the A/E and the State and Local Plumbing Authorities.
   1. Introduce chlorine or a solution of calcium or sodium hypochlorite, filling the lines slowly and applying the sterilizing agent at a rate of 50 parts per million of chlorine, as determined by residual chlorine tests at the ends of the lines. Open and close all valves and hydrants while chlorinating the system.
   2. After sterilization agent has been applied for 24 hours, test for residual chlorine at the ends of the lines. If less than 25 ppm is indicated, repeat the sterilization process.
   3. When tests show at least 25 ppm of residual chlorine, flush the system until all traces of the chemical are removed.

C. The Owner reserves the right to require testing of the water again at any time prior to final acceptance of the work and, if found bacteriologically unsafe, to require the Contractor to re-chlorinate the system until the water is proven equal to that supplied by the public system.

3.02 SANITARY WASTE/VENT AND STORM DRAINAGE SYSTEMS

A. Test systems as recommended by Local and State Plumbing Inspection Authorities.

3.03 OPERATIONAL TEST

A. Upon completion of and prior to acceptance of the installation, the Contractor shall subject the plumbing system to operating tests to demonstrate satisfactory functional and operational efficiency. Such operating tests shall cover a period of not less than 8 hours for each system and shall include the following information in a report with conclusion as to the adequacy of the system:
   1. Time, date, and duration of test.
   2. Water pressure at the most remote and the highest fixtures.
   3. Operation of each fixture and fixture trim.
   4. Operation of each valve, hydrant, and faucet.
   5. Pump suction and discharge pressures.
   6. Temperature of each domestic hot water supply.
   7. Operation of each floor and roof drain by flooding with water.
   8. Operation of each vacuum breaker and backflow preventer.

END OF SECTION

SECTION 220700
PLUMBING PIPE INSULATION

PART 1 GENERAL

1.01 REFERENCE STANDARDS

A. ASTM International (ASTM).

B. American Society of Heating, Refrigerating, and Air Conditioning Engineers, Inc. (ASHRAE).

C. North American Insulation Manufacturers Association (NAIMA).

D. NAIMA – "Guide to Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation".

E. "National Commercial & Industrial Insulation Standards" – MICA Manual.

F. National Fire Protection Association (NFPA).

G. Underwriter's Laboratories (UL).

H. Underwriter's Laboratories Environment (UL Environment).

1. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 DESCRIPTION OF WORK

A. Work of this Section includes, but is not limited to: Pipe insulation, Equipment insulation, Insulation adhesives, mastics and caulking.

B. Definitions

1. Concealed Insulated Surfaces: Piping and equipment in walls, partitions, floors, pipe chases, pipe shafts, duct shafts, sealed alleyways, and above suspended ceilings.
2. Exposed Insulated Surfaces: Piping and equipment located in mechanical rooms, tunnels, and rooms without suspended ceilings.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Skilled mechanics with a minimum of 10 years field experience who have successfully completed an apprenticeship program or another craft training program certified by the Department of Labor, Bureau of Apprenticeship and Training.

B. Products shall not contain formaldehyde, asbestos, lead, mercury, or mercury compounds [if available]. Products shall be Certified UL GREENGUARD Gold or Indoor Advantage Gold [if available].

C. Recycled Content: A minimum of 50 percent recycled glass content certified and UL Validated.

D. Products shall contain no polybrominated diphenyl ethers (PBDE) such as Penta-BDE, Octa-BDE or Deca-BDE fire retardants; whenever available.

E. Comply with fire and smoke hazard ratings indicated.

1. Test by procedure ASTM E84, NFPA 255, and UL 723.
2. Accessories such as adhesives, mastics, cements, tapes, and glass fabric, same or better component ratings.
3. Following are rating requirements: Flame spread (maximum): 25, Smoke developed (maximum): 50
4. Properly identify products and/or their shipping cartons for flame and smoke ratings.
5. Where prohibited by code or local ordinances, do not use elastomeric-type insulation anywhere within ceiling plenum return air systems.

1.04 SUBMITTALS

A. Shop Drawings: Submit schedule indicating service, application, thickness and finishes.

B. Product Data: Manufacturer's cut sheets and literature, Performance data.

C. Samples: Not required for review.

D. Reference Submittals: Not required for review.

E. Contract Close-Out Information: Manufacturer's installation, maintenance, and painting data, Guarantees.

F. EPD or HPD Submittals: Third Party Validated.

PART 2 PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Glass Fiber Pipe Covering: Knauf Insulation, Manville, Owens-Corning, Manson,

B. Fire-Retardant Adhesive: Manville, Benjamin Foster, 3M, Insul-Coustic, Childers.

C. Lagging Adhesive: Manville, Benjamin Foster, Borden, Insul-Coustic.

D. Elastomeric Pipe Insulation and Equipment Covering: Armstrong Armaflex, IMCOA, Imcolock, Ultrafoam.

E. Insulated Fitting Covers: Knauf Proto, Manville, Certain-Teed,

F. Insulation Caulking: Dow No. 11.

2.02 GENERAL

A. Provide fire and smoke hazard ratings as indicated for entire composite (insulation, jacket or facing, and adhesive used to adhere the facing or jacket to the insulation).

B. Do not use material that exceeds specified flame and smoke ratings.

C. Use permanent treatments to jackets or facings to impart specified fire ratings.

D. Use of water-soluble treatments is prohibited.

E. At Hangers and Bracing: See Division 22 Section “Hangers and Supports for Plumbing Piping and Equipment”.

2.03 PIPE INSULATION, NON-FLEXIBLE

A. Pipe Insulation, Non-flexible

1. Knauf Insulation Earthwool 1000 Pipe Insulation ASJ+/SSL+ pipe insulation Thermal conductivity (K value): Not greater than 0.23 at mean temperature of 75 deg F.
2. Insulation thicknesses shall meet the minimum suggested requirements of ASHRAE 90.1 2013, IECC 2015 or local code requirements.
3. Apply to the following piping in thickness indicated:
   a. Domestic Potable & non-potable Cold Water:

Pipe Size	Insulation Thickness
2 inch and smaller	1/2 inch
2-1/2 inch and larger	1 inch

   b. Domestic Hot Water (thru 140 deg F):

Pipe Size	Insulation Thickness
1-1/2 inch and smaller	1 inch
2-1/2 inch and larger	1-1/2 inch

   c. Storm Water Piping: Including all vertical and horizontal rain leaders shall be 1 inch.

2.04 PIPE INSULATION, FLEXIBLE

A. Pipe Insulation, Flexible

1. Armstrong self-seal AP Armaflex flexible elastomeric pipe insulation.
2. Thermal conductivity (K value): Not greater than 0.27 at mean temperature of 75 deg F.
3. Apply to following piping in thickness indicated: Waste piping from water coolers and drinking fountains: All sizes 1/2 inch

2.05 INSULATION FOR COLD EQUIPMENT

A. Insulation for Cold Equipment:

1. Armstrong Armaflex II sheet insulation; 1-1/2 inch material installed in 2 layers with joints staggered.
2. Thermal conductivity (K value): Not greater than 0.27 at mean temperature of 75 deg F.
3. Apply to following equipment a thickness of 3/4 inch: Domestic water meter, Roof drain bodies

2.06 INSULATION FASTENERS

A. Insulation Adhesive: Childers CP-82.

B. Insulation Mastic: Childers CP-30.

C. Insulation Caulking: Dow No. 11.

PART 3 EXECUTION

3.01 APPLICATION - GENERAL

A. Do not insulate piping until satisfactory completion of required pressure tests.

B. Apply insulation to clean, dry surfaces with pipe surfaces at room temperature.

C. Butt insulation firmly together with longitudinal and end joints sealed with compatible jackets, facings and adhesives as specified.

D. Apply adhesives, mastics and coatings per manufacturer's recommendations and as specified.

E. On cold surfaces where vapor barrier jackets are used, apply insulation with a continuous, unbroken vapor seal. Adequately insulate and vapor seal hangers, supports, and anchors that are secured directly to cold surfaces to prevent condensation.

F. Continue insulation through sleeves and wall and ceiling openings except insulation shall not continue through fire-rated (2-hour or greater) partitions, walls, floor-ceiling systems.

G. Insulate all fittings, valve bodies, flanges and other pipeline accessories.

H. At hangers and bracing, install in accord with Division 22 Section “Hangers and Supports for Plumbing Piping and Equipment”.

I. Contractors shall consult manufacturer's Technical Bulletins for detailed information on safety precautions in using all insulation products, polyurethanes, polyisocyanurates, and related materials. The data shall describe fire and other risks, safety in handling, toxicity, threshold limit values, physiological effects of inhalation and eye and skin contact, incompatibilities and other essential information regarding use. Obtain six (6) copies for distribution and use at jobsite and for submittal with shop drawing submittals.

J. Roof Conductors: Insulate all horizontal and vertical piping.

3.02 FIBERGLASS INSULATION INSTALLATION

A. Insulation Installation on Straight Pipes and Tubes.
   1. Secure pipe insulation to pipe using self-sealing lap system.
   2. On high temperature piping, above 500 deg. F (260 deg. C), apply insulation using double layer and staggered joints. For double layer installation, secure the unjacketed inner layer using filament tape; without deforming insulation material. All joints and ends must be firmly butted and secured with appropriate securing material.
   3. Firmly rub all longitudinal and circumferential joints using a squeegee or sealing tool.
   4. Longitudinal jacket laps for pipe insulation installed on piping systems with operating temperatures below ambient shall be vapor sealed with factory-applied pressure sensitive adhesive vapor retarder, self-sealing lap. For proper sealing, firmly rub lap joints with reasonable pressure being applied with a plastic squeegee or sealing tool. Vapor seal all circumferential joints with factory-furnished, matching pressure sensitive butt strips installed with reasonable pressure being applied with a plastic squeegee or sealing tool. Additionally, coat raw edges of pipe insulation sections with vapor retarder mastic at 12 foot (3.6 m) to 21 foot (6.4 m) intervals; at Engineer's discretion on straight piping, and on either side of all fittings, flanges, or valves. Vapor retarder mastic shall completely coat the ends of the pipe and extend onto the bore of the pipe insulation and onto the jacketing

a minimum of 2 inches (51 mm). Follow NAIMA's "Guide to Insulating Chilled Water Piping Systems with Mineral Fiber Pipe Insulation" for additional details.

5. Install metal shields between hangers or supports and the pipe insulation. Install rigid insulation inserts as required between the pipe and the insulation shields. Inserts shall be of equal thickness to the adjacent insulation, and shall be vapor sealed as required. Insulation shields shall be no less than the following lengths:
   a. 1-1/2 inch to 2-1/2 inch IPS: 10 inch (254 mm) long.
   b. 3 inch to 6 inch IPS: 12 inch long.
   c. 8 inch to 10 inch IPS: 16 inch long.
   d. 12 inch and over IPS: 22 inch long
6. For piping subject to abuse in mechanical rooms or high traffic areas, protect insulation from mechanical abuse by the use of appropriate thickness of PVC jacketing, metal jacketing, or laminated self-adhesive water and weather seal.
7. For piping exposed to the elements, install a jacket that shall be UV resistant PVC with a minimum thickness of 0.030 inch, a minimum 0.016 inch thick aluminum jacket with factory-applied moisture barrier, or a minimum 0.010 inch thick stainless steel jacket with factory-applied moisture barrier. Fittings shall be of similar materials or outdoor weatherable PVC. Apply all jacketing per manufacturer's recommendations for the conditions.

B. Insulation Installation for Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with fiberglass blanket insulation.
   4. Install jacket material using manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install preformed formaldehyde free fiberglass fittings; minimum 50 percent recycled glass content, of same material as straight segments of pipe insulation when available.
   2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Fittings:
   1. Install preformed formaldehyde free fiberglass fittings; minimum 50 percent recycled glass content, of same material as straight segments of pipe insulation when available.
   2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to valve body.
   3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   4. Install insulation to flanges as specified for flange insulation application.

E. PIPE & TANK INSULATION
   1. Apply on clean, dry surfaces.
   2. Cut to appropriate length using manufacturers' stretch out guide for the specific pipe size. Add an additional 2 inches to 4 inches (102 mm) for a staple flap.
   3. Install insulation around the duct circumference in a manner that ensures a firm fiber mesh at all joints. Fasten the longitudinal with outward clinching staples placed 3 inches on center. As an alternative, individual sections may be fastened in place using continuous and overlapping strands of ¾" wide glass fiber filament tape around the insulation jacketing O.D. Longitudinal and circumferential joints shall be sealed with 4" wide matching pressure sensitive tape squeegeed along the entire length.
   4. For duct exposed to the elements, jacketing shall be UV resistant PVC with a minimum thickness of 0.030 inches, or 0.016 inches thick aluminum with factory applied

moisture barrier or 0.010 inches thick stainless steel with a factory applied moisture barrier or laminated self-adhesive water and weather seals. Fitting covers shall be of similar materials. The insulation and jacketing shall be held firmly in place with a friction type Z lock or a minimum 2″ overlap joint. For systems operating below ambient, all PVC joints shall be sealed completely along the longitudinal and circumferential seams and installed so as to shed water. When required, all PVC circumferential joints shall be sealed by use of preformed butt strips; minimum 2″ wide or a minimum 2″ overlap. Butt strips shall overlap the adjacent jacketing a minimum ½ inch and be completely weather sealed. PVC Jacketing shall be limited to a maximum 20 inch OD of the insulation when exposed to direct sunlight. For systems operating above ambient, circumferential joints should overlap a minimum of 2″ and not be sealed. Insulation thickness for duct covered by PVC Jacketing shall be such that the surface temperature of the PVC does not exceed 125°F (52°C).

5. ends at 12 foot to 21 foot intervals; at the Engineer's discretion, and on either side of fittings, flanges or valves before taping. Mastic shall extend a minimum of 2 inches onto the bore of the pipe and 2 inches onto the jacketing.

3.03 APPLICATION OF FLEXIBLE PIPE INSULATION

A. Install tubing wherever possible by slipping material over piping. Otherwise, slit pipe insulation, tightly butt ends and seal butt joints and slit seams with suitable adhesive.

B. Insulate fittings and valve bodies with segments cut from pipe insulation. Apply with adhesive.

C. Insulate piping at hanger points with fiberglass material protected with metal saddles.

3.04 APPLICATION OF INSULATION ON COLD EQUIPMENT

A. Apply with Armstrong 520 adhesive covering entire surface as well as back of insulation.

B. Coat all butt edges and press firmly together with 1/8-inch overlay pressure.

C. Apply two (2) coats of Armstrong Armaflex finish over sheet surfaces.

END OF SECTION

SECTION 221116
DOMESTIC WATER PIPING AND DEVICES

PART 1 - GENERAL

1.01 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 DESCRIPTION OF WORK

A. This Section applies to:
   1. Potable Cold Water Piping
   2. Hot Water Piping
   3. Raw Cold Water Piping
   4. Interior Hose Bibbs (HB-1)
   5. Exterior Wall Hydrants (WH-1)
   6. Strainers
   7. Water Hamer Arrestors
   8. Vacuum Breaker
   9. Drain Valves
   10. Temperature and Pressure Relief Valves
   11. Pressure Reducing Valve
   12. Escutcheons
   13. Backflow Preventors

1.03 QUALITY ASSURANCE

A. General: Provide all supervision, labor, tools, materials, equipment, accessories and specialties necessary to completely install, clean and test the plumbing systems. All materials shall be free from defects impairing strength and durability and shall be of the best quality for the indicated purposes. All Work shall have structural properties sufficient to solely sustain or withstand strain and stresses to which it is normally subjected; all Work shall be true to detail.

B. Codes and Standards (Division 22 Section “Common Work Results for Plumbing” Listings and the following).
   1. Plumbing installation shall be in accordance with the state and local plumbing code, and all other codes having jurisdiction.
   2. American Standard Code for Pressure Piping ANSI B31.1
   3. National Association of Corrosion Engineers
   4. American National Standards Institute (ANSI)
   5. American Society of Mechanical Engineers (ASME)
   6. American Society for Testing and Materials (ASTM)
   7. American Water Works Association
   8. Manufacturer's Standardization Society of the Valve and Fitting Industry
   9. Plumbing and Drainage Institute
   10. State Plumbing Code
   11. State Building Code

C. Material Standards
   1. ASTM B32-94: Specification for Solder, Metal Sizes.
   2. ASTM B42-93: Specification for Seamless Copper Pipe, Standard Size.
   3. ASTM B75-93: Specification for Seamless Copper Tube.
   4. ASTM B88-93a: Specification for Seamless Copper Water Tube.
   5. ASTM B251-93: Specification for General Requirements for Wrought Seamless Copper and Copper-Alloy Tube.
   6. ASTM B302-92: Specification for Threadless Copper Pipe.

7. ASTM A53-94: Specification for Pipe, Steel, Black and Hot Dipped, Zinc-Coated Welded and Seamless.
8. AWWA C651-92: Standard for Disinfecting Water Mains.

1.04 SUBMITTALS

A. Shop Drawings" Valves: Submit in separate packages for each service/schedule as specified.

B. Product Data: Catalog cuts.

C. Samples: Not required for review.

D. Reference Submittals: Not required for review.

1.05 HANDLING, DELIVERY, AND STORAGE

A. General: Handling, delivery, and storage shall be in accordance with the manufacturer's recommendations. No extra cost shall be charged the Owner for handling, delivery, or storage. In no case shall the pipe or appurtenance be dumped, dropped, or thrown.

PART 2 - PRODUCTS

2.01 PIPING

A. General: The outside of all piping and fittings shall bear the Manufacturer's standard marking for type, pressure, etc. The A/E does not guarantee the accuracy of the figure numbers as listed.

B. Pipe - General
1. All carbon steel pipe shall be fabricated from open hearth or electrical furnaces. No Bessemer pipe shall be installed.
2. All pipe and fittings shall be equal to or better than the grade specified.
3. Whenever Specifications call for close bending or coiling, use Grade B pipe.
4. All piping material shall be new and free from defects and shall be subject to standard mill test before being shipped.
5. Pipe shall be labeled.
6. Fittings and valves shall have the Manufacturer's name or trademark legibly raised or cut into each piece.
7. All pipe shall be cut off even and reamed full bore. Threads shall be cut smooth, true and to full standard size. Piping shall be installed clean of chips, burrs or oil.
8. No salvaged or used pipe shall be used without the written approval of the A/E or Owner. Wherever such approval is given, recut the ends of the pipe, square, cut new threads on screwed pipe, and thoroughly clean the pipe of all rust, dirt, scale and foreign matter before installation.

C. Domestic Water Pipe 4-inch Size and Smaller
1. **Pipe:**
   a. Copper tube, seamless, type L hard temper, ASTM B-88, above ground, and type K soft temper, 2-inch and smaller, below ground.
   b. Copper Press-Connect, ASME B16.51
2. **Fittings:**
   a. Cast brass or wrought copper, solder type, ASTM 75, ANSI B16.22..
3. **Joints:** Soldered, 95-5 tin-antimony solder above ground, and silver solder below ground.
4. **Unions:** Sweat-end, 150 lb. cast brass, ground joint.
5. **Press Fittings**
   a. Manufacturers: Pro-Press, Apollo, Streamline, Viega
   b. Pipe: Copper press fittings may be used as an option, per ASTM B16.18 or ASTM B16.22.
   c. Fittings: Press-Type fittings shall be joined using appropriate sized Tools per ASTM B88. Manufacturers: ProPress
6. Mechanically formed tee connections and couplings, such as T-drill, are NOT acceptable.

2.02 PIPING AUXILIARIES / SPECIALTIES

A. General: All auxiliaries and specialties shall be guaranteed by the manufacturer for the pressure, temperature and materials being handled. All auxiliaries and specialties shall be suitable for the piping to which they are attached.

B. Interior Hose Bibbs (HB-1): Manufacturers: Woodford, Chicago, Crane, Nibco, or Mifab.

C. Wall Hydrants (WH-1): Manufacturers: Josam, J.R. Smith, Wade, Woodford, Mifab or Zurn.

D. Water Meter: In exterior vault, refer to civil drawings and specifications. Coordinate with civil contractor.

E. Strainers: Manufacturers: Sarco, Anderson, Armstrong, Crane, or Watts. Sarco type BT or BF-150, bronze body with stainless steel screen. Provide drain valve on strainer.Furnish and Install a “line-size” Y-Strainer on the inlet side of the backflow preventor.
   1. Furnish and Install a “line-size” Y-Strainer on the inlet side of the backflow preventor.

F. Vacuum Breakers
   1. Manufacturers: Watts, Chicago Faucet, Febco, Wilkins, Conbraco, or Woodford.
   2. Hose Connections: ASSE 1011, Watts #8A, 3/4-inch hose thread. (#8AC in finished areas).
   3. Pressure Type Vacuum Breaker: ASSE 1020, Watts #800QT with ball valves and gauge cocks for 1-1/4 inch thru 2 inch size. ASSE 1056, Watts #008QT anti-spill-type for 1/2 inch through 1 inch size.

G. Drain Valves: Powell 502-HS with cap and chain, or equal by Hammond, Keystone, or Watts.

H. Temperature and Pressure Relief Valves: ASME-coded, All-bronze construction with seat-to-disc alignment that will not stick or freeze. Shall start to open at 230 deg F and shall be fully open at 240 deg F. Shall have snap action thermostat and sensing bulb sized to water heater Manufacturer's recommendations. Manufacturers: Watts, McDonnel, Wilkins, Conbraco.

I. Pressure Reducing Valve: Valve shall automatically reduce a higher inlet pressure to a steady lower downstream pressure. Must meet “Reduction of Lead in Drinking Water Act”. All bronze body and cover. Outlet pressure shall be set to 65.0 psi
Manufacturer: Cla-Val Model CRD-L for sizes 1/2” to 2-1/2” pipe sizes

J. Escutcheons shall be one-piece, steel type with polished, chrome-plated finish and setscrew fastener. Install pipe escutcheons at ALL pipe penetrations thru walls that are visible by public view.

K. Backflow Preventor: Where indicated on the plumbing drawings furnished and install a Reduced Pressure Zone Assembly to prevent backsiphonage and backpressure conditions. The Lead-Free assembly shall consist of two shut-off valves, relief valve and two check valves.
   1. Provide with Air-Gap device and route drain piping to floor drain.
   2. Furnish and Install a “line-size” Y-Strainer on the inlet side of the backflow preventor.
      a. Sizes 2” and larger shall be a flanged, Wye Pattern cast-iron strainer similar to Watts # 77F-DI-FDA-125
      b. Sizes less than 2” in size shall be Wye-Pattern, lead free cast strainer Watts # LF777SI
   3. Install center-line of backflow preventor + 24” A.F.F.
   4. Backflow Assemblies less than 2” in size shall be similar to Watts # LF909
   5. Backflow Assemblies 2-1/2” and larger in size shall be similar to Watts # LF909
   6. Approved Manufacturers: Watts, Wilkens

PART 3 - EXECUTION

3.01 INSTALLATION, GENERAL

A. General

1. Comply with Division 22 Section “Common Work Results for Plumbing”, as well as the requirements of Division 22 Sections “Hangers and Supports for Plumbing Piping, and “Plumbing Insulation”.
2. Piping shall be installed in a manner which permits easy removal of valves and disconnection of equipment. Unions or flanged joints shall be installed for this purpose.
3. Piping shall be installed, supported, guided, and anchored to properly provide for movement due to expansion and contraction without undue strains on the joints and in such a manner that it will not sag, buckle or sway.
4. Piping shall not be supported from other pipes, conduits, ducts or similar installations.
5. No piping shall be supported by the equipment to which it is connected. Install base elbows, hangers or other approved independent method of support for the pipe.
6. Connections to equipment shall be arranged to facilitate ease of removal and service without dismantling of the run-outs of main piping, and shall be installed by the use of multiple elbows or other similar methods to minimize strain on the equipment connections.
7. No field-fabricated welding fittings shall be permitted. All welding tees, elbows, reducers, and caps shall be commercially manufactured products.
8. Do not obstruct passageways, headroom, door and window operation, and similar areas with the installation of the piping.
9. All open ends of pipes, including equipment connections, shall be properly sealed at all times during installation to keep dirt and all foreign material out of the piping. Plugs used shall be commercially manufactured products.
10. Pipe size reductions shall be made with factory-fabricated eccentric reducers or reducing fittings and shall be installed in a manner which does not cause pocketing or inhibit the flow of the material.
11. Install shut-off service valves with unions on all connections to equipment and on each side of control valves as required for ease of proper servicing and maintenance; see Division 22 Section “General Duty Valves for Plumbing Piping”.
12. Unless otherwise indicated, the discharge from pressure-and temperature-relief valves and equipment drains shall be piped to the nearest floor drain, hub drain, or mop sink, installed with an approved air gap as required, and arranged for safe discharge.
13. No pipe shall penetrate any structural member without the written approval of the A/E. Where such penetration is allowed, the structural member shall be reinforced subject to the approval of the A/E.
14. Dielectric Separation: Provide dielectric separation at all copper piping and valves connected to ferrous piping. Brass or bronze valves installed in ferrous piping shall not require dielectric separation. Connections between copper piping and ferrous flanged piping and equipment connections shall be with a bronze companion flange with dielectric separation for flanges and bolts. Connections between copper piping and screwed ferrous piping shall be Clearflow Dielectric Waterway fittings.
15. Movement: Mains: Provide adequate offsets, bends, loops, flexible joints and guides as required to prevent over-stressing of piping and/or the structure. Branches: Provide for expansion and contraction by means of offsets, swings, joints or loops to eliminate stress on connected piping, valves or equipment. Provide for proper drainage as required. Maintain a free floating, properly braced and supported piping system.
16. Provide all rough-in and final connections to equipment and services indicated in the Contract Documents for equipment and services to be functional.
17. Pipe Sleeves shall be installed at ALL pipe penetrations of floors.

B. Cross Connections and Interconnections: No plumbing fixtures, devices, equipment or pipe connections shall be installed that will provide a cross-connection or interconnection between a potable water supply and any source of nonpotable water such as a drainage system, a soil or waste pipe, or a boiler or cooling tower where the water may be chemically treated.

C. Painting of Piping: Refer to Division 09 Section “Interior Painting”.

3.02 BUILDING PIPING SYSTEM: INSTALLATION

A. Domestic Water: Cold, Hot, Recirculating: All piping shall be installed and pitched to provide proper drainage. Install drain valves at all low points and as required to provide drainage facilities for the piping. Wherever system is sectionalized, install drain valves between each sectional shut-off valve. All hot water piping shall be pitched to provide natural gravity recirculation regardless of a recirculation pump. Install pressure gauge in domestic cold water main at water entrances to building.

B. Shock Elimination: All piping shall be protected against water shock. Install a water hammer arrestor of the proper size at the end of the main, at the end of all branch lines, and at the end of lines serving groups of fixtures. Water hammer arrestors shall be sized and installed as recommended by the Plumbing and Drainage Institute (PDI) and shall eliminate water hammer. All water hammer arrestors shall be installed in locations where they are readily accessible for service. Where required, provide suitable access doors. Note: Install water hammer arrestors on each water line serving laundry clothes washers.

C. Contamination Protection: Provide an approved in-line double check backflow preventer at each connection to a fixture where indicated or required by code. Such fixtures shall include coffee makers, ice makers, clothes washers, etc.

D. Backflow Prevention: Install a code approved backflow preventer unit in the service main, where indicated on the Drawings, or as required by code. Include in-line strainer, dual-service shut-off valves, double-check valves, and check cocks. Install pressure gauge on inlet and outlet side of backflow preventor. Properly support unit, independent of the piping, with union connections.

E. Water Meter: In exterior vault, refer to civil drawings and specifications. Coordinate with civil contractor.

END OF SECTION

SECTION 221199
PEX PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Domestic water piping and fittings for the following applications:
   1. Domestic cold water piping
   2. Domestic hot water piping

1.02 RELATED SECTIONS

A. Section 22 11 16 — Domestic Water Distribution and Devices

B. Section 22 07 00 — Plumbing Piping Insulation

C. Section 22 05 29 — Hangers and Supports for Plumbing Piping and Equipment

1.03 REFERENCES

A. American National Standards (ANSI)
   1. ANSI/UL 263: Fire test of building construction and materials. Standard methods of fire endurance tests of building construction and materials.

B. ASTM International (ASTM)
   1. ANSI/UL 263: Fire test of building construction and materials. Standard methods of fire endurance tests of building construction and materials.
   2. ASTM E84: surface burning characteristics of building materials.
   3. ASTM
   4. ASTM F2023: test method for evaluating the oxidative resistance of cross-linked (PEX) tubing and systems to hot chlorinated water.
   5. ASTM F3347: Standard Specification for Metal Press Insert Fittings with Factory Assembled Stainless Steel Press
   6. Sleeve for SDR9 Cross-linked Polyethylene (PEX) Tubing.
   7. ASTM F3348: Standard Specification for Plastic Press Insert Fittings with Factory Assembled Stainless Steel Press Sleeve for SDR9 Cross-linked Polyethylene (PEX) Tubing.
   8. ASTM F876: specification for cross-linked polyethylene (PEX) tubing.

C. American Water Works Association (AWWA)
   1. AWWA C904: cross-linked polyethylene (PEX) pressure pipe, ½ in. (12 mm) through 3 in. (76 mm), for water service.

D. CAN/ULCS102.2 Standard method of testing for surface burning characteristics of flooring, floor covering and miscellaneous materials and assemblies.

E. CSA CAN/CSA B137.5: Cross-linked polyethylene (PEX) tubing systems for pressure applications.

F. International Association of Plumbing & Mechanical Officials (IAPMO)
   1. Uniform Mechanical Code.
   2. Uniform Plumbing Code.

G. International Code Council (ICC)
   1. International Mechanical Code (IMC)
   2. International Plumbing Code (IPC)

H. National Standard Plumbing Code (NAPHCC)

I. National Sanitation Foundation (NSF)
   1. NSF 14 Plastics Piping System Components and Related Materials
   2. NSF 61 Drinking Water System Components - Health Effects

1.04 SUBMITTALS

A. Submit under provisions of Section 01 30 00 — Administrative Requirements.

B. Product data: Provide manufacturer's product submittal data.

C. Shop drawings: Provide installation drawings indicating piping layout, size dimension by installation segment, vault locations, support fixtures and schedules with all details required for installation of the system.

D. Samples: Submit selection and verification samples of piping.

E. Quality assurance/control submittals
   1. Test reports: Upon request, submit test reports from recognized testing laboratories.
   2. Submit the following documentation.
      a. Manufacturer's certificate stating that products comply with specified requirements.

F. Closeout submittals: Submit the following documents.
   1. Warranty documents specified herein.
   2. Operation and maintenance data.
   3. Manufacturer's field reports specified herein.
   4. Final as-built piping layout drawing.

1.05 QUALITY ASSURANCE

A. The installer shall be a qualified installer, licensed within the jurisdiction, and familiar with the installation of cross-linked polyethylene (PEX) tubing systems.

B. The installation of cross-linked polyethylene (PEX) tubing for hot and cold water distribution systems shall conform to the requirements of the ICC International Plumbing Code or IAPMO Uniform Plumbing Code.

1.06 DELIVERY, STORAGE AND HANDLING

A. The cross-linked polyethylene (PEX) tubing shall be shipped to the job site on truck or in such a manner to protect the tubing. The cross-linked polyethylene fittings and manifolds shall not be handled roughly during shipment. The tubing and fittings shall be unloaded with reasonable care.

B. Cross-linked polyethylene plastic tubing and fittings shall be stored in a flat, dry, well ventilated location, not exposed to direct sunlight. Normal care in handling shall be exercised to avoid abuse of the tubing. The tubing and fittings shall not be thrown or dropped on the ground, walked on, or dragged.

1.07 PROJECT CONDITIONS

A. The location of a manifold with valves shall be accessible and in an area not subject to freezing. Proper support of the manifold shall be provided.

B. PEX tubing should not be left exposed in direct sunlight for extended periods of time – short periods not to exceed 6 months are permissible.

C. Plastic manifolds and fittings should not be left exposed in direct sunlight for extended periods of time — short periods not to exceed 15 days are permissible.

1.08 WARRANTY

A. Project warranty: Refer to Conditions of the Contract for project warranty provisions.

B. Manufacturer’s Warranty: The tubing and fittings manufacturer shall warrant that the tubing and fittings are free from defects and conform to the designated standard. The warranty shall only be applicable to tubing and fittings installed in accordance with the manufacturer’s installation instructions.

C. The manufacturer of the tubing and fittings shall not be responsible for improper use, handling, or installation of the products.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Acceptable manufacturer: Viega, Uponor.

B. Requests for substitutions will be considered in accordance with provisions of Section 01 60 00 — Product Requirements.

2.02 DOMESTIC WATER PIPING AND FITTINGS (MATERIAL)

A. Tubing Standard: Viega PureFlow PEX high-density cross-linked polyethylene tubing shall be manufactured to the requirements of ASTM F876 and meet the standard grade hydrostatic pressure ratings from Plastic Pipe Institute in accordance with TR-4/03. The following three standard grade ratings are required:

200 degrees F (93 degrees C) at 80 psig (551 kPa)

180 degrees F (82 degrees C) at 100 psig (689 kPa)

73.4 degrees F (23 degrees C) at 160 psig (1102 kPa)

a. Chlorine testing: According to ASTM F876 shall meet or exceed the following end use condition.

1) End use conditions of : 100% @ 140°F. Per PEX 5306 (CL5).

b. UV testing: According to ASTM F876 PEX tubing products shall meet or exceed the following exposure limits.

1) Viega PureFlow PEX 6 months.

B. Fitting Standard: PureFlow Press fittings shall be manufactured from UNS, C87700, C87710 bronze or polyphenylsulfone, meeting the requirements of ASTM F877 and ASTM F3347 (metallic) or ASTM F3348 (polymer) tested as a system with Viega PureFlow PEX tubing. The PureFlow Press sleeve shall be manufactured out of a 304 grade or better stainless steel and have three view holes (attached sleeve) to ensure proper PEX tubing insertion. The attached sleeve fitting will incorporate a tool locator ring that shall be in place while making a proper press connection. The PureFlow Press connection shall be made with a Viega supplied ratcheting PureFlow Press hand tool or PureFlow Press power tool.

C. Manifolds: Acceptable manifolds shall include:

1. Copper Manifolds: Shall be copper material having a male or female solder, ProPress. All outlets shall be PureFlow Press or ProPress fittings. Shall be provided by the Cross-linked Polyethylene system manufacturer.
2. Polymer Manifolds: Shall be plastic material having a male NPSM thread, PureFlow Press inlets. All outlets shall be PureFlow Press connections provided by the PEX system manufacturer.

D. Adapter Fittings: PEX adapter fittings shall conform to one of the following ASTM standards; F877, F1807, F2159, or ASME B1.20.1 and be listed to the CSA B137.5. The adapter fittings shall mate to NPT threads, copper tubing, copper fittings or ProPress fittings.

2.03 VALVES

A. Viega PureFlow Press-Connect Valves 3/8” to 3/4“:

1. Approved for use with Viega PureFlow Pex high-density cross-linked polyethylene tubing manufactured to the requirements of ASTM F876 and meet the standard grade hydrostatic pressure ratings from Plastic Pipe Institute in accordance with TR-4/03.
2. Valves shall conform to ASTM F1807, NSF/ANSI 61, NSF/ANSI 372, UPC and cCSAus approvals.
3. Viega PureFlow Press Zero Lead Ball valve shall be equipped with a full port, Eco Brass body, chrome plated brass ball, PTFE seat, Nickel Plated Brass Stem. Two Piece Ball valve features Teflon seals with EPDM and FKM stem seals with a Nickel Plated Zinc handle and press ends.

4. Temperature Range: 0 degF to 180 degF
5. Max Operating Pressure: 160 psi

B. Viega PureFlow Press-Connect Valves 1" to 2":
1. Approved for use with Viega PureFlow Pex high-density cross-linked polyethylene tubing manufactured to the requirements of ASTM F876 and meet the standard grade hydrostatic pressure ratings from Plastic Pipe Institute in accordance with TR-4/03.
2. Valves shall conform to ASTM F877, ASTM F3347, NSF/ANSI 61, NSF/ANSI 359, NSF/ANSI 372, UPC, CSA B137.5 and CSA B125.3 approvals.
3. Viega PureFlow Press Zero Lead Ball valve shall be equipped with a zero lead Bronze body, stainless steel ball, PTFE seat, Brass Stem, Steel Zinc-Plated Handle with plastic cover, and a stainless steel press sleeve.
4. Two Piece Ball valve features EPDM stem seals and EPDM O-Ring with press ends.
5. Temperature Range: 0 degF to 180 degF
6. Max Operating Pressure: 160 psi

C. Viega PureFlow Press-Connect Stop Valves 1" to 2":
1. Approved for use with Viega PureFlow Pex high-density cross-linked polyethylene tubing manufactured to the requirements of ASTM F876 and meet the standard grade hydrostatic pressure ratings from Plastic Pipe Institute in accordance with TR-4/03.
2. Valves shall conform to ASTM F877, NSF/ANSI 61, NSF/ANSI 372 approvals. Available in straight and angled configurations.
3. Viega PureFlow Press Zero Lead Ball valve shall be equipped with a full port, Eco Brass body, chrome plated brass ball, PTFE seat, Nickel Plated Brass Stem. Ball valve features Teflon seals with EPDM and FKM stem seals with a Nickel Plated Zinc handle.
4. Temperature Range: 0 degF to 180 degF
5. Max Operating Pressure: 160 psi

2.04 SOURCE QUALITY CONTROL

A. The PEX tubing and fitting manufacturer shall maintain a third party listing of the tubing and fittings. The tubing and fittings shall be certified in accordance with ANSI/NSF 14/61 to verify suitability to transport potable water. The tubing and fittings shall have the mark "NSF-pw", "cNSF® us pw-G", or "NSF 61" permanently marked on the product to verify the material listing.

B. The manufacturer of the PEX tubing and fittings shall maintain a quality control program in accordance with ISO 9001 or NSF International in the manufacturing plant to assure that the tubing and fittings are continually being produced to the required standard. The tubing and fittings shall be certified as complying with NSF 14.

PART 3 – EXECUTION

3.01 EXAMINATION

A. The installing contractor shall carefully examine the PEX tubing for defects, cuts, abrasions, cracks, fading color, or blemishes. There shall be no cracks or heavy deformations of the tubing. Fittings and manifolds shall be checked for any signs of abuse. Any damaged tubing or fittings shall be rejected.

3.02 PREPARATION

A. Viega PureFlow PEX tubing: Cross-linked polyethylene tubing shall be cut with a PEX tubing cutter. The tubing shall be cut squarely and neatly to permit a proper connection between the tubing and fitting.

3.03 INSTALLATION GENERAL CONDITIONS

A. Plans indicate general location and arrangement of PEX system. Identified locations and arrangements are used to size pipe and calculate friction and loss and other design considerations. Install PEX tubing as indicated, except where deviations to layout are approved on coordination drawings.

3.04 INSTALLATION, PEX TUBING

A. Pressure rating: Install components having a pressure rating equal to or greater than the system operating pressure.

B. Install PEX tubing that is free of blemishes, cuts, gouges, kinks or noticeable fading of color.

C. Changes in direction: PEX tubing shall not exceed an eight times the tubing outside diameter (OD) free bend radius or a five times the tubing OD supported bend radius, with use of a Viega approved bend support. Install fittings for changes in direction where any minimum bend radius is exceeded and branch connections.

D. PureFlow Press connections: PureFlow Press fittings shall be made in accordance with the manufacturer's installation instructions. The Stainless press sleeve shall be placed over the end of the squared off PureFlow PEX tubing while fully inserting the fitting barb into the tubing. Full tubing insertion shall be verified by a visual confirmation of PEX being present through the view holes before engaging a press connection. Full insertion for an attached sleeve connection means tubing must be completely visible in at least two view holes and partially visible in the final view hole. The PureFlow Press connection shall be made with a Viega supplied ratcheting PureFlow Press hand tool or PureFlow Press power tool.

E. Threaded joints: Threaded joints shall have a potable water listed joint sealant tape applied to the male threads only. Tighten joint with a wrench and backup wrench as required.

F. PEX tubing protection: Protect PEX tubing from exposure to direct and indirect sunlight exposure. PEX tubing shall be stored under cover, shielded from direct and indirect sunlight when material is stored for any length of time.

G. Penetration protection: Provide allowance for thermal expansion and contraction of PEX tubing passing through a wall, floor, ceiling or partition by wrapping with pipe insulation, or by installing through an appropriately sized sleeve. Penetrations of fire resistance rated assemblies shall maintain the rating of the assembly.

H. Backfill material: Back fill material must be free of large rocks, glass, or other sharp objects which can damage the PEX tubing.

I. Horizontal support: PEX tubing must be supported every 32" horizontally with Viega approved suspension clips or plastic insulators.

J. Vertical support: PEX tubing must be supported at each floor or ceiling penetration and every four feet in between.

3.05 FIELD QUALITY CONTROL

A. Pressure testing PEX pipe and fittings: Pressure test PEX-a piping systems in accordance with local code and manufacturer's requirements.

B. System flushing, pressure testing and system conditioning procedure:
   1. Hydrostatic pressure testing shall be completed in accordance with local Codes.
   2. Leave joints uninsulated and exposed for the duration of the test.
   3. Flush the domestic water system with ambient temperature, clean, potable water unless there is a risk of damage due to freezing.
   4. After completing each hydrostatic leak testing procedure, drain the system until empty.
   5. If testing with compressed air, do not exceed 120 psi.

3.06 CLEANING

A. Remove temporary coverings and protection of adjacent work areas.

B. Repair or replace damaged installed products.

C. Clean the installed products in accordance with manufacturer's instructions prior to Owner's acceptance.

D. Water system disinfection
   1. PEX piping should be disinfected in accordance with AWWA C651, Standard for Disinfecting Water Mains, or local codes.
   2. Use non-petroleum-based cleaners
   3. Not exceed a pH of 11
   4. Have water temperatures less than 140°F (60°C)
   5. Use a chlorine solution of 50 parts per million (ppm) for 24 hours or 200 ppm for three hours for disinfection.
   6. To prevent reduced service life of system components, disinfection solutions should not stand in the system longer than 24 hours. Flush the system with potable water after disinfection.

3.07 PROTECTION

A. Protect installed work from damage caused by subsequent construction activity on the site.

END OF SECTION

1. SECTION 221300
SANITARY SEWER SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

A. Floor Drains
   1. Trap Guards
   2. Floor Sinks
   3. Hub Drains
   4. Trench Drains
   5. Cleanouts
   6. Backwater Valves

B. Related Documents:
   1. Section 22 11 00 - Water Distribution
   2. Section 22 13 00 - Sanitary Sewerage (Sanitary Waste and Vent Piping)
   3. Section 22 14 00 - Storm Drainage

1.02 REFERENCE

A. Applicable provisions of all Sections 22 shall govern work under this section.

1.03 REFERENCE STANDARDS

A. ANSI A112.14.1 - Backwater Valves

B. ANSI A112.21.1 - Floor Drains.

C. ANSI A112.21.2 - Roof Drains.

D. ANSI A112.26.1/PDI WH-201 - Water Hammer Arrestors.

E. ASSE 1001 - Pipe Applied Atmospheric Type Vacuum Breakers.

F. ASSE 1010 - Water Hammer Arrestors.

G. ASSE 1011 - Hose Connection Vacuum Breakers.

H. ASSE 1012 - Backflow Preventers with Intermediate Atmospheric Vent.

I. ASSE 1013 - Reduced Pressure Principle Backflow Preventers.

J. ASSE 1018 - Trap Seal Primer Valves.

K. ASSE 1019 - Wall Hydrants, Frost Proof Automatic Draining, Anti-Backflow Type.

1.04 QUALITY ASSURANCE

A. Substitution of Materials: Refer to Section GC - General Conditions of the Contract, Equals and Substitutions..

B. Plumbing products requiring approval by the State of Indiana.

1.05 SHOP DRAWINGS

A. Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

PART 2 - PRODUCTS

2.01 FLOOR DRAINS

A. Manufacturer: J.R. Smith, Wade, Zurn.

B. Grates and Covers:

1. Medium duty unless specified otherwise) in areas not subject to equipment loads. Secure with vandal resistant screws.
2. Heavy duty (or reinforced) in areas which are subject to heavy equipment loads.
3. Contractor shall coordinate location of drains indicated on plumbing drawings with structural / general contractor.
4. Jails: Areas of inmate access shall have drain strainers secured with tamper resistant screws.
5. See Floor Drain Schedule on drawings for model numbers and drain descriptions.

2.02 PLUMBING DRAINS

A. FD-1: Floor Drain, General Duty: (On Grade)
1. Duco cast iron bottom outlet body, with double drainage flashing flange and reversible clamping collar, with 5" round adjustable nickel bronze strainer assembly. Strainer diameter to be a minimum twice the outlet size of the outlet connection.
2. Provide with cast iron p-trap or approved equal.
3. Floor drain is to be provided with either a J.R Smith Stink-Stopper # 2692 or SureSeal-backcheck for sewer gas control.

B. FD-2: Equipment Drain with Funnel: (On / Above Grade)
1. Duco cast iron body with integral deep seal cast iron p-trap, with flashing flange and clamping collar, with round adjustable nickel bronze strainer, with round adjustable nickel bronze cleanout plug with solid secured cover.
2. Install 4" diameter nickel bronze funnel assembly.
3. Floor drain is to be provided with either a J.R Smith Stink-Stopper # 2692 or SureSeal-backcheck for sewer gas control.

2.03 TRAP GUARDS

A. Manufacturers: (ICC PMG Product Certified) RectorSeal Sure-Seal # SS2009V, Zurn, IPS Corp, PPP Inc.

B. Flexible elastomeric PVC construction diaphragm trap guard for installation in new and existing floor drains, hub drains, and trench drains. Trap guard to prevent trap evaporation and waste backflow. Size as applicable to the drain outlet size, up to 4" size. This product to be tested and certified to the requirements of ASSE 1072 & IAPMO Research and Testing, Inc., and any subsequent submittal must contain a certificate of compliance listing all the approved sizes.

C. Contractor to verify with local plumbing inspector that flexible type trap guard devices are allowed. When the use of trap guard devices are not allowed, install a "Watts" Series A200, flow-thru trap primer.

2.04 TRENCH DRAINS

A. TD-1: Trench Drain: 4" Precast trench drain, heavy duty load bearing z frame. 5" ductile iron slotted grate. Recessed area for locking device. Durable black e-coating. DIN class E. 4" trash basket/sediment bucket T304 stainless steel. Fiber reinforced polymer. Rigid metal installation bracket accepts #4 rebar. Ships with plywood cover top to keep trench clean during construction. 0.5% typical slope. See drawing Drain Schedule for additional information.
1. Manufacturers: Duratrench, Zurn, ABT, Inc. Polydrain.
2. Grating shall be 05SBHC24DBD heavy duty ADA compliant and heel proof slotted grate.

2.05 CLEANOUTS

A. Manufacturer: Josam, J.R. Smith, Wade, Watts, Zurn.

B. Exterior Unpaved Areas: CO-1, Cast iron hub or plug with tapered threaded PVC closure plug, cast iron or PVC frost sleeve and cover set in 24" square by 4" min. thick reinforced concrete pad top. Neenah R-1976 with non-ferrous securing screw.

1. Interior Concrete Floor Areas: CO-2, Enameled cast iron body with round adjustable scoriated polished nickel bronze cover, tapered threaded ABS closure plug. Zurn ZN-1400- / ZN-1400-T.
2. Interior Finished Wall Areas: Line type cleanout tee with tapered threaded ABS cleanout plug, round polished stainless steel access cover secured with machine screw. Zurn Z-1446- (Note: Screw shall not pass completely through the ABS plug, trim screw as necessary)
    a. Interior Exposed Vertical Stacks: Line type cleanout tee with tapered threaded ABS closure plug. Zurn Z-1445.
    b. Interior Horizontal Lines: Cast iron hub with tapped ferrule and tapered threaded ABS or PVC closure plug, or no-hub coupling and blind plug.

C. Exterior Unpaved Areas: CO-1, Cast iron hub or plug with tapered threaded PVC closure plug, cast iron or PVC frost sleeve and cover.

2.06 SEWER CAMERA INSPECTION

A. The cost of the camera inspection shall be at the expense of the Contractor.

B. The camera inspection shall be performed within 14 days after the sanitary sewer mains have been cleaned and/or rodded out.

C. The camera inspection shall be performed on all sanitary sewer mains 4” and larger before any new work is performed on the sewer piping.

D. Record inspection data using high-quality video media such as DVD or other approved media.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Coordinate location and setting of plumbing specialties with adjacent construction. Install in accordance with manufacturers recommendations.

B. Set floor drains, roof drains, trench drains and cleanouts level and plumb adjusted to finished floor elevation, roof elevation or finished wall location. Locate where serviceable. Allow minimum of 18" clearance around cleanouts for rodding. Lubricate threaded cleanout plugs with graphite and oil, teflon tape or waterproof grease. Install trap primer connections where indicated. Provide deep seal traps on floor drains and hub drains installed in mechanical rooms, penthouses or rooms with excessive positive or negative pressure.

C. Floor drains and hub drains installed in public restrooms, locker rooms, seldom used rooms, and areas with minute drainage flow shall have a trap guard device installed.

D. During construction, floor drains and drench drains shall be protected from dirt and debris. Contractor shall cover drains with temporary tape or coverings to be removed once construction is complete.

E. Adjust receiver height to drain tile inlet and outlet elevations and cleanout to finished floor elevation.

F. Floor Drains shall be installed to allow the strainer to be recessed 1/4” below finished floor. Drain shall have a slopped 12” sweep around outside diameter of strainer.

END OF SECTION

SECTION 221316
SANITARY WASTE AND VENT PIPING

PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes:
   1. Pipe, tube, and fittings.
   2. Specialty pipe fittings.
   3. Encasement for underground metal piping.

1.02 PERFORMANCE REQUIREMENTS

A. Components and installation shall be capable of withstanding the following minimum working pressure unless otherwise indicated:
   1. Soil, Waste, and Vent Piping: 10-foot head of water.
   2. Waste, Force-Main Piping: 100 psig.

1.03 ACTION SUBMITTALS

A. Product Data: For each type of product indicated.

B. LEED Submittals:
   1. Product Data for Credit IEQ 4.1: For solvent cements and adhesive primers, documentation including printed statement of VOC content.
   2. Laboratory Test Reports for Credit IEQ 4: For solvent cements and adhesive primers, documentation indicating that products comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

1.04 INFORMATIONAL SUBMITTALS

A. Seismic Qualification Certificates: (When Required) For waste and vent piping, accessories, and components, from manufacturer.
   1. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
   2. Detailed description of piping anchorage devices on which the certification is based and their installation requirements.

B. Field quality-control reports.

1.05 QUALITY ASSURANCE

A. Piping materials shall bear label, stamp, or other markings of specified testing agency.

B. Comply with NSF/ANSI 14, "Plastics Piping Systems Components and Related Materials," for plastic piping components. Include marking with "NSF-dwv" for plastic drain, waste, and vent piping and "NSF-sewer" for plastic sewer piping.

1.06 MANUFACTURERS

A. Charlotte Pipe and Foundry Co., North American Pipe Corp.

1.07 PROJECT CONDITIONS

A. Interruption of Existing Sanitary Waste Service: Do not interrupt service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary service according to requirements indicated:
   1. Notify Construction Manager and Owner no fewer than five days in advance of proposed interruption of sanitary waste service.
   2. Do not proceed with interruption of sanitary waste service without Construction Manager's and Owner's written permission.

PART 2 - PRODUCTS

2.01 PIPING MATERIALS

A. Comply with requirements in "Piping Schedule" Article for applications of pipe, tube, fitting materials, and joining methods for specific services, service locations, and pipe sizes.

2.02 PIPING BELOW GRADE:

SANITARY:

A. HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS
   1. Pipe and Fittings: ASTM A 74, CISPI, Service and Extra Heavy classes.
   2. Gaskets: ASTM C 564, rubber.
   3. Calking Materials: ASTM B 29

B. PVC PIPE AND FITTINGS
   1. Pipe: Solid wall Schedule 40 PVC.
   2. Pipe Compound: ASTM D1784 Cell Class 12454.
   3. End Type: Belled
   4. Lay Length: Max. 10 ft.

OIL WASTE:

C. HUB-AND-SPIGOT, CAST-IRON SOIL PIPE AND FITTINGS
   1. Pipe and Fittings: ASTM A 74, CISPI, Service and Extra Heavy classes.
   2. Gaskets: ASTM C 564, rubber.
   3. Calking Materials: ASTM B 29

D. CHARLOTTE PIPE Edge HP Iron Hub and Spigot or equal
   1. Pipe and fittings: ASTM A74, Service Class
   2. Gaskets: ASTM C564 rubber.
   3. Caulking Materials: ASTM B29, pure lead and oakum or hemp fiber.

E. CHARLOTTE PIPE Edge HP Iron Hubless
   1. Pipe and fittings: ASTM A888 and CISPI 301
   2. Couplings: Standard Duty CISPI 310 and Heavy Duty ASTM C 1540.

2.03 PIPING ABOVE GRADE:

1. PVC PIPE AND FITTINGS

B. Solid-Wall PVC Pipe: ASTM D 2665, drain, waste, and vent.

C. PVC Socket Fittings: ASTM D 2665, made to ASTM D 3311, drain, waste, and vent patterns and to fit Schedule 40 pipe.

D. Adhesive Primer: ASTM F 656.
   1. Adhesive primer shall have a VOC content of 550 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Adhesive primer shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Solvent Cement: ASTM D 2564.
   1. PVC solvent cement shall have a VOC content of 510 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
   2. Solvent cement shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

2.04 SPECIALTY PIPE FITTINGS

A. Transition Couplings:

1. General Requirements: Fitting or device for joining piping with small differences in OD's or of different materials. Include end connections same size as and compatible with pipes to be joined.
2. Fitting-Type Transition Couplings: Manufactured piping coupling or specified piping system fitting.
3. Unshielded, Non-pressure Transition Couplings:
    a. Manufacturers:
        1) Dallas Specialty & Mfg. Co.
        2) Fernco Inc.
        3) Mission Rubber Company; a division of MCP Industries, Inc.
        4) Plastic Oddities; a division of Diverse Corporate Technologies, Inc.
        5) Husky
    b. Standard: ASTM C 1173.
    c. Description: Elastomeric, sleeve-type, reducing or transition pattern. Include shear ring and corrosion-resistant-metal tension band and tightening mechanism on each end.
    d. Sleeve Materials:
        1) For Cast-Iron Soil Pipes: ASTM C 564, rubber.
        2) For Plastic Pipes: ASTM F 477, elastomeric seal or ASTM D 5926, PVC.
        3) For Dissimilar Pipes: ASTM D 5926, PVC or other material compatible with pipe materials being joined.
4. Shielded, Non-pressure Transition Couplings:
    a. Manufacturers:
        1) Cascade Waterworks Mfg. Co.
        2) Mission Rubber Company; a division of MCP Industries, Inc.
    b. Standard: ASTM C 1460.
    c. Description: Elastomeric or rubber sleeve with full-length, corrosion-resistant outer shield and corrosion-resistant-metal tension band and tightening mechanism on each end.

PART 3 EXECUTION

3.01 EARTH MOVING

A. Comply with requirements for excavating, trenching, and backfilling specified in Section 312000 "Earth Moving."

3.02 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of piping systems. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, pump sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on coordination drawings.

B. Install piping in concealed locations unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited unless specifically indicated otherwise.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal.

E. Install piping to permit valve servicing.

F. Install piping at indicated slopes.

G. Install piping free of sags and bends.

H. Install fittings for changes in direction and branch connections.

I. Install piping to allow application of insulation.

J. Make changes in direction for soil and waste drainage and vent piping using appropriate branches, bends, and long-sweep bends. Sanitary tees and short-sweep 1/4 bends may be used on vertical stacks if change in direction of flow is from horizontal to vertical. Use long-turn, double Y-branch and 1/8-bend fittings if two fixtures are installed back to back or side by side with common drain pipe. Straight tees, elbows, and crosses may be used on vent lines. Do not change direction of flow more than 90 degrees. Use proper size of standard increasers and reducers if pipes of different sizes are connected. Reducing size of drainage piping in direction of flow is prohibited.

K. Lay buried building drainage piping beginning at low point of each system. Install true to grades and alignment indicated, with unbroken continuity of invert. Place hub ends of piping upstream. Install required gaskets according to manufacturer's written instructions for use of lubricants, cements, and other installation requirements. Maintain swab in piping and pull past each joint as completed.

L. Exterior Sewers: Maintain a minimum of 48” above top of pipe to finished grade. Verify burial depth of sewer piping with local city / county sewer department.

M. Install soil and waste drainage and vent piping at the following minimum slopes unless otherwise indicated: Invert elevations of sanitary waste piping are generally indicated on the Plumbing Foundation drawing.
   1. Building Sanitary Drain: 2 percent downward in direction of flow for piping 3 inch and smaller; 1 percent downward in direction of flow for piping 4” and larger.
   2. Vent Piping: 1 percent down toward vertical fixture vent or toward vent stack.

N. Install cast-iron soil piping according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook," Chapter IV, "Installation of Cast Iron Soil Pipe and Fittings."
   1. Install encasement on underground piping according to ASTM A 674 or AWWA C105/A 21.5.

O. Install steel piping according to applicable plumbing code.

P. Install aboveground PVC piping according to ASTM D 2665.

Q. Install underground ABS and PVC piping according to ASTM D 2321.

R. Plumbing Specialties:
   1. Install cleanouts at grade and extend to where building sanitary drains connect to building sanitary sewers in sanitary drainage gravity-flow piping. Install cleanout fitting with closure plug inside the building in sanitary drainage force-main piping.
   2. Install drains in sanitary drainage gravity-flow piping.

S. Do not enclose, cover, or put piping into operation until it is inspected and approved by authorities having jurisdiction.

T. Install sleeves for piping penetrations of walls, ceilings, and floors.

U. Install escutcheons for piping penetrations of walls, ceilings, and floors where exposed to public view.

3.03 JOINT CONSTRUCTION

A. Join hub-and-spigot, cast-iron soil piping with gasket joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for compression joints.

B. Join hub-and-spigot, cast-iron soil piping with calked joints according to CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for lead-and-oakum calked joints.

C. Join hubless, cast-iron soil piping according to CISPI 310 and CISPI's "Cast Iron Soil Pipe and Fittings Handbook" for hubless-piping coupling joints.

D. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads unless dry seal threading is specified.

2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

E. Join stainless-steel pipe and fittings with gaskets according to ASME A112.3.1.

F. Grooved Joints: Cut groove ends of pipe according to AWWA C606. Lubricate and install gasket over ends of pipes or pipe and fitting. Install coupling housing sections, over gasket, with keys seated in piping grooves. Install and tighten housing bolts.

G. Flanged Joints: Align bolt holes. Select appropriate gasket material, size, type, and thickness. Install gasket concentrically positioned. Use suitable lubricants on bolt threads. Torque bolts in cross pattern.

H. Plastic, Nonpressure-Piping, Solvent-Cement Joints: Clean and dry joining surfaces. Join pipe and fittings according to the following:
1. Comply with ASTM F 402 for safe-handling practice of cleaners, primers, and solvent cements.
2. PVC Piping: Join according to ASTM D 2855 and ASTM D 2665 Appendixes.

3.04 SPECIALTY PIPE FITTING INSTALLATION

A. Transition Couplings:
1. Install transition couplings at joints of piping with small differences in OD's.
2. In Aboveground Force Main Piping: Fitting-type transition couplings.
3. In Underground Force Main Piping:
a. Piping 1-1/2” and Smaller: Fitting-type transition couplings.
b. Piping 2” and Larger: Pressure transition couplings.

3.05 CONNECTIONS

A. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Connect soil and waste piping to exterior sanitary sewerage piping. Use transition fitting to join dissimilar piping materials.

C. Connect drainage and vent piping to the following:
1. Plumbing Fixtures: Connect drainage piping in sizes indicated, but not smaller than required by plumbing code.
2. Plumbing Fixtures and Equipment: Connect atmospheric vent piping in sizes indicated, but not smaller than required by authorities having jurisdiction.
3. Plumbing Specialties: Connect drainage and vent piping in sizes indicated, but not smaller than required by plumbing code.
4. Install test tees (wall cleanouts) in conductors near floor and floor cleanouts with cover flush with floor.
5. Install horizontal backwater valves in pit with pit cover flush with floor.
6. Equipment: Connect drainage piping as indicated. Provide shutoff valve if indicated and union for each connection. Use flanges instead of unions for connections 2-1/2” and larger.

D. Where installing piping adjacent to equipment, allow space for service and maintenance of equipment.

E. Make connections according to the following unless otherwise indicated:
1. Install unions, in piping 2” and smaller, adjacent to each valve and at final connection to each piece of equipment.
2. Install flanges, in piping 2” and larger, adjacent to flanged valves and at final connection to each piece of equipment.

3.06 FIELD QUALITY CONTROL

A. During installation, notify authorities having jurisdiction at least 24 hours before inspection must be made. Perform tests specified below in presence of authorities having jurisdiction.
1. Roughing-in Inspection: Arrange for inspection of piping before concealing or closing-in after roughing-in and before setting fixtures.

2. Final Inspection: Arrange for final inspection by authorities having jurisdiction to observe tests specified below and to ensure compliance with requirements.

B. Reinspection: If authorities having jurisdiction find that piping will not pass test or inspection, make required corrections and arrange for reinspection.

C. Reports: Prepare inspection reports and have them signed by authorities having jurisdiction.

D. Test sanitary drainage and vent piping according to procedures of authorities having jurisdiction or, in absence of published procedures, as follows:
   1. Test for leaks and defects in new piping and parts of existing piping that have been altered, extended, or repaired. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.
   2. Leave uncovered and unconcealed new, altered, extended, or replaced drainage and vent piping until it has been tested and approved. Expose work that was covered or concealed before it was tested.
   3. Roughing-in Plumbing Test Procedure: Test drainage and vent piping except outside leaders on completion of roughing-in. Close openings in piping system and fill with water to point of overflow, but not less than 10-foot head of water. From 15 minutes before inspection starts to completion of inspection, water level must not drop. Inspect joints for leaks.
   4. Finished Plumbing Test Procedure: After plumbing fixtures have been set and traps filled with water, test connections and prove they are gastight and watertight. Plug vent-stack openings on roof and building drains where they leave building. Introduce air into piping system equal to pressure of 1-inch wg. Use U-tube or manometer inserted in trap of water closet to measure this pressure. Air pressure must remain constant without introducing additional air throughout period of inspection. Inspect plumbing fixture connections for gas and water leaks.
   5. Repair leaks and defects with new materials and retest piping, or portion thereof, until satisfactory results are obtained.
   6. Prepare reports for tests and required corrective action.

3.07 CLEANING AND PROTECTION

A. Clean interior of piping. Remove dirt and debris as work progresses.

B. Protect drains during remainder of construction period to avoid clogging with dirt and debris and to prevent damage from traffic and construction work.

C. Place plugs in ends of uncompleted piping at end of day and when work stops.

D. Exposed Vent Piping: Protect plumbing vents exposed to sunlight with two coats of water-based latex paint.

END OF SECTION

SECTION 221400

STORM WATER SYSTEMS

PART 1 - GENERAL

1.01 SCOPE

This section contains specifications for plumbing pipe and pipe fittings for this project. Included are the following topics:

PART 1 - GENERAL
- Scope
- Related Work
- Reference
- Reference Standards
- Shop Drawings
- Quality Assurance
- Delivery, Storage, and Handling
- Design Criteria
- Welder Qualifications

PART 2 - PRODUCTS
- Storm Water Piping

PART 3 - EXECUTION
- General
- Preparation
- Erection
- Copper Pipe Joints
- Welded Pipe Joints
- Threaded Pipe Joints
- Solvent Welded Pipe Joints
- Mechanical Hubless Pipe Connections
- Mechanical Joint Pipe Connections
- Push-On Gasketed Pipe Connections
- Mechanical Grooved Pipe Connections
- Mechanically Formed Tee Fittings
- Storm and Clearwater Waste and Vent
- Subsoil Drain
- Piping System Leak Tests
- Construction Verification Items

1.02 RELATED WORK

22 05 29 - Hangers and Supports for Plumbing Piping and Equipment

22 05 14 - Plumbing Specialties

1.03 REFERENCE

Applicable provisions of Division 1 govern work under this section.

1.04 REFERENCE STANDARDS

ASTM A74 Cast Iron Soil Pipe and Fittings
ASTM A105 Forgings, Carbon Steel, for Piping Components
ASTM A126 Gray Cast Iron Castings for Valves, Flanges, and Pipe Fittings
ASTM A888 Hubless Cast Iron Soil Pipe and Fittings
ASTM C564 Rubber Gaskets for Cast Iron Soil Pipe and Fittings
ASTM C1540 Heavy Duty Shielded Couplings for Joining Hubless Cast Iron Soil Pipe and Fittings
ASTM D1785 Poly Vinyl Chloride (PVC) Plastic Pipe
ASTM D2241 Poly Vinyl Chloride (PVC) Pressure-Rated Pipe (SDR Series)
ASTM D2464 Threaded Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 80
ASTM D2241 Poly Vinyl Chloride (PVC) Plastic Pipe Fittings, Schedule 40
ASTM D2564 Solvent Cements for Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings
ASTM D2665 Poly Vinyl Chloride (PVC) Plastic Drain, Waste and Vent Pipe and Fittings
ASTM D2729 Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM D2855 Making Solvent Cemented Joints with Poly Vinyl Chloride (PVC) Pipe and Fittings
ASTM D3034 Type PSM Poly Vinyl Chloride (PVC) Sewer Pipe and Fittings
ASTM D3139 Joints for Plastic Pressure Pipes Using Flexible Elastomeric Seals
ASTM D3212 Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals
ASTM D3311 Drain, Waste and Vent (DWV) Plastic Fitting Patterns
ASTM F437 Threaded Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Sch 80
ASTM F438 Socket Type Chlorinated Poly Vinyl Chloride (CPVC) Plastic Pipe Fittings, Sch 40
ASTM F441 Chlorinated Poly Vinyl Chloride (CPVC Plastic Pipe, Schedules 40 and 80
ASTM F656 Primers for Use in Solvent Cement Joints of Poly Vinyl Chloride (PVC) Plastic Pipe and Fittings

1.05 SHOP DRAWINGS

Schedule from the contractor indicating the ASTM, AWWA or CISPI specification number of the pipe being proposed along with its type and grade if known at the time of submittal, and sufficient information to indicate the type and rating of fittings for each service.

Statement from manufacturer on his letterhead that pipe furnished meets the ASTM, AWWA or CISPI specification contained in this section.

1.06 QUALITY ASSURANCE

Substitution of Materials: Refer to Section GC – General Conditions of the Contract, Equals and Substitutions.

Order all copper, cast iron, steel, PVC and polyethylene pipe with each length marked with the name or trademark of the manufacturer and type of pipe; with each shipping unit marked with the purchase order number, metal or alloy designation, temper, size, and name of supplier.

Any installed material not meeting the specification requirements must be replaced with material that meets these specifications without additional cost to the State.

1.07 DELIVERY, STORAGE, AND HANDLING

Promptly inspect shipments to insure that the material is undamaged and complies with specifications.

Cover pipe to prevent corrosion or deterioration while allowing sufficient ventilation to avoid condensation. Do not store materials directly on grade. Protect pipe, tube, and fitting ends so they are not damaged. Where end caps are provided or specified, take precautions so the caps remain in place. Protect fittings, flanges, and unions by storage inside or by durable, waterproof, above ground packaging.

Offsite storage agreements will not relieve the contractor from using proper storage techniques.

Storage and protection methods must allow inspection to verify products.

1.08 DESIGN CRITERIA

A. Use only new material, free of defects, rust and scale, and meeting the latest revision of ASTM OR AWWA specifications as listed in this specification.

PART 2 - PRODUCTS

STORM WATER PIPING

2.01 EXTERIOR ABOVE GROUND:

A. Manufacturers:
   1. North American Pipe Corp.
   2. Harvel Plastics Inc.
   3. Genova Products
   4. Cresline or approved equal.

B. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; fitting patterns, ASTM F656; solvent cement.

C. Joints: ASTM D 2665: ASTM D 3311: ASTM F 1866.

2.02 EXTERIOR BELOW GROUND 15" AND SMALLER:

A. Manufacturers:
   1. North American Pipe Corp.
   2. Harvel Plastics Inc.
   3. Genova Products
   4. Cresline or approved equal.

B. PVC plastic pipe, Schedule 40, ASTM D 2665.

C. Joints: ASTM D 3034.

D. PVC plastic pipe, Schedule 40, Class 12454-B (PVC 1120), ASTM D1785; PVC plastic drain, waste and vent pipe and fittings, ASTM D2665; fitting patterns, ASTM D3311; primer, ASTM F656; solvent cement, ASTM D2564.

E. Joints: All PVC pipe joints shall be gasketed, bell-and-spigot, push-on type conforming to ASTM D3212, "Standard Specification for Joints for Drain and Sewer Plastic Pipes Using Flexible Elastomeric Seals." Gaskets may be factory installed or field installed as recommended by the pipe manufacturer. Lubricant shall be as recommended by the pipe manufacturer.

PART 3 - EXECUTION

3.01 GENERAL

A. Install pipe and fittings in accordance with reference standards, manufacturer's recommendations and recognized industry practices.

3.02 PREPARATION

A. Cut pipe ends square. Ream ends of piping to remove burrs. Clean scale and dirt from interior and exterior of each section of pipe and fitting prior to assembly.

3.03 INSTALLATION

Install all piping parallel to building walls and ceilings and at heights which do not obstruct any portion of a window, doorway, stairway, or passageway. Where interferences develop in the field, offset or reroute piping as required to clear such interferences. Coordinate locations of plumbing piping with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. In all cases, consult drawings for location of pipe spaces, ceiling heights, door and window openings, or other architectural details before installing piping.

Provide a full size cleanout at the base of each Roof Conductor.

Install underground warning tape 6"-12" below finished grade above all exterior below ground piping. Where existing underground warning tape is encountered, repair and replace.

Maintain piping in clean condition internally during construction.

Provide anchors, expansion joints, swing joints and/or expansion loops so that piping may expand and contract without damage to itself, equipment, or building.

Do not route piping through or above transformer vaults or above transformers, panelboards, or switchboards, including the required service space for this equipment.

Note: Insulate roof drains, overflow drains and all horizontal portions of the storm water piping system.

3.04 PUSH-ON GASKETED PIPE CONNECTIONS

Clean pipe end, bell, gasket seat and gasket of dirt or debris. Coat end of pipe and gasket with gasket lubricant. Insure pipe is supported off the ground so lubricant does not pick up dirt. Push spigot end into gasket bell with levered pipe joining tool recommended by pipe manufacturer. Large diameter exterior mains may be joined by pushing end of pipe section with backhoe against wood blocking over pipe end. Insert to fully seated position or to reference mark on pipe.

3.05 STORM AND CLEARWATER - DEPTH

Verify invert elevations and building elevations prior to installation. Install exterior piping pitched to drain at indicated elevations and slope. Install interior piping pitched to drain at minimum slope of 1/8" per foot for piping 3" and larger.

Install exterior piping below predicted frost level and not less than 3' bury depth to top of pipe wherever possible.

3.06 PIPING SYSTEM LEAK TESTS

Do not insulate or conceal pipe until it has been successfully tested.

For hydrostatic tests, use clean water and remove all air from the piping being tested by means of air vents or loosening of flanges/unions. Measure and record test pressure at the high point in the system.

System will not be approved until it can be demonstrated that there is no measurable loss of test pressure during the test period.

Inspect system for leaks. Where leaks occur, repair the area with new materials and repeat the test; caulking will not be acceptable.

Entire test must be witnessed by the Owner’s representative and the Project Engineer.

System	Test Medium	Initial Test Pressure	Duration	Final Test Pressure	Duration
Clearwater Waste and Vent	Water	N/A	2 hr	10' Water	2 hr
Storm and Clearwater Vent	Water	N/A	2 hr	10' Water	2 hr
Pressurized Storm/Clearwater	Water/ Waste	Water	2 hr	100 psig	2 hr

END OF SECTION

SECTION 221513
COMPRESSED AIR PIPING SYSTEMS

PART 1 GENERAL

1.01 SUMMARY

A. This Section includes piping and related specialties for general-service compressed-air systems operating at 125 psig.

1.02 DEFINITIONS

A. CR: Chlorosulfonated polyethylene synthetic rubber.

B. EPDM: Ethylene-propylene-diene terpolymer rubber.

C. HDPE: High-density polyethylene plastic.

D. NBR: Acrylonitrile-butadiene rubber.

E. Low-Pressure Compressed-Air Piping: System of compressed-air piping and specialties operating at pressures of 150 psig or less.

1.03 ACTION SUBMITTALS

A. Product Data: For the following:
   1. Dielectric fittings.
   2. Flexible pipe connectors.
   3. Safety valves.
   4. Pressure regulators. Include rated capacities and operating characteristics.
   5. Automatic drain valves.
   6. Filters. Include rated capacities and operating characteristics.
   7. Lubricators. Include rated capacities and operating characteristics.
   8. Quick couplings.
   9. Hose assemblies.

1.04 INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installers.

B. Field quality-control test reports.

1.05 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For general-service compressed-air piping specialties to include in emergency, operation, and maintenance manuals.

1.06 QUALITY ASSURANCE

A. ASME Compliance:
   1. Comply with ASME B31.9, "Building Services Piping," for low-pressure compressed-air piping.

PART 2 PRODUCTS

2.01 PIPES, TUBES, AND FITTINGS

A. Schedule 40, Steel Pipe: ASTM A 53/A 53M, Type E or S, Grade B, black or hot-dip zinc coated with ends threaded according to ASME B1.20.1.
   1. Steel Nipples: ASTM A 733, made of ASTM A 53/A 53M or ASTM A 106, Schedule 40, galvanized seamless steel pipe. Include ends matching joining method.
   2. Malleable-Iron Fittings: ASME B16.3, Class 150 or 300, threaded.
   3. Malleable-Iron Unions: ASME B16.39, Class 150 or 300, threaded.
   4. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel, threaded.
   5. Wrought-Steel Butt-Welding Fittings: ASME B16.9, Schedule 40.
   6. Steel Flanges: ASME B16.5, Class 150 or 300, carbon steel.

B. Copper Tube: ASTM B 88, Type M seamless, drawn-temper, water tube.

1. Wrought-Copper Fittings: ASME B16.22, solder-joints.
2. Copper Unions: ASME B16.22 or MSS SP-123.

2.02 JOINING MATERIALS

A. Pipe-Flange Gasket Materials: Suitable for compressed-air piping system contents.
   1. ASME B16.21, nonmetallic, flat, asbestos free, 1/8-inch maximum thickness unless thickness or specific material is indicated.
      a. Full-Face Type: For flat-face, Class 125, cast-iron and cast-bronze flanges.
      b. Narrow-Face Type: For raised-face, Class 250, cast-iron and steel flanges.

B. Flange Bolts and Nuts: ASME B18.2.1, carbon steel, unless otherwise indicated.

C. Solder Filler Metals: ASTM B 32, lead-free alloys. Include water-flushable flux according to ASTM B 813.

2.03 VALVES

A. Metal Ball and Check Valves: Comply with requirements in Section 220523 "General-Duty Valves for Plumbing Piping."

2.04 DIELECTRIC FITTINGS

A. General Requirements: Assembly of copper alloy and ferrous materials with separating nonconductive insulating material. Include end connections compatible with pipes to be joined.

B. Dielectric Unions:
   1. Manufacturers: Watts, Wilkins, Capital Manufacturing.
   2. Description:
      a. Standard: ASSE 1079.
      b. Pressure Rating: 125 psig minimum at 180 deg F.
      c. End Connections: Solder-joint copper alloy and threaded ferrous.

C. Dielectric Flanges:
   1. Manufacturers: Watts, Wilkins, Capital Manufacturing
   2. Description:
      a. Standard: ASSE 1079.
      b. Factory-fabricated, bolted, companion-flange assembly.
      c. Pressure Rating: 125 psig minimum at 180 deg F.
      d. End Connections: Solder-joint copper alloy and threaded ferrous; threaded solder-joint copper alloy and threaded ferrous.

2.05 FLEXIBLE PIPE CONNECTORS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Flex-Hose, Flexicraft, Metraflex.

C. Stainless-Steel-Hose Flexible Pipe Connectors: Corrugated-stainless-steel tubing with stainless-steel wire-braid covering and ends welded to inner tubing. Install flexible pipe connectors at air compressor.
   1. Working-Pressure Rating: 200 psig minimum.
   2. End Connections, NPS 2 and Smaller: Threaded steel pipe nipple.
   3. End Connections, NPS 2-1/2 and Larger: Flanged steel nipple.

2.06 SPECIALTIES

A. Safety Valves: ASME Boiler and Pressure Vessel Code: Section VIII, "Pressure Vessels," construction; National Board certified, labeled, and factory sealed; constructed of bronze body with poppet-type safety valve for compressed-air service.
   1. Pressure Settings: Higher than discharge pressure and same or lower than receiver pressure rating.

B. Air-Main Pressure Regulators: Bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 250-psig inlet pressure, unless otherwise indicated.
   1. Type: Pilot operated.

C. Air-Line Pressure Regulators: Diaphragm or pilot operated, bronze body, direct acting, spring-loaded manual pressure-setting adjustment, and rated for 200-psig minimum inlet pressure, unless otherwise indicated.

D. Automatic Drain Valves: Stainless-steel body and internal parts, rated for 200-psig minimum working pressure, capable of automatic discharge of collected condensate. Include mounting bracket if wall mounting is indicated.

E. Coalescing Filters: Coalescing type with activated carbon capable of removing water and oil aerosols; with color-change dye to indicate when carbon is saturated and warning light to indicate when selected maximum pressure drop has been exceeded. Include mounting bracket if wall mounting is indicated.

F. Mechanical Filters: Two-stage, mechanical-separation-type, air-line filters. Equip with deflector plates, resin-impregnated-ribbon-type filters with edge filtration, and drain cock. Include mounting bracket if wall mounting is indicated.

G. Air-Line Lubricators: With drip chamber and sight dome for observing oil drop entering air stream; with oil-feed adjustment screw and quick-release collar for easy bowl removal. Include mounting bracket if wall mounting is indicated.
   1. Provide with automatic feed device for supplying oil to lubricator.

2.07 QUICK COUPLINGS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. General Requirements for Quick Couplings: Assembly with locking-mechanism feature for quick connection and disconnection of compressed-air hose.

C. Automatic-Shutoff Quick Couplings: Straight-through brass body with O-ring or gasket seal and stainless-steel or nickel-plated-steel operating parts.
   1. Socket End: With one-way valve and threaded inlet for connection to piping or threaded hose fitting.
   2. Plug End: Flow-sensor-bleeder, check-valve type with barbed outlet for attaching hose.

D. Valve-less Quick Couplings: Straight-through brass body with stainless-steel or nickel-plated-steel operating parts.
   1. Socket End: With O-ring or gasket seal, without valve, and with barbed inlet for attaching hose.
   2. Plug End: With barbed outlet for attaching hose.

2.08 HOSE ASSEMBLIES

A. Description: Compatible hose, clamps, couplings, and splicers suitable for compressed-air service, of nominal diameter indicated, and rated for 300-psig minimum working pressure, unless otherwise indicated.
   1. Hose: Reinforced single-wire-braid, CR-covered hose for compressed-air service.
   2. Hose Clamps: Stainless-steel clamps or bands.
   3. Hose Couplings: Two-piece, straight-through, threaded brass or stainless-steel O-ring or gasket-seal swivel coupling with barbed ends for connecting two sections of hose.
   4. Hose Splicers: One-piece, straight-through brass or stainless-steel fitting with barbed ends for connecting two sections of hose.

PART 3 EXECUTION

3.01 PIPING APPLICATIONS

A. Compressed-Air Piping between Air Compressors and Receivers: Use the following piping materials for each size range:

1. Piping 2” and Smaller: Schedule 40, galvanized-steel pipe; threaded, malleable-iron fittings; and threaded joints.

B. Drain Piping: Use the following piping materials:
   1. Type M copper tube; wrought-copper fittings; and soldered joints.

3.02 VALVE APPLICATIONS

A. General-Duty Valves: Comply with requirements in Section 220523 "General-Duty Valves for Plumbing Piping" for metal general-duty valves. Use metal valves, unless otherwise indicated.

B. Metal General-Duty Valves: Use valve types specified in "Valve Applications" Article in Section 220523 "General-Duty Valves for Plumbing Piping" according to the following:
   1. Low-Pressure Compressed Air: Valve types specified for low-pressure compressed air.
   2. Equipment Isolation NPS 2 and Smaller: Safety-exhaust, copper-alloy ball valve with exhaust vent and pressure rating at least as great as piping system operating pressure.

3.03 PIPING INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of compressed-air piping. Indicated locations and arrangements were used to size pipe and calculate friction loss, expansion, air-compressor sizing, and other design considerations. Install piping as indicated unless deviations to layout are approved on Coordination Drawings.

B. Install piping concealed from view and protected from physical contact by building occupants, unless otherwise indicated and except in equipment rooms and service areas.

C. Install piping indicated to be exposed and piping in equipment rooms and service areas at right angles or parallel to building walls. Diagonal runs are prohibited, unless otherwise indicated.

D. Install piping above accessible ceilings to allow sufficient space for ceiling panel removal and to coordinate with other services occupying that space.

E. Install piping adjacent to equipment and machines to allow service and maintenance.

F. Install air and drain piping with 1 percent slope downward in direction of flow.

G. Install nipples, flanges, unions, transition and special fittings, and valves with pressure ratings same as or higher than system pressure rating, unless otherwise indicated.

H. Equipment and Specialty Flanged Connections:
   1. Use steel companion flange with gasket for connection to steel pipe.
   2. Use cast-copper-alloy companion flange with gasket and brazed or soldered joint for connection to copper tube. Do not use soldered joints for connection to air compressors or to equipment or machines producing shock or vibration.

I. Flanged joints may be used instead of specified joint for any piping or tubing system.

J. Install eccentric reducers where compressed-air piping is reduced in direction of flow, with bottoms of both pipes and reducer fitting flush.

K. Install branch connections to compressed-air mains from top of main. Provide drain leg and drain trap at end of each main and branch and at low points.

L. Install thermometer and pressure gage on discharge piping from each air compressor and on each receiver. Comply with requirements in Section 220519 "Meters and Gages for Plumbing Piping."

M. Install piping to permit valve servicing.

N. Install piping free of sags and bends.

O. Install fittings for changes in direction and branch connections.

P. Install sleeves for piping penetrations of walls, ceilings, and floors. Comply with requirements for sleeves specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

Q. Install sleeve seals for piping penetrations of concrete walls and slabs. Comply with requirements for sleeve seals specified in Section 220517 "Sleeves and Sleeve Seals for Plumbing Piping."

R. Install escutcheons for piping penetrations of walls, ceilings, and floors. Comply with requirements for escutcheons specified in Section 220518 "Escutcheons for Plumbing Piping."

S. Install air compressors on a 4” high concrete base.

T. Install drip connections with drain valves at low points of the piping system.

3.04 JOINT CONSTRUCTION

A. Ream ends of pipes and tubes and remove burrs. Bevel plain ends of steel pipe.

B. Remove scale, slag, dirt, and debris from inside and outside of pipe and fittings before assembly.

C. Threaded Joints: Thread pipe with tapered pipe threads according to ASME B1.20.1. Cut threads full and clean using sharp dies. Ream threaded pipe ends to remove burrs and restore full ID. Join pipe fittings and valves as follows:
   1. Apply appropriate tape or thread compound to external pipe threads.
   2. Damaged Threads: Do not use pipe or pipe fittings with threads that are corroded or damaged. Do not use pipe sections that have cracked or open welds.

D. Soldered Joints: Apply ASTM B 813, water-flushable flux, unless otherwise indicated, to tube end. Join according to ASTM B 828 or CDA's "Copper Tube Handbook."

E. Flanged Joints: Use asbestos-free, nonmetallic gasket suitable for compressed air. Join flanges with gasket and bolts according to ASME B31.9 for bolting procedure.

F. Dissimilar Metal Piping Material Joints: Use dielectric fittings.

3.05 VALVE INSTALLATION

A. General-Duty Valves: Comply with requirements in Section 220523 "General-Duty Valves for Plumbing Piping."

B. Install shutoff valves and unions or flanged joints at compressed-air piping to air compressors.

C. Install shutoff valve at inlet to each automatic drain valve, filter, lubricator, and pressure regulator.

D. Install check valves to maintain correct direction of compressed-air flow to and from compressed-air piping specialties and equipment.

3.06 DIELECTRIC FITTING INSTALLATION

A. Install dielectric fittings in piping at connections of dissimilar metal piping and tubing.

B. Piping 2” and Smaller: Use dielectric unions.

3.07 FLEXIBLE PIPE CONNECTOR INSTALLATION

A. Install flexible pipe connectors in discharge piping and in inlet air piping from remote air-inlet filter of each air compressor.

B. Install stainless-steel-hose flexible pipe connectors in steel compressed-air piping.

3.08 SPECIALTY INSTALLATION

A. Install safety valves on receivers in quantity and size to relieve at least the capacity of connected air compressors.

B. Install air-main pressure regulators in compressed-air piping at or near air compressors.

C. Install air-line pressure regulators in branch piping to equipment and tools.

D. Install automatic drain valves on aftercoolers, receivers, and dryers. Discharge condensate onto nearest floor drain.

E. Install coalescing filters in compressed-air piping at or near air compressors and upstream from mechanical filters. Mount on wall at locations indicated.

F. Install mechanical filters in compressed-air piping at or near air compressors and downstream from coalescing filters. Mount on wall at locations indicated.

G. Install air-line lubricators in branch piping to machine tools. Mount on wall at locations indicated.

H. Install quick couplings at piping terminals for hose connections.

I. Install hose assemblies at hose connections.

3.09 CONNECTIONS

A. Install unions, in piping 2” and smaller, adjacent to each valve and at final connection to each piece of equipment and machine.

B. Install flanges, in piping 2-1/2” and larger, adjacent to flanged valves and at final connection to each piece of equipment and machine.

3.10 HANGER AND SUPPORT INSTALLATION

A. Comply with requirements in Section 220548 "Vibration and Seismic Controls for Plumbing Piping and Equipment" for seismic-restraint devices.

B. Comply with requirements in Section 220529 "Hangers and Supports for Plumbing Piping and Equipment" for pipe hanger and support devices.

C. Vertical Piping: MSS Type 8 or 42, clamps.

D. Individual, Straight, Horizontal Piping Runs:
   1. 100 Feet or Less: MSS Type 1, adjustable, steel clevis hangers.
   2. Longer Than 100 Feet: MSS Type 43, adjustable roller hangers.

E. Multiple, Straight, Horizontal Piping Runs 100 Feet or Longer: MSS Type 44, pipe rolls. Support pipe rolls on trapeze.

F. Base of Vertical Piping: MSS Type 52, spring hangers.

G. Support horizontal piping within 12 inches of each fitting and coupling.

H. Rod diameter may be reduced 1 size for double-rod hangers, with 3/8-inch minimum rods.

I. Install hangers for Schedule 40, steel piping with the following maximum horizontal spacing and minimum rod diameters:
   1. NPS 1/4 to NPS 1/2: 96 inches with 3/8-inch rod.
   2. NPS 3/4 to NPS 1-1/4: 84 inches with 3/8-inch rod.
   3. NPS 1-1/2: 12 feet with 3/8-inch rod.
   4. NPS 2: 13 feet with 3/8-inch rod.
   5. NPS 2-1/2: 14 feet with 1/2-inch rod.
   6. NPS 3: 15 feet with 1/2-inch rod.
   7. NPS 3-1/2: 16 feet with 1/2-inch rod.
   8. NPS 4: 17 feet with 5/8-inch rod.

J. Install supports for vertical, Schedule 40, steel piping every 10 feet.

3.11 LABELING AND IDENTIFICATION

A. Install identifying labels and devices for general-service compressed-air piping, valves, and specialties. Comply with requirements in Section 220553 "Identification for Plumbing Piping and Equipment."

3.12 FIELD QUALITY CONTROL

A. Perform field tests and inspections.

B. Tests and Inspections:
   1. Piping Leak Tests for Metal Compressed-Air Piping: Test new and modified parts of existing piping. Cap and fill general-service compressed-air piping with oil-free dry air or gaseous nitrogen to pressure of 50 psig above system operating pressure, but not less

than 150 psig. Isolate test source and let stand for four hours to equalize temperature. Refill system, if required, to test pressure; hold for two hours with no drop in pressure.

2. Repair leaks and retest until no leaks exist.
3. Inspect filters, lubricators and pressure regulators for proper operation.

C. Prepare test reports.

END OF SECTION

SECTION 222000
NATURAL GAS SYSTEMS

PART 1 GENERAL

1.01 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to, Division 01, General Requirements.

1.02 JOB CONDITIONS

A. Coordinate the exact location of this work with the work of other trades before fabrication and installation. Verify all dimensions and elevations. Provide additional offsets and section of piping as may be required to meet the applicable job conditions. Coordinate with and review all related drawings of all trades before starting work.

Contractor shall coordinate gas meter setting with local gas service provider. Verify gas piping service route and available gas pressure.

1.03 SUBMITTALS

A. Shop Drawings: Piping, Fittings and Regulators

B. Product Data: Manufacturer's cut sheets and/or literature.

1.04 QUALITY ASSURANCE

A. Steel Support Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Pipe Welding Qualifications: Qualify procedures and operators according to ASME Boiler and Pressure Vessel Code.

C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

D. Installer Qualifications: Company specializing in performing the Work of this Section with minimum three (3) years documented experience.

E. Conformance to National Fuel Gas Code.

F. Material and installation requirements shall follow NFPA 54, state and local gas company codes.

G. Conformance to ANSI B31.

H. Gas regulators shall be AGA rated.

PART 2 PRODUCTS

2.01 PIPING - ASTM A 53/A 53M, BLACK STEEL, SCHEDULE 40

A. Below-ground pipe 5 feet from the building to above-ground at the building shall be Schedule 40 welded-joint steel pipe with factory-applied protective coating, such as X-Trucote. Joints shall be field-coated with the same material applied as recommended by the manufacturer. If underground gas distribution pipe is steel, provide a dielectric union at point of connection. Install a 17-pound anode pack between the building and 5 feet outside the building next to the connection to the main service pipe. Attach the anode lead wire to the piping by means of an exothermic weld, following the instructions of the manufacturer.

B. Above-Ground Gas Piping: Standard weight, Schedule 40, welded or screwed, black carbon steel pipe, ANSI/ASTM A53.
   1. 1-1/2 inches and smaller: 150 lb. screwed malleable black iron fittings.
   2. 1-1/2 inches and smaller in concealed spaces: Schedule 40 black steel with socket welded fittings.
   3. 2 inches to 2-1/2 inches: 150 lb. screwed malleable black iron fittings.
   4. 3 inches: Welded or forged steel butt welded, pipe and fitting.

a. OR

5. PRESS-CONNECT FITTINGS
6. Approved Manufacturers: Viega MegaPressG
7. References: ANSI LC4/CSA 6.32 – Metallic Press-Connect Fittings for Fuel Gas Distribution Systems.
8. Building: Two pressure ranges. Primary pressure is more than 0.5 psig, but not more than 2.0 psig.
9. Piping Size limited to 3/4” to 2-1/2"

C. All concealed piping shall be welded.

D. All gas piping exposed to outside weather environment shall be protected from corrosion by application of a non-metallic-based painting system specifically designed and manufactured for protection of steel piping.
   1. Apply two finish coats of Rust-O-Leum, Krylon, or De Rusto heavy duty paint. Allow proper drying time between coats. Color as selected by Owner. The union of the underground coating and above-ground paint shall be at least 2 inches above finished grade.

E. Gas piping within the building shall be electrically continuous and bonded to a grounding electrode.

2.02 VALVES, REGULATORS AND ACCESSORIES

A. Gas cocks shall be lubricated plug.

B. Valves: Shut-off Valves sizes 2 inches and smaller shall be iron body lubricated plug valve conforming to ASTM-A-126, U.L. Listed and A.G.A. Approved for natural gas service with threaded ends, wrench operation, rated for 200 WOG service pressure and –20 to 200 degrees F.

C. Valves: Shut-off Valves sizes 2½ inches and larger shall be iron body lubricated plug valve conforming to ASTM-A-126, U.L. Listed and A.G.A. Approved for natural gas service with flanged ends, wrench operation, rated for 200 WOG service pressure and –20 to 200 degrees F.

D. Valves at local connections sizes 2 inches and smaller shall be bronze body, full port ball or butterfly type, U.L. Listed and A.G.A. Approved for natural gas service with threaded ends, quarter turn lever handle operation, rated for 175 W.O.G. service pressure and 30 to 275 degrees F

E. Gas Pressure Regulators: Shall be as manufactured by Pietro-Fiorentini, Senus or Fisher. Regulators shall have cast iron body, die-cast aluminum alloy diaphragm case and aluminum or brass orifices. Line pressure is typically 2.0 psig with regulator spring adjustable and selected for an outlet pressure of 7-inch to 14-inch W.C.

   1. Regulators to be similar to Pietro-Fiorentini - Model # PF400 with vent limiter feature to eliminate external vent piping system.

F. When required by regulator manufacturer, properly vent gas pressure regulators to the outdoor atmosphere with screened vent caps.

G. Provide nickel-plated steel plates on exposed pipes passing through walls, ceilings, floors, and partitions.

H. Regulators shall be installed with a line-size plug valve, a pressure gauge on inlet side of regulator and a pressure gauge on the outlet side at least ten pipe diameters from the regulator.

PART 3 EXECUTION

3.01 INSTALLATION

A. Gas piping system installation shall conform to the Standard for the Installation of Gas Appliances and Gas Piping USA Z21.30, ANSI Z106.1, NFPA No. 54 and No. 58, the rules of

local and state regulatory agencies governing the installation of gas piping, the Gas Utility Energy Code for indirect gas service, and local gas utility company.

B. Locations and Arrangements: Drawings (plans, schematics, and diagrams) indicate the general location and arrangement of piping systems. Design locations and arrangements of piping take into consideration pipe sizing, flow direction, slope of pipe, expansion, and other design considerations. So far as practical, install piping as indicated.

C. Concealed Locations: Except as specified below, install gas piping (in masonry walls) in an airtight conduit constructed of Schedule 40 seamless black steel with welded joints. Vent conduit to the outside and terminate with a screened vent cap.
   1. Above-Ceiling Locations: Gas piping may be installed in accessible above-ceiling spaces (subject to the approval of the authority having jurisdiction), whether or not such spaces are used as a plenum. Valves shall not be located in such spaces. Piping in plenums shall be welded.
   2. In Floors: Piping installed in floors shall have protective wrapping specified in PART 2 above. Piping cast in concrete slabs shall be surrounded with a minimum of 1-1/2 inches of concrete and shall not be in physical contact with other metallic structures such as reinforcing rods or electrically neutral conductors. Piping shall not be embedded in concrete slabs containing quick-set additives or cinder aggregate. Piping shall be welded.
   3. Piping in Partitions: Concealed piping shall not be located in solid partitions.
   4. Prohibited Locations: Do not install gas piping in or through a circulating air duct, clothes chute, chimney or gas vent, ventilating duct, dumbwaiter or elevator shaft. This does not apply to accessible above-ceiling space specified above.

D. Sleeves
   1. Set sleeves during construction of walls, floors and foundations.
   2. If a hole is required after the structure is cast, its location and size shall be approved by the A/E. Core-drill the hole. Maintain the fire integrity of the structure.
   3. Where pipes pass through building construction, use proper length and gauge pipe sleeves of galvanized steel. Anchor sleeves to building construction. Size anchors to permit passage of insulation where insulation is required. Maintain the fire integrity of walls, floors, ceilings, and partitions.
   4. Where pipes pass through foundation walls and footings, provide cast iron sleeve and caulk the space between sleeve and pipe with lead wool, watertight.
   5. Install sleeves in floors perfectly plumb and in walls level. Center the pipe in the sleeve. Pack sleeves with fire-rated materials, per shop-drawing-approved submittals, and caulk in tight.
   6. Extend floor sleeves only 3/8 inch to 1/2 inch above finished floors. Neatly level tops of sleeves.
   7. Finish wall and partition sleeves flush with wall lines.

E. Seal pipe penetrations of fire barriers using fire barrier penetration sealers specified in Division 07 Section “Joint Sealants”.

F. Drips and Sediment Traps
   1. Install a drip leg at points where condensate may collect, at the outlet of the gas meter, and in a location readily accessible to permit cleaning and emptying. Do not install drips where condensate is likely to freeze.
   2. Construct drips and sediment traps using a tee fitting with the bottom outlet plugged or capped. Use a minimum of 3 pipe diameters in length for the drip leg. Use same size pipe for drip leg as the connected pipe.
   3. Drip legs at equipment connections shall be down stream of valve.

G. Use fittings for all changes in direction and all branch connections.

H. Install exposed piping at right angles or parallel to building walls. Diagonal runs are not permitted, unless expressly indicated.

I. Install piping free of sags or bends and with ample space between piping to permit proper insulation applications.

J. Piping in walls shall be free of any joints or fittings. The concealed pipe space must be ventilated with either an open wall top, or a wall louver/grille installed.

K. Install piping tight to slabs, beams, joists, columns, walls, and other permanent elements of the building. Provide space to permit insulation applications, with 1-inch clearance outside the insulation. Allow sufficient space above removable ceiling panels to allow for panel removal.

L. Locate groups of pipes parallel to each other, spaced to permit applying insulation and servicing of valves.

M. Install gas piping at a uniform grade of 1/4 inch in 15 feet, upward to risers, and from the risers to the meter, or service regulator when meter is not provided, or the equipment.

N. Make reductions in pipe sizes using eccentric reducer fittings installed with the level side down.

O. Connect branch outlet pipes from the top or sides of horizontal lines, not from the bottom.

P. Conform to the table below for maximum spacing of supports:

Steel Pipe Size (NPS)	Spacing in Feet	Min Rod Size Inches
1/2	6	3/8
3/4 to 1-1/4	6	3/8
1-1/2 to 3 (horizontal)	12	1/2
3-1/2 to 5 all sizes (vertical)	Every floor level	

Q. Install unions in threaded pipes, adjacent to each valve, at final connections to each piece of equipment, and elsewhere as indicated. Unions are not required on flanged devices.

R. Install dielectric unions where piping of dissimilar metals are joined.

S. Install flanges in welded piping, on valves, apparatus, and final connections to each piece of equipment.

T. Install strainers on the supply side of each control valve, pressure reducing valve, pressure regulating valve, solenoid valve, and elsewhere as indicated.

U. When gas supplies and regulators are indicated to serve a gas-fired water heater a separate regulator (line-size) is required for each water heater supply line.

3.02 PIPE JOINT CONSTRUCTION

A. Welded Joints: Comply with the requirements in ASME Boiler and Pressure Vessel Code, Section IX.

B. Threaded Joints: Conform to ANSI B1.20.1, tapered pipe threads for field-cut threads. Join pipe, fittings, and valves as follows:
   1. Note the internal length of threads in fittings or valve ends, and proximity of internal seat or wall, to determine how far pipe should be threaded into joint. Refer to NFPA 54, for guide for number and length of threads for field threading steel pipe.
   2. Align threads at point of assembly.
   3. Apply appropriate tape to thread compound to the external pipe threads.
   4. Assemble joint to appropriate thread depth. When using a wrench on valves place the wrench on the valve end into which the pipe is being threaded.
   5. Damaged Threads: Do not use pipe with threads which are corroded or damaged. If a weld opens during cutting or threading operations, that portion of pipe shall not be used.

C. Flanged Joints: Align flanges surfaces parallel. Assemble joints by sequencing bolt tightening to make initial contact of flanges and gaskets as flat and parallel as possible. Use suitable lubricants on bolt threads. Tighten bolts gradually and uniformly to appropriate torque specified by the bolt manufacturer.

D. Flexible Hose Connections: Provide as a mean for final connection of gas piping to gas-fired, movable Kitchen equipment. Provide flexible gas hose, moveable grade, braider, PVC coated, with 304 stainless steel connectors. NSF/ANSI 169 and ANSI Z21.69.CA 6.16

E. Manufacturers: Dormont (Blue-Hose).

3.03 VALVE APPLICATIONS

A. General: The drawings indicate valve types, locations, and arrangements.

B. Shut-off Duty: Use gas cocks specified in PART 2 above.

3.04 VALVE INSTALLATIONS

A. Install valves in accessible locations, protected from physical damage. Tag valves with a metal tag attached with a metal chain indicating the piping systems supplied.

B. Install a gas cock upstream of each gas pressure regulator. Where two gas pressure regulators are installed in series in a single gas line, a manual valve is not required at the second regulator.

C. Install pressure relief or pressure limiting devices so they can be readily operated to determine if the valve is free; so they can be tested to determine the pressure at which they will operate; and examined for leakage when in the closed position.

3.05 TERMINAL EQUIPMENT CONNECTIONS

A. Install gas cock upstream and within 6 feet of gas appliance. Install a union or flanged connection downstream from the gas cock to permit removal of controls.

B. Sediment Traps: Install a tee fitting with the bottom outlet plugged or capped as close to the inlet of the gas appliance as practical. Drip leg shall be a minimum of 3 pipe diameters in length. Sediment shall be downstream of shut-off valve.

3.06 ELECTRICAL BONDING AND GROUNDING

A. Install above-ground portions of gas piping systems, upstream from equipment shut-off valves electrically continuous and bonded to a grounding electrode in accordance with NFPA 70 - "National Electrical Code."

B. Conform to NFPA 70, National Electrical Code, for electrical connections between wiring and electrically-operated control devices.

3.07 FIELD QUALITY CONTROL

A. Piping Tests: Inspect, test, and purge natural gas systems in accordance with NFPA 54 and local utility requirements.

END OF SECTION

SECTION 223000
PLUMBING EQUIPMENT

PART 1 - GENERAL 1.01 SCOPE

A. This section includes specifications for:
   1. PART 1 – GENERAL
      a. Scope
      b. Related Documents
      c. Reference
      d. Quality Assurance
      e. Shop Drawings
      f. Operation and Maintenance Data
   2. PART 2 – PRODUCTS
      a. Water Heaters – Gas Fired
      b. Water Softeners
      c. Expansion Tanks
      d. Thermostatic Mixing Valves
   3. PART 3 - EXECUTION
      a. Installation
      b. Construction Verification Items
      c. Functional Performance Testing

1.02 TRAINING 1.03 RELATED DOCUMENTS

A. Section 01 91 01 or 01 91 02 – Commissioning Process

B. Section 22 08 00 – Commissioning of Plumbing

C. Section 22 05 23 - General-Duty Valves for Plumbing Piping

D. Section 22 05 15 - Piping Specialties

E. Section 22 07 00 - Plumbing Insulation

F. Division 26 00 00 - Electrical

1.04 REFERENCE

A. Applicable provisions of Division 1 shall govern work under this section.

B. Plumbing products requiring approval by the State of Indiana must be approved or have pending approval at the time of shop drawing submission.

1.05 SHOP DRAWINGS

A. Include data concerning dimensions, capacities, materials of construction, ratings, certifications, weights, pump curves with net positive suction head requirements, manufacturer's installation requirements, manufacturer's performance limitations, and appropriate identification.

1.06 OPERATION AND MAINTENANCE DATA

A. All operations and maintenance data shall comply with the submission and content requirements specified under section GENERAL REQUIREMENTS.

B. NOTE: All plumbing products and devices must meet the Federal Public Law 111-380, The Reduction of Lead in Drinking Water Act, effective January 04, 2014.

PART 2 - PRODUCTS 2.01 HIGH EFFICIENCY COMMERCIAL GAS FIRED WATER HEATER

A. Manufacturers: A.O. Smith, Lochinvar, Bradford White

B. The water heater shall be capable of full modulation firing down to 20% of rated input with a turn down ratio of 5:1.

C. Natural gas water heater shall be A. O. Smith Cyclone Mxi model or equal, minimum 96% thermal efficiency, a storage capacity of 100 gallons, an input rating of BTUs per hour, a recovery rating of 178 gallons per hour (gph) at 100°F rise.

D. Water heater shall have:
   1. Modulating gas burner that automatically adjusts the input based on demand.
   2. Powered anodes that are non sacrificial and maintenance free.
   3. Have seamless glass-lined steel tank construction, with glass lining applied to all waterside surfaces after the tank has been assembled and welded;
   4. Meets the thermal efficiency and/or standby loss requirements of the U. S. Department of Energy and current edition of ASHRAE/IES 90.1;
   5. Have foam insulation and a CSA Certified and ASME rated T&P relief valve;
   6. Have a down-fired power burner designed for precise mixing of air and gas for optimum efficiency, requiring no special calibration on start-up;
   7. Be approved for 0″ clearance to combustibles.

E. The control shall be an integrated solid-state temperature and ignition control device with integral diagnostics, graphic user interface, fault history display, and shall have digital temperature readout. No charge connectivity shall be provided allowing for remote viewing and fault notification via app.
   1. All models are design certified by Underwriters Laboratories (UL), Inc., according to ANSI Z21.10.3 - CSA 4.3 standards governing storage type water heaters;
   2. Meet the thermal efficiency and standby loss requirements of the U. S. Department of Energy and current edition ASHRAE/IES 90.1. Complies with SCAQMD Rule 1146.2 and other air quality management districts with similar requirements for low NOx emissions.

F. Operation of the water heater(s) in a closed system where thermal expansion has not been compensated for (with a properly sized thermal expansion tank) will void the warranty.

G. The Water Heater shall bear the ASME "HLW" stamp and shall be National Board listed for inputs in excess of 200,000 Btu/Hr. There shall be no banding material, bolts, gaskets or "O" rings in the header configuration. The stainless steel combustion chamber shall be designed to drain condensation to the bottom of the heat exchanger assembly. A built-in trap shall allow condensation to drain from the heat exchanger assembly. The complete heat exchanger assembly shall carry a five (5) year limited warranty.

H. The water heater shall be constructed with a heavy gauge steel jacket assembly, primed and pre-painted on both sides. The combustion chamber shall be sealed and completely enclosed, independent of the outer jacket assembly, so that integrity of the outer jacket does not affect a proper seal. A burner/flame observation port shall be provided. The burner shall be a premix design and constructed of high temperature stainless steel with a woven metal fiber outer covering to provide modulating firing rates. The water heater shall be supplied with a gas valve designed with negative pressure regulation and be equipped with a variable speed blower system, to precisely control the fuel/air mixture to provide modulating water heater firing rates for maximum efficiency. The water heater shall operate in a safe condition at a de-rated output with gas supply pressures as low as 4 inches of water column.

I. The water heater shall utilize a 24 VAC control circuit and components. The control system shall have an electronic display for water heater set-up, water heater status, and water heater diagnostics. All components shall be easily accessed and serviceable from the front and top of the jacket. The water heater shall be equipped with; a high limit temperature control certified to UL353, ASME certified pressure relief valve, outlet water temperature sensor, inlet water temperature sensor, a UL 353 certified flue temperature sensor, low water flow protection and built-in freeze protection. The manufacturer shall verify proper operation of the burner, all controls and the heat exchanger by connection to water and venting for a factory fire test prior to shipping.

J. The water heater shall feature the “Smart System” control with a Multi-Colored Graphic LCD display with Navigation Dial and Soft Keys, password security, pump delay with freeze protection, pump exercise, and USB PC port connection. The water heater shall feature night setback for the domestic hot water tank and shall be capable of controlling a building recirculation pump while utilizing the night setback schedule for the building recirculation pump. The water heater shall have the capability to accept a 0-10 VDC input connection for BMS control of modulation or setpoint and enable/disable of the water heater, and a 0-10VDC output of water heater modulation rate. The water heater shall have a built-in cascading sequencer with modulation logic options of “lead lag” or “efficiency optimized”. Both modulation logic options should be capable of rotation while maintaining modulation of up to eight water heaters without utilization of an external controller. Supply voltage shall be 120 volt / 60 hertz / single phase.

K. The water heater shall be equipped with two terminal strips for electrical connection. A low voltage connection board with data points for safety and operating controls, i.e., Auxiliary Relay, Auxiliary Proving Switch, Alarm Contacts, Runtime Contacts, Manual Reset Low Water Cutoff, Flow Switch, High and Low Gas Pressure Switches, Tank Thermostat, Tank Sensor, Building Management System Signal, Modbus Control Contacts and Cascade Control Circuit. A high voltage terminal strip shall be provided for supply voltage. The high voltage terminal strip plus integral relays are provided for independent control of the Domestic Hot Water Pump and Building Re-circulation Pump.

L. Install the following accessories on each water heater:
   1. Relief valve.
   2. Drain valve
   3. Thermometer.
   4. Concentric vent kit.
   5. Neutralization kit

M. The water heater’s total combined air intake length shall not exceed 100 equivalent feet

N. The water heater’s total combined exhaust venting length shall not exceed 100 equivalent feet.

O. Direct Vent Vertical System: Vertical roof top termination of both the vent and combustion air. The flue shall be PVC sealed vent material terminating at the roof top with the manufacturers specified vent termination. A separate pipe shall supply combustion air directly to the water heater from the outside. The air inlet pipe may be PVC pipe. The air inlet must terminate on the roof top with the manufacturer’s specified air inlet cap.

2.02 WATER SOFTENERS

A. Automatic Water Softener System: Complete from inlet to outlet, designed within values scheduled herein; of capacity and arrangement as shown on drawings and specified herein; furnished, installed and placed in operation.

B. Acceptable Manufacturer(s): Puritan, Aqua Systems.

C. Softener Tank: one piece, nonmetallic, seamless construction with continuous fiberglass roving outer shell; rated at 150 psig at 120°F.

D. Minimum connection size: 2” female connections.

E. Brine System: single brine measuring and salt storage tank with salt platform; tank and cover constructed of fiberglass or molded polyethylene; full-operated plastic fitted brine valve for automatic control of brine withdraw and fresh water refill. F. Electrical Characteristics:

G. As scheduled and indicated on drawings, typically 120 volt single phase.

H. Control: Brass control “Fleck” valve, cycled to regenerate from one to twelve day period.

I. Softener Tank: Reinforced fiberglass tank with hub and lateral distribution system. See schedule on drawings for size and capacity per tank.

J. Provide vacuum breaker on discharge pipe for each fiberglass softener tank.

K. Brine Tank: High density polyethylene tank with a non-degradable salt platform. See schedule on drawings for size of brine tank.

L. Control: Alternating, fully programmable, progressive flow design. Brass, piston operated multicycle control valves for meter initiated regeneration.

M. Meter: Bronze construction, transmitting low voltage signal to controller.

N. Test Kit: Provide water testing kit to make chemical tests necessary for controlling operation and adjustments of brine dosage.

O. Sediment Filter: Furnish and install a “Spin-Down” reusable screen filter, 2” in size with ball type drain valve. Similar to Rusco Inc. “Sediment-Trapper”

P. Softening Capacity: See schedule on plumbing drawings.

2.03 SOFTENER INSTALLATION

A. Coordinate with plumbing piping and related electrical work to achieve a complete operating system.

B. Install drain piping to nearest floor drain.

C. Resin tank and brine tank(s) shall be installed on 4” high concrete pad, unless noted otherwise.

D. On Inlet:
   1. Strainer.
   2. Pressure gage.
   3. Shut-off valve.

E. On Outlet:
   1. Shut-off valve.
   2. Pressure gage.
   3. Flow meter

F. Contractor shall provide initial salt fill, start water softening system and instruct owner in proper operation and maintenance of unit.

2.04 DOMESTIC WATER EXPANSION TANKS

A. Manufacturer: Amtrol, Bell and Gossett, Wessels, Watts.

B. Vertical steel pre-charged, diaphragm expansion tank, 125 psi ASME labeled construction, complete with replaceable flexible butyl rubber bladder, system connection fitting, Schrader type air charge fitting, steel base ring stand, factory prime and enamel painted exterior finish, ASME relief valve. Materials exposed to water to be NSF or FDA approved for potable water service. Size as indicated on plumbing schedule, see drawings.

C. NOTE: Tanks over 5.0 gallons of volume shall be placed on wall mounted shelf, furnished and installed by the contractor.

2.05 THERMOSTATIC MIXING VALVES

A. TMV-1: High/Low Master Manifold System: Provide lead-free, factory assembled and tested thermostatic high-low valves, constructed of bronze body and cap with replaceable corrosion and lime resistant components, including universal mounting capability, equipped with integral check-stops, removable strainers, liquid-filled thermostat with 10 year warranty, dial thermometer.

B. TMV-2: Low Flow Valve: The valve shall be ASSE 1017 listed. Valve shall be lead free construction with integral filter washers and check valve and adjustable cap with locking feature. Rough bronze finish with dial thermometer.

1. Manufacturers: Lawler, Watts, Powers.

P A R T 3 - E X E C U T I O N 3.01 INSTALLATION

A. Install plumbing equipment where indicated in accordance with manufacturer's recommendations. Coordinate equipment location with piping, ductwork, conduit and equipment of other trades to allow sufficient clearances. Locate equipment and arrange plumbing piping to provide access space for servicing all components.

B. Set commercial water heaters and water softeners on 4” high concrete housekeeping pads. Adjust and level equipment. Refer to manufacturer’s requirements for exterior space required around equipment when sizing concrete housekeeping pads.

C. Connect equipment to water and drain piping using unions or flanges and isolation valves.

D. Size temperature and relief valves per CSA ratings. Route Piping of temperature and pressure relief valves to terminate over nearest floor drain or floor as indicated.

E. Startup and test equipment adjusting operating and safety controls for proper operation.

F. Cycle softener and adjust for specified exchange rate, regeneration time, consumption, backflow rate, etc. Provide initial salt fill of brine tank.

G. Adjust compression tank pre-charge to scheduled minimum operating pressure prior to connecting to system.

END OF SECTION

SECTION 224000
PLUMBING FIXTURES

PART 1 GENERAL 1.01 REFERENCE

A. All applicable requirements of other portions of the Contract Documents apply to the work of this Section, including, but not limited to Division 01, General Requirements.

1.02 DESCRIPTION OF WORK

A. Work of this Section includes, but is not limited to:
   1. Inclusion of all plumbing fixtures, complete and ready for use. All fixtures, except as otherwise specified, shall be constructed of vitreous china with all visible exposed surfaces glazed.
   2. Providing all stops, traps, escutcheons, connections, etc., as are necessary to complete the installation of each fixture, whether such items are listed or not.
   3. Plumbing Trim: All finished exposed faucets, traps, connecting piping, stops, flush valves and other fixture trim shall be chromium-plated brass unless otherwise specified and shall be supported rigidly to fixtures and to walls with matching brackets at not more than 2'-0" center. All fastenings shall be chromium-plated brass or may be 302 stainless steel if of matching color and finish. Faucets shall be furnished as required. Vacuum breakers shall be provided as a part of the fixture trim wherever there is a possibility of back-siphoning.
   4. Fixture Stops: Shut-offs for urinal and water closet flush valves shall be an integral part of the fixture or fitting; shut-offs for all other fixtures shall be loose-key, lock-shield-type. All fixture stops shall be angle- or straight-type adapted for each particular location and shall be located immediately adjacent to the fixture. Use threaded adaptors when used in conjunction with copper tube work.
   5. All exposed screws or fasteners for plumbing fixtures and faucets shall be vandalproof. Contractor shall take care to coordinate this item with his suppliers prior to Shop Drawings submittal.
   6. Aerators, where required for sinks and lavatories shall be vandalproof type.
   7. Sinks: Contractor shall verify the physical size of each specified sink with the proposed sink cabinet and countertop. See Architectural and Interior’s design drawings for ADA required fixtures.

1.03 QUALITY ASSURANCE

A. Meet the requirements of the following:
   1. State Plumbing Code.
   2. State Department of Housing, Buildings and Construction.

B. Material Standards
   1. ANSI/ASME A112.19.2-90: Vitreous China Plumbing Fixtures.
   2. ANSI/ASME A112.19.3-87: Stainless Steel Plumbing Fixtures (Designed for Residential Use).
   3. ANSI/ASME A112.19.M-94: Porcelain Enameled Formed Steel Plumbing Fixtures.
   4. ANSI/ASME A112.19.5-79: Trim for Water Closet Bowls, Tanks, and Urinals.
   5. ANSI/ASSE 1016-90: Performance Requirements for Thermostatic, Pressure Balancing and Combination Control Valves for Bathing Facilities.
   6. ANSI/ASSE 1025-78: Performance Requirements for Diverters for Plumbing Faucets with Hose Spray, Anti-Siphon-Type, Residential Applications.

1.04 SUBMITTALS

A. Shop Drawings: Required for review.

B. Product Data: Catalog cuts, including all fixture trim.

C. Samples: Not required for review.

D. Project Information: Not required for review.
E. Contract Close-Out Information: Operating and maintenance data, Guarantees

PART 2 PRODUCTS

2.01 SEE PLUMBING FIXTURE SCHEDULE ON DRAWINGS FOR ADDITIONAL FIXTURES TYPES AND MODEL NUMBERS.

2.02 MATERIALS - GENERAL

A. Acceptable Manufacturers
   1. Plumbing Faucets: American Standard, Kohler, Delta, and Moen.
   2. Flush Valves: Sloan and Zurn.
   3. Vitreous China Plumbing Fixtures: American Standard, Kohler and Zurn.
   4. Mop Sinks: Fiat, Stern Williams and Mustee
   5. Water Closet Seats: Church, Bemis, Beneke, and Centoco.
   6. Stainless Steel Sinks: Elkay, Just, Franke.
   7. Fixture Carriers: Josam, J.R. Smith, Watts and Zurn.

B. Plumbing Fixtures – General: Constructed or equipped with anti-siphon devices to prevent siphoning waste material into potable water supply system.

C. Escutcheons and Plates: Conceal all holes where pipes pass through walls, floors or ceilings; use plates or escutcheons.

D. Piping Exposed in Finished Areas (including fittings and trim): Chromium-plated or nickelplated brass with polished bright surface.

E. Trim for Lavatories and Sinks: Provide with renewable cartridges.

F. Vitreous Caps: Provide for water closet bolts.

G. Sealant: Silicone-type. See Division 07 Section “Joint Sealants”.

H. Sinks: Shall be 18 gauge 304 stainless steel with Satin finish. Verify with architectural and interior design drawings ADA requirements.

I. Mop Sinks: Molded Stone construction, 3” internal drain with faucet, hose bracket, mop hanger bracket and stainless steel wall guard.

J. ADA Sinks: Waste outlets for all ADA sinks shall be 90 degree offset grid drain similar to Elkay LK235L

2.03 INSULATION AT HANDICAPPED LAVATORIES

A. Handicapped lavatories exposed waste, hot and cold water supply lines shall be insulated with a molded, flexible vinyl insulation system with all fasteners. Provide insulation for 1-1/4-inch waste offset drain, tailpiece, P-trap and waste arm and 3/8-inch supply tubing and 3/8-inch keyed stop valve. Color shall be as selected by the A/E.

B. Insulation shall comply with ASTM E84 25/450, flame spread index of not more than 25 and a smoke-developed index of not more than 450.

C. Manufacturers/Products: Plumbrex, Truebro, Johns Mansville.

PART 3 EXECUTION 3.01 INSTALLATION

A. Sink manufacturer shall provide proper template to architectural woodwork supplier for cutting of countertop. Plumber shall place sink in countertop and complete faucet and piping. B. Install all fixtures in accordance with Manufacturer's recommendations.

C. Contractor shall coordinated ADA required fixtures and sinks with architectural and interior design drawings.

D. All fixture support carriers shall be of the type necessary to permit adjustment to fit variations in construction. All grounds or special supports necessary for setting fixtures shall be provided

before plastering or other finished construction work is begun. All fixtures shall be hung at standard height unless otherwise indicated by the A/E.

E. Minimum fixture connection sizes are shown on the Drawings.

F. Provide fixture carriers and required drainage fittings on all wall hung fixtures. Anchor carriers securely to floor.

G. Where plumbing fixtures connect to walls, floors, and countertops, seal all joints with sealant.

H. Seal Mop Sinks to wall and floor with building sealant.

I. Provide anchors behind the wall for flush valve supply piping.

J. Adjust self-sustaining closet seats for proper operation and to sustain in any position.

K. Insulate the hot and cold water and waste piping under handicapped lavatories.

L. After all fixtures have been set and are ready for use, and before the Contractor leaves the job, he shall thoroughly clean all fixtures furnished and set by him, removing all stickers, rust stains and any other matter or discoloration of fixtures, leaving every part in new condition. He shall, further, adjust all flush valves and other fixture water tempering or balancing at supplies to give proper water flow of fixtures.

END OF SECTION

SECTION 23 00 00
HVAC GENERAL REQUIREMENTS

PART 1 – GENERAL

1.1 SUMMARY

A. This Section includes the general requirements applicable to all Heating, Ventilation, and Air Conditioning work.

B. Provide complete and fully operational HVAC systems controlled as indicated in the construction documentation.

C. The construction documents are comprised of both specifications and construction drawings. Information pertinent to design intent may be included in either or both locations, which create one set of contract documents.

1.2 DEFINITIONS

A. Basis of Design: Equipment and materials identified in the drawing schedules, notes, and specifications and identified as a specific product or example represents the intended Basis of Design. Any equipment or materials provided by the Contractor must meet or exceed the performance quality of the Basis of Design.

B. Substitution: Any equipment or material which is not the Basis of Design.

C. General Requirements: The provisions set forth in the Division 01 sections apply to the entire work of the contract and other elements which are included in the project. Basic contract definitions are in the General Conditions.

D. Finished Spaces: Spaces other than mechanical and electrical equipment rooms, furred spaces, pipe and duct chases, spaces above ceilings, unexcavated spaces, crawlspaces, and tunnels generally considered normally occupiable by people.

E. Exposed, Interior Installations: Installed indoors and exposed to viewing by people. Examples included finished spaces and mechanical rooms equipment rooms.

F. Exposed, Exterior Installations: Exposed to view but outside the building envelope and therefore exposed to weather and ambient conditions. Examples include roof top locations.

G. Concealed, Interior Installations: Installed within the building envelope, but concealed from view. Examples include those items installed within walls, above ceilings, below floors, or in chases.

H. Concealed, Exterior Installations: Installed outside of the building envelope, but concealed from view and protected from weather conditions by a secondary structure, but subject to outdoor ambient conditions. Examples include installations within enclosures that are not heated or cooled.

I. Indicated: Implication of a cross reference to a graphic representation, note, schedules, or other specification section or another area within the contract documents. The terms “shown”,

"noted", "scheduled", and "specified" are used as synonyms to "indicated". No limitation of cross reference location is intended except as specifically noted.

J. Furnish: Supply and deliver to project site, ready for unloading, unpacking, assembly, installation and similar operations. Where "furnish" applies to work for which the installation is not otherwise specified, "furnish" shall mean "furnish and install".

K. Install: Operations at the project site including "unloading, unpacking, assembly, erection, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operation.

L. Provide: To furnish and install complete and ready for intended use.

1.3 SUBMITTALS

A. Action Submittals: These submittals are required to be returned with no exceptions prior to procuring or installing products or materials. The Submittal Review process is described in Section 01.
   1. Work Plans: Written Narrative of the work plan used to create the schedule. Coordinate with other trades and contractors to develop required work plans as required to develop the long term coordinated construction schedule.
   2. Product Data: Providing information on the actual product selection intended for use as specified in other Division 23 Specifications and the Construction Documents. All product data submittals shall clearly identify the product to be used subject to rejection.
   3. Shop Drawings: Providing information on the actual installation methodology to be used to install items as specified in other Division 23 Specifications and the Construction Documents

B. Informational Submittals: These submittals are intended to facilitate coordination and construction phasing and scheduling. These submittals will not be returned unless non-conformance with the contract documents is noted.
   1. Construction Schedules: Schedule of work showing percent completion of milestones in the work plan. Coordinate with the general contractor, owner, or owner's representative, to develop, maintain, and regularly update the construction schedule as required
   2. Coordination Documents: Drawings including Plans, Sections, Elevations, localized infrastructure crossing details, drawn to scale, on which the items below have been included utilizing information from all trades, contractors, and installers:
      a. Building Structure and structural supports and attachments for piping, ductwork, lighting fixtures, cables, cable trays, raceways and conduit.
      b. Building Roofs, walls, floors, windows, doors, and ceilings.
      c. Suspended Ceilings components.
      d. HVAC Equipment, piping, ductwork, controls devices, and associated electrical disconnects.
      e. Size and Location of access doors and panels required for maintenance of products installed in walls and inaccessible ceilings.
      f. Size and Location of penetrations through the finished floor.
      g. Size and Location of penetrations through fire rated walls.
      h. Items penetrating the finished ceiling, including but not limited to:
         1) Air outlets and inlets
         2) Luminaires
         3) Fire Suppression Sprinklers

4) Fire Alarm Components, such as horns and strobes
5) Life Safety Components, such as exit signs
6) Mass Notification Components, such as speakers
7) IT components, such as routers
8) Security components, such as cameras
9) Service Access Panels

C. Substantial Completion Submittals: These submittals are required prior to achieving substantial completion from the Architect or Engineer of Record. One hard copy shall be turned over to the Owner's Maintenance Staff at Owner Training.
1. Record Drawings Submittal reviewed with "No Exceptions" by Architect and/or Engineer of record.
2. Commissioning Documentation as required by other specification sections provided in .PDF file format on a USB Thumb-drive and one printed copy organized by specification section in multiple three ring binders not to exceed 4", including at minimum:
a. Start Up Reports for all HVAC Equipment and components.
b. Testing, Adjusting and Balancing report returned with "No Exceptions" by the Architect and/or Engineer of record.
c. Manufacturer's Operation and Maintenance Data for all HVAC system Products, including all accessory sizes required, such as belt and filter sizes and types.
d. Emergency Service Contact including Name, email address, and Phone Number.
e. Written Record from Owner stating Owner's Representative system training has been successfully delivered.
3. Service Valve Tag Chart and Location Maps.
4. Updated Control Valve Schedule.
5. Field Reports indicating successfully completing Ductwork Leakage Testing.
6. Field Reports indicating successfully completing Piping Pressure Testing.
7. Any and all maintenance required items as specified in other Division 23 Sections in packages with protective cover for storage and identified with labels describing contents and intended use. (i.e. FAN BELT – AHU-1 SUPPLY FAN)

1.4 DELIVERY, STORAGE, AND HANDLING

A. Where feasible, arrange for product delivery to the construction site when construction has progressed to allow for delivery to the final installed location protected from the weather and site security is sufficient to prevent easy theft (lockable door, container, or cage area and/or a night guard).

B. Deliver all pipes with factory applied end caps. Caps shall be maintained through shipping and storage until such time pipe is being installed to prevent entrapment of debris and contaminants and minimize pre-construction corrosion of materials.

C. Do not allow any materials to be stored exposed to weather, standing water, excessive dirt and dust, or in a manner to prevent the flow of traffic through the worksite.

D. Handle all products with care and per manufacturer's written instructions for lifting and rigging. Do not install damaged items without written consent from the Owner.

1.5 COORDINATION

A. The drawings indicate the general arrangement, routing, and scope of the systems and are to be followed as often as possible. Deviations form the drawn layout are permissible, if necessitated by field conditions and approved by the Architect or Engineer of Record through submittal and properly coordinated with all other trades.

B. The drawings are not intended to show every minor vertical and/or horizontal offset required to navigate a complete installation of the system due to obstructions that may arise due to field conditions. Contractors shall anticipate potential additional offsets in their construction proposals.

C. The drawings, schedules, and specifications shall be considered one cooperative document. Items may or may not appear in both drawings and specifications. Anything appearing in one or the other location shall be considered included in the contract documents and the contractor shall provide a bid based inclusive of both Specifications and Drawings. Any and all identified conflicting statements between the Specifications and Drawings that affects the final bid price shall be submitted for clarification during the bidding process.

D. New Equipment: All equipment provided by the contractor shall be provided as "new" and not "used". Contractor shall not energize equipment prior to substantial completion unless:
   1. Factory Representative and/or Owner's Representative is in attendance for start-up testing.
   2. The Test, Adjusting and Balancing Contractor is actively testing the equipment
   3. Specific, written authorization from the Owner has been granted for:
      a. Space Pressurization in conjunction with approved pressurization plan.
      b. Space Tempering during finish installation.

E. Contractor shall field verify all measurements in the field and shall be responsible for the correct fitting of all systems and components. Contractor shall coordinate all work with other branches and trades to minimize conflict and delays. Contractors shall:
   1. Coordinate work plan in advance with all other trades and immediately upon discovery, report any anticipated difficulty with proposed resolutions to the general contractor and/or Architect or Engineer of Record.
   2. Provide the General Contractor and Owner with a detailed schedule to be incorporated within the overall construction schedule to include at minimum:
      a. Any necessary demolition, as phased by floor and area.
      b. Temporary Construction as required to maintain any existing services.
      c. Coordination Efforts
      d. Architectural Rough Ins – i.e. wall and floor sleeves installation.
      e. Product Submittals
      f. Shop Drawing Submittals
      g. Product Procurement and storage
      h. Product Installation
      i. Duct and Piping Installation
      j. Installation of Insulation and Identification Systems
      k. Start-Up and Commissioning of Equipment
      l. Owner Training
      m. Punch List Inspection
      n. Substantial Completion
   3. Coordinate space needs of ductwork, piping, chases, wall, floor, and roof penetrations, with other trades during construction to allow for easy installation.

4. Coordinate installation of all structural supporting elements, sleeves, sleeve seals, etc. through cast-in-place concreate and other structural components as they are constructed.
5. Coordinate requirements for all access hatches, panels, doors, hand holes for HVAC items during work planning for wall and ceiling construction. Access panels and doors are specified in Division 08.
6. Coordinate any and all trenching, excavating, bedding, and backfilling with general contractor and appropriate piping specifications and earthwork specifications in other divisions.
7. Coordinate any HVAC Demolition with all aspects of demolition and temporary construction by other trades, including dust barriers and electrical demolition. Do not remove electrical components of HVAC equipment without electrical components first being locked out and removed by Division 26 demolition contractor.

PART 2 – PRODUCTS

2.1 MANUFACTURERS

A. Manufacturer: Subject to compliance requirements, provide a product from one of the listed manufacturers. Any manufacturer specifically mentioned on the drawing shall be considered Basis – of – Design.

B. Available or Acceptable Manufacturers: Manufacturers of known equivalence. When listed, provide a product by one of the manufacturers listed or submit a non-listed manufacturer's product for review. Contractor is responsible for all cost deviations arising from use of a non-listed manufacturer.

2.2 ELECTRICAL REQUIREMENTS

A. Electrical Characteristics for HVAC Equipment: Unless otherwise approved, supply equipment with the electrical characteristics as indicated in the contract documents.

B. Equipment with electrical characteristics different from those indicated in the contract documents shall only be supplied if the following is approved in writing:
1. The electrical supply wiring and conduit size is properly coordinated and modified.
2. The electrical over-current protection device is properly coordinated and modified.
3. The changes associated with panelboards, local transformers, and disconnects are properly coordinated and modified.
4. Any additional costs of other contractors associated with the change in electrical characteristics are the responsibility of the Mechanical Contractor.

2.3 PIPE, TUBE, AND FITTINGS

A. See Section 231113 Hydronic Piping and 231116 Hydronic Piping Specialties

B. See Section 232300 Refrigerant Piping

2.4 DUCTWORK

A. See Section 233100 HVAC Ducts and Casings and 233300 Duct Accessories

2.5 GROUT

A. Description: ASTM C 1007B, nonshrink and nonmetallic, dry hydraulic-cement grout
   1. Post Hardening, volume adjusting, non-staining, noncorrosive, nongaseous, and recommended for interior and exterior applications
   2. 5000-PSI, 28-day compressive strength
   3. Premixed or packaged

2.6 JOINING MATERIALS

A. Refer to Division 23 Piping Sections for special joining materials not listed below. When joining materials are in conflict, utilize the joining materials specified in the piping specific application specification.

B. Pipe-Flange Gasket Materials: Suitable chemical and thermal conditions for the specific use of the piping as specified in other Division Piping Sections
   1. ASME B16.21, nonmetallic, flat, asbestos-free, 1/8-inch maximum thickness unless otherwise indicated
   2. AWWA C110, rubber, flat face, 1/8-inch-thick, full face or ring type, unless otherwise indicated

C. Flange Bolts and Nuts: ASME B182.1, Carbon Steel, unless otherwise indicated

D. Plastic, Pipe-Flange Gasket, Bolts, and Nuts: Type and material as recommended by piping system manufacturer for intended service, unless otherwise indicated.

E. Solder Filler Metals: ASTM B 32, lead-free alloys with ASTM B 813 water flushable flux. Melting point suitable for service.

F. Brazing Filler Metals: AWS A5.8, BCuP Series, copper-phosphorous alloys for general-duty brazing, unless otherwise indicated.
   1. Refrigerant Piping Brazing Filler Metals: AWS A5.8, Bagl, Silver alloy, unless otherwise specified by the manufacturer’s written installation instructions.

G. Welding Filler Metals: Comply with AWS D10.12 for welding materials appropriate for the wall thickness and chemical composition of the steel pipe being welded.

H. Solvent Cements for Plastic Pipe
   1. PVC Piping:
      a. Solvent Cement: ASTM 2564
      b. Primer: ASTM F 6565
   2. CPVC Piping:
      a. Solvent Cement: ASTM 493

PART 3 - EXECUTION

3.1 PRE-WORK INSPECTION

A. Examine the work area before beginning installation. Ensure
   1. Conditions are safe and satisfactory for working.
   2. Rough-In work is installed properly.

3. All coordination activities are successfully completed.
4. The area is free of conflicts to proper installation.

B. Do not proceed with work if conditions are unsatisfactory.

3.2 PLANNING

A. Plan work beforehand.

B. Communicate work plan to other contractors performing work in the area.

C. Coordinate all work as listed in the Coordination Section of this specification.

3.3 HVAC DEMOLITION

A. Refer to general demolition specifications in division 02.

B. Disconnect, demolish, and remove HVAC systems, equipment, and components as indicated.
1. To Be Removed: Uninstall and remove from site, including all insulation, pipe or ductwork, hangers and supports, specialties, and appurtenances as indicated. Cap at limits of demolition with same or compatible material if portion of service is existing to remain.
2. To Be Abandoned in Place: Disconnect from main service, drain, clean, and cap with same or compatible material.
3. Existing to Remain: Do not remove. Contractor is responsible for maintaining in a serviceable condition during work.

C. Contractor shall be responsible for replacing and repairing items that are existing to remain yet damaged by the contractor during work.

3.4 INSTALLATION

A. Install mechanical items in accordance with the contract documents and manufacturer's published installation instructions.

3.5 CONCRETE BASES

A. Anchor equipment to concrete base according to equipment manufacturer's published installation instructions and in accordance with seismic requirements, if present.

B. Construct concrete bases of dimensions indicated, but not less than 6 inches larger than supported unit in all directions.

C. Install dowel rods 18 inches on center to connect concrete base to concrete floor.

D. Install epoxy-coated anchor bolts for supported equipment that extends through the concrete base and anchor to structural floor.

E. Place and secure anchorage devices using supported equipment manufacturer's published documentation, including setting drawings, diagrams, templates, instructions furnished with equipment to be supported.

F. Use 3000 PSI 28-day compressive strength concrete and reinforcements as specified in Division 03.

G. Ensure anchor bolts have proper exposed elevation to properly secure equipment to base.

3.6 GROUTING

A. Mix and install grout for HVAC equipment base bearing surface, pump, and other equipment base plates, and anchors.

B. Clean all surfaces to be grouted prior to installing grout.

C. Provide forms as needed to properly install grout.

D. Place grout, completely filling bases and forms.

E. Avoid entrapment of air within the grout during installation.

F. Place grout on concrete bases and provide smooth and level bearing surfaces for equipment to be supported

G. Place grout around anchors.

H. Cure placed grout.

3.7 METAL SUPPORTS AND ANCHORAGES

A. Refer to Division 05 for structural steel requirements.

B. Metal Channel (“strut”) products in accordance with the Metal Framing Manufacturer’s Association standards may be used for metal framings, supports, and anchorages.

C. Cut, fit, and place miscellaneous metal supports accurately in locations as needed, with proper alignment and elevation required to support and anchor HVAC materials and equipment as intended in the contract documents.

D. Field Welding shall comply with AWS D1.1

3.8 WOOD SUPPORTS AND ANCHORAGES

A. Cut, fit, and place wood grounds, nailers, blocking, and anchorages as needed to support and anchor HVAC equipment and materials.

B. Select fasteners that will not penetrate wood members through a finished or exposed side. Tighten connections between members. Do not install fasteners resulting in split or weakened wood members.

C. Attach to substrates as required to support the sum of the dead load and applied working load of supported equipment.

3.9 EQUIPMENT INSTALLATION – COMMON REQUIREMENTS

A. Contractor shall confirm proper fit of equipment.

B. Install equipment level and plumb.

C. To the extent possible, install equipment and products perpendicular and parallel to exterior walls unless otherwise indicated.

D. Install equipment perpendicular and parallel to other building systems and components unless otherwise indicated.

E. Install all HVAC products and equipment:
   1. To maximize headroom if specific mounting height is not specified.
   2. To facilitate maintenance and service.
   3. To maintain manufacturer's recommended minimum clearances.
   4. To meet NFPA 70 required clearances to electrical components.
   5. To allow space for installation of necessarily sloped items at intended slope.

F. Connect equipment for ease of disconnecting and removing, with minimum interference to other installations

G. Extend grease fittings to accessible locations outside of motor compartments and equipment casings.

3.10 CLEANING AND RESTORATION

A. Contractor shall repair damage resulting from the contractor's work.

B. Leave the work area broom clean at the end of each work shift.

C. Thoroughly clean the work area at the completion of construction. At a minimum, Contractor shall:
   1. Remove all excess grout, paint, plaster, caulk, firestopping, or other products used during installation of HVAC systems from finished surfaces.
   2. Clean duct systems clear of construction debris and dust.
   3. Clean the blowers, fan housings, discharge plenums, scrolls, blades, vanes, shafts, baffles, dampers, and drive assemblies of all air handling units and fans free of construction debris and dust.
   4. Clean all coils and heat exchangers dust free and render Coil Visibly Clean and within 10% of design coil pressure drop.
   5. Clean all drain pains free of debris and dust.
   6. Clean all dust from diffusers, registers, and grilles.
   7. Clean, empty, and replace all strainer baskets.
   8. Clean debris from all insect and bird screens.
   9. Install new, clean air filters.
   10. Remove all trash from mechanical equipment rooms.
   11. Sweep clean all mechanical rooms.
   12. Remove dust from exposed equipment casings.
   13. Ensure all equipment tags and labels are clean and legible.

3.11 FIELD QUALITY CONTROL

A. Manufacturer's Field Service: Engage a factory-authorized service representative to start up, test, and inspect mechanical equipment components, assemblies, connections, and installations as indicated.

B. Non-Conforming Work: Items shall be deemed defective if they do not pass tests and inspections, including commissioning functional testing.

3.12 FIELD PAINTING

A. When field applied coatings are specified, painting of HVAC Systems, equipment, and components is specified in Division 09.

B. Damage and Touchup: Marred, scratched, dinged, or otherwise damaged factory finishes shall be repaired with materials to match original factory finish using the manufacturer's approved methods.

3.13 OWNER TRAINING

A. Contractor shall provide training to the Owner's maintenance personnel on the systems and equipment installed. Training shall include, at a minimum:
   1. Means of turning equipment on and off safely.
   2. Review of Equipment Sequences and Operation.
   3. Review of Equipment Capacities and Capabilities.
   4. Means of making minor adjustments to setpoints.
   5. Review of Building Automation Systems.
   6. Basic Maintenance requirements.
      a. Filter Change Parameters and procedures.
      b. Fan Belt Change Procedures.
      c. Bearing Grease extension locations.
      d. Greasing Intervals.
      e. Strainer cleaning procedures and intervals.
      f. Turnover of Substantial Completion Hard Copy.

SECTION 23 05 13
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section includes single- and three-phase motors for application on equipment provided under other sections and for motors furnished loose to Project.

B. Related Sections:
   1. Section 260526 - Grounding and Bonding for Electrical Systems.
   2. Section 260553 - Identification for Electrical Systems.

1.2 REFERENCES

A. American Bearing Manufacturers Association:
   1. ABMA 9 - Load Ratings and Fatigue Life for Ball Bearings.

B. National Electrical Manufacturers Association:
   1. NEMA MG 1 - Motors and Generators.

C. International Electrical Testing Association:
   1. NETA ATS - Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems.

1.3 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Action Submittals:
   1. Product Data:
      a. Submit catalog data for each motor furnished loose. Indicate nameplate data, standard compliance, electrical ratings and characteristics, and physical dimensions, weights, mechanical performance data, maintenance procedures and intervals, and support points.
      b. Submit data for each motor furnished as a package with the package submittal. Indicate nameplate and performance data, standard compliance, electrical ratings and characteristics and maintenance procedures and intervals.
   2. Test Reports: Indicate procedures and results for specified factory and field testing and inspection.

C. Information Submittals:
   1. Motor Manufacturer’s published Operation and Maintenance Data, to be included in close out submittals.

1.4 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing products specified in this section with minimum three years' experience.

B. Testing Agency: Company specializing in testing products specified in this section with minimum three <3> years' documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Product storage and handling requirements.

B. Lift only with lugs provided. Handle carefully to avoid damage to components, enclosure, and finish.

C. Protect products from weather and moisture by covering with plastic or canvas and by maintaining heating within enclosure.

D. For extended outdoor storage, remove motors from equipment and store separately.

1.6 COORDINATION

A. Coordinate all features of motors, installed units, and accessory devices to be compatible with:
   1. Means of Motor Starting.
   2. Torque, speed, and mechanical power requirements of the application.
   3. Ratings and characteristics of the electrical supply circuit.
   4. Means of speed control.
   5. Ambient and environmental conditions, both during storage and in the final installed location.

B. Coordinate all motor installation requirements with Division 26 contractor.

PART 2 PRODUCTS

2.1 PRODUCT REQUIREMENTS FOR MOTORS FURNISHED WITH EQUIPMENT

A. Motors 1/2 hp and Larger: Three-phase motor as specified below.

B. Motors Smaller Than 1/2 hp: Single-phase motor may be supplied as specified below, except motors less than 250 watts or 1/4 hp may be equipment manufacturer's standard.

C. Three-Phase Motors: NEMA MG 1, Design B, premium-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds as indicated on Drawings.
   1. Voltage: As indicated on Drawings
   2. Service Factor: 1.15
   3. Enclosure: Meet conditions of installation unless specific enclosure is indicated on Drawings.
   4. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.
   5. Design Code: Design B
   6. Insulation System: NEMA Class F.

7. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.
8. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.
9. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.
10. Sound Power Levels: Conform to NEMA MG 1.

D. Single Phase Motors:
1. Permanent split-capacitor type where available, otherwise use split-phase start/capacitor run or capacitor start/capacitor run motor.
2. Voltage: as indicated on the drawings, single phase, 60 Hz.

E. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

2.2 THREE-PHASE MOTORS FURNISHED LOOSE

A. Acceptable Manufacturers: Acceptable Manufacturer's are listed below. Other manufacturers of equivalent products may be submitted for review.
1. General Electric
2. Siemens
3. Baldor
4. Marathon Electric Company

B. Product Description: NEMA MG 1, Design B, premium-efficient squirrel-cage induction motor, with windings to accomplish starting methods and number of speeds indicated.

C. Voltage: as indicated on the drawings, three phase, 60 Hz.

D. Service Factor: 1.15

E. Enclosure: Meet conditions of installation unless specific enclosure is specified or indicated.

F. Design for continuous operation in 40 degrees C environment, with temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

G. Insulation System: NEMA Class F.

H. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

I. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay with wiring to terminal box.

J. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA 9, L-10 life of 200,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

K. Sound Power Levels: Conform to NEMA MG 1.

L. Wiring Terminations: Furnish terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated.

2.3 SOURCE QUALITY CONTROL

A. Test motors in accordance with NEMA MG 1, including winding resistance, no-load speed and current, locked rotor current, insulation high-potential test, and mechanical alignment tests.

PART 3 EXECUTION

3.1 EXISTING WORK

A. Disconnect and remove abandoned motors

B. Maintain access to existing motors and other installations remaining active and requiring access. Modify installation or provide access panel.

C. Clean and repair existing motors to remain or are to be reinstalled.

3.2 INSTALLATION

A. Install securely on firm foundation. Mount ball bearing motors in accordance with motor manufacturer's requirements.

B. Install engraved plastic nameplates in accordance with Section 260553 for all motors.

C. Electrical Installer shall provide and install all necessary materials and labor to ground and bond motors in accordance with Section 260526.

3.3 FIELD QUALITY CONTROL

A. Perform inspections listed in NETA ATS, Section 7.15 for Rotating Machinery.

B. Perform Insulation Resistance Testing on all motor installations for the nominal voltage rating of the equipment. Motors that do not meet the minimum insulation resistance value tabulated in ANSI/NETA ATS-2009, summarized below, shall be reworked or replaced until the motor passes testing.

NOMINAL RATING OF EQUIPMENT (VOLTS)	MINIMUM TEST VOLTAGE, DC	MINIMUM INSULATION RESISTANCE IN MEGOHMS
<250	500	25
250 < RATED VOLTS < 600	1,000	100

SECTION 23 05 17
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Sleeves.
   2. Sleeve-Seal Systems.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data for each type of product to be installed.

B. Information Submittals:
   1. Maintenance Data: For each type of product to be installed.

PART 2 – PRODUCTS

2.1 SLEEVES

A. All wall and floor pipe penetration sleeves up to 24” and less than 150°F can be molded non-metallic, non-corrosive, high density polyethylene and formed to have a water stop and anchor plate at least 4” larger than the outside diameter of the sleeve itself. End caps with nailing flanges shall be provided on each end to facilitate attaching the sleeve to the wall form and to prevent deformation during the concrete pour. End caps shall remain in place to protect the opening from foreign debris and rodent entry until it is penetrated by the pipe, tubing, or conduit. Century Line model CS by Link-Seal, Metraflex, or prior approved.

B. For openings from 29.25” to 64” contractor can be Link-Seal’s Cell-Cast disks, providing a round hole in conformance with Link-Seal sizing data. Cell-Casts shall consist of 3” and/or 4” lightweight interlocking polyethylene cells stacked to form the thickness of the poured concrete wall. Molded into each cell shall be a cavity to accept a 2” x 4” nailer.

C. Contractor shall determine the required inside diameter of each individual wall opening or sleeve before ordering, fabricating or installing. The inside diameter of each wall opening shall be sized as recommended by Faco or the manufacturer to fit the pipe and Link-Seal to assure a water-tight and air-tight seal.

D. Cast-Iron Wall Pipes: Cast or fabricated of cast or ductile iron and equivalent to the ductile iron pressure pipe, with plan ends and integral waterstop unless otherwise indicated.

E. Galvanized-Steel Wall Pipes: ASTM A 53/53M Schedule 40, with plan ends and welded steel collar; zinc coated.

F. Galvanized-Steel-Pipe Sleeves: ASTM A 53/53M, Type E, Grade B, Schedule 40, zinc coated with plain ends.

G. Galvanized-Steel-Sheet Sleeves: 0.0239-inch minimum thickness with round tube, closed with a longitudinal joint.

H. PVC-Pipe Sleeves: STM D 1785 Schedule 40.

I. Molded-Polyethylene or Polypropylene Sleeves: Removable, tapered cup shaped, smooth outer surface with nailing flange to attach to framing member.

J. Molded PVC Sleeves: With nailing flange to attach to framing member.

2.2 SLEEVE SEAL SYSTEMS

A. Acceptable Manufacturers: Acceptable Manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review.
   1. Metraflex
   2. Advance Products & Systems
   3. GPT
   4. Link-Seal
   5. Pipeline Seal and Insulator

B. Description: Modular sealing-element unit, designed for assembly in the field, intended to fill annular space between piping and pipe sleeve.
   1. Basis of Design Product: Metraflex MS seriesLink-Seal
   2. Sealing Pressure: 20 PSIG air and / or 40 ft Head water.
   3. Sealing Elements: EPDM-Rubber interlocking links shaped to fit pipe surface snug. Include type and number required for pipe size and material.
   4. Pressure Plates:
      a. Glass reinforced plastic, under maximum media temperature of 250 degrees F.
      b. Steel, Zinc Dichromate over maximum media temperature of 250 degrees F or when exposed to weather.
   5. Connecting Bolts and Nuts:
      a. Carbon Steel with an organic resign coating for corrosion resistance of greater than ten years for interior installations.
      b. 316 Stainless Steel or Steel, Zinc Dichromate, or equivalent corrosion-resistant hardware for underground or exterior wall penetrations.

PART 3 - EXECUTION

3.1 INSTALLATION

A. A. Install sleeves for piping penetrations through all floors, walls, partitions, and roofs.
   1. Install sleeves in concrete floors, roof slabs, and walls as new floor, slab, or wall is constructed.
   2. Select sleeves to receive sleeve seal systems to have at least a nominal 1-inch annular space between piping and concrete, excluding insulation.
   3. Select sleeves not receiving sleeve seal systems to have 1/4 - inch clear annular space between sleeve and insulation of piping system.
   4. Cut sleeves to length such that sleeve is flush with both finished surfaces.
      a. All sleeves in through floors in mechanical rooms shall extend 2” above finished floor surface.

5. Install piping through center of sleeve. Align centerlines of sleeve and pipe.
6. Fill the area outside of sleeves with grout.
7. Fill the annular area inside of sleeves without sleeve seal systems with caulk. Piping insulation of the pipe penetrating shall have an insulation jacket compatible with the caulk. Refer to section 079200 for "Joint Sealants" for non-fire rated walls.
8. For all penetrations through Fire-Barriers, maintain the indicated rating of the barrier. Seal pipe penetration with firestop materials. Comply with firestopping requirements as specified in section 078413 "Penetration Firestopping"

B. Install sleeve-seal-systems in exterior walls, and piping service installations through slabs-on-grade.
1. Select type, size, and number of sealing elements required for penetrating pipe characteristics per manufacturer's written instructions.
2. Align the centerline of installed piping with the centerline of pipe sleeve.
3. Install sleeve-seal-system links in annular space per manufacturer's published instructions.

C. Install weatherproof wall box penetrations per manufacturer's written instructions.

SECTION 23 05 18
ESCUTCHEONS FOR HVAC PIPING

PART 1 – GENERAL

1.1 SUMMARY

A. This section includes:
   1. Escutcheons.
   2. Floor plates.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data for each type of product indicated.

PART 2 – PRODUCTS

2.1 ESCUTCHEONS

A. One-piece, steel type: With polished, chrome-plated finish and set screw fastener.

B. One-piece, stainless steel type: With polished, stainless steel finish.

C. One-piece, stamped steel type: with polished, chrome-plated finish and spring-clip fastener.

D. One-piece, deep-pattern type: Deep-draw, box-shaped steel with polished, chrome-plated finish and spring clip fastener.

E. Split-plate, stamped steel type: with polished, chrome-plated finish; concealed or exposed rivet hinge and spring clip fastener.

2.2 FLOOR PLATES

A. Split floor plates: Steel with concealed hinge.

PART 3 – EXECUTION

3.1 INSTALLATION

A. Install escutcheons for all interior exposed piping penetrations through floors, walls, and ceilings.

B. Install escutcheons with inside diameter closely fitting around outside diameter of piping and piping insulation and outside insulation completely covering opening and pipe sleeve.

C. Install escutcheons fitting to the piping type:
   1. Pipe Sleeve through wall: one-piece deep pattern.

2. Uninsulated piping: Split Plate Steel.
3. Insulated Piping: Split Plate Steel.

D. Install floor plates for piping penetrations through mechanical room floors that do not have extended pipe sleeves.

E. Install floor plates with the inside diameter loosely fitting around piping and pipe insulation and the outside diameter covering the pipe sleeve and opening completely.

3.2 FIELD QUALITY CONTROL

A. A. Replace broken and damaged escutcheons and floor plates using new materials.

SECTION 23 05 29
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Pipe hangers and supports.
2. Pipe Stands.
3. Pipe Support Accessories.
4. Flashing.
5. Equipment curbs.
6. Formed steel channel.
7. Equipment bases and supports.

1.2 REFERENCES

A. American Society of Mechanical Engineers:
1. ASME B31.1 - Power Piping.
2. ASME B31.5 - Refrigeration Piping.
3. ASME B31.9 - Building Services Piping.

B. ASTM International:
1. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.
2. ASTM E814 - Standard Test Method for Fire Tests of Through Penetration Fire Stops.
3. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers.
4. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems.

C. American Welding Society:
1. AWS D1.1 - Structural Welding Code - Steel.

D. FM Global:
1. FM - Approval Guide, A Guide to Equipment, Materials and Services Approved By Factory Mutual Research For Property Conservation.

E. Manufacturers Standardization Society of the Valve and Fittings Industry:
1. MSS SP 58 - Pipe Hangers and Supports - Materials, Design and Manufacturer.
2. MSS SP 69 - Pipe Hangers and Supports - Selection and Application.
3. MSS SP 89 - Pipe Hangers and Supports - Fabrication and Installation Practices.

F. Underwriters Laboratories Inc.:
1. UL 263 - Fire Tests of Building Construction and Materials.
2. UL 723 - Tests for Surface Burning Characteristics of Building Materials.
3. UL 1479 - Fire Tests of Through-Penetration Firestops.
4. UL 2079 - Tests for Fire Resistance of Building Joint Systems.
5. UL - Fire Resistance Directory.

G. Intertek Testing Services (Warnock Hersey Listed):
   1. WH - Certification Listings.

1.3 DEFINITIONS

A. Firestopping (Through-Penetration Protection System): Sealing or stuffing material or assembly placed in spaces between and penetrations through building materials to arrest movement of fire, smoke, heat, and hot gases through fire rated construction.

1.4 PERFORMANCE REQUIREMENTS

A. Delegated Design: Design trapeze pipe hangers and equipment supports, including comprehensive engineering analysis by a qualified professional engineer, using performance requirements and design criteria indicated.

B. Structural Performance: Hangers and supports for HVAC piping and equipment shall withstand the effects of gravity loads and stresses within limits and under conditions indicated according to ASCE/SEI 7.
   1. Design supports for multiple pipes, including pipe stands, capable of supporting combined weight of supported systems, system contents, and test water.
   2. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.
   3. Design seismic-restraint hangers and supports for piping and equipment.

C. Firestopping Materials: Comply with requirements of Section 078400.

D. Seismic applications listed within SMACNA that are not usable within a given structure, shall be resolved through engineered adaptations or alteration. Whenever possible these adaptations or alternations shall use SMACNA approved components, to maintain compliance and uniformity with SMACNA's engineering standards and design principles. In all cases, and prior to installation, these adaptations or alternations shall be engineered in accordance with standard engineering practices by a qualified, registered structural engineer, and shall be submitted to project structural engineer and mechanical engineer for their review and approval.

1.5 SUBMITTALS

A. Section 013300 - Submittal Procedures: Submittal procedures.

B. Action Submittals:
   1. Shop Drawings: Indicate system layout with location including critical dimensions, sizes, and pipe hanger and support locations and detail of trapeze hangers.
   2. Product Data: Submit manufacturers catalog data including load capacity for all hangers, supports, stands, rods, and structural channel products.
   3. Design Data: Indicate load carrying capacity of trapeze, multiple pipe, and riser support hangers. Indicate calculations used to determine load carrying capacity of trapeze, multiple pipe, and riser support hangers. Submit sizing methods sealed by a registered professional engineer.
   4. Manufacturer's Installation Instructions:
      a. Hangers and Supports: Submit special procedures and assembly of components.
      b. Firestopping: Submit preparation and installation instructions.
   5. Manufacturer's Certificate: Certify products meet or exceed specified requirements.

C. Informational Submittals:
   1. Welding Certificates.
   2. Operational and Maintenance Data for all products installed.

1.6 QUALIFICATIONS

A. Manufacturer: Company specializing in manufacturing Products specified in this section with minimum three years documented experience.

B. Installer: Company specializing in performing Work of this section with minimum three years documented experience or as approved by manufacturer.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Section 016000 - Product Requirements: Requirements for transporting, handling, storing, and protecting products.

B. Accept materials on site in original factory packaging, labeled with manufacturer's identification.

C. Protect from weather and construction traffic, dirt, water, chemical, and damage, by storing in original packaging.

1.8 ENVIRONMENTAL REQUIREMENTS

A. Section 016000 - Product Requirements: Environmental conditions affecting products on site.

B. Provide ventilation in areas to receive solvent cured materials.

1.9 FIELD MEASUREMENTS

A. Verify field measurements prior to fabrication.

PART 2 PRODUCTS

2.1 PIPE HANGERS AND SUPPORTS

A. Acceptable Manufacturers: Acceptable Manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review.
   1. Anvil International
   2. B-Line Systems
   3. Empire Industries, Inc.
   4. ERICO/Michigan Hanger Co.
   5. Globe Pipe Hanger Products
   6. Grinnel Corp.
   7. Hilti
   8. National Pipe Hanger Corp.
   9. PHD Manufacturing, Inc.

B. General Descriptions:

1. Carbon-Steel Pipe Hangers and Supports
    a. Factory fabricated, galvanized Carbon-steel MSS SP-58, Types 1 through 58, pipe hangers.
    b. Plastic Coated, Jacketed, or lined as required.
    c. Padded with fiberglass or other pipe insulation pad or cushioning to support bearing surface of piping.
2. Saddles:
    a. Galvanized steel, 180 degree shaped, marked with insulation outside diameter.
    b. Standard manufacturer's size to correspond to insulated pipe size.
3. Copper Pipe Hangers
    a. Factory fabricated, copper-coated-steel MSS SP-58, Types 1 through 58
4. Trapeze Pipe Hangers:
    a. Shop or Field Fabricated pipe support assembly compliant with MSS SP-69, Type 59, made rom structural carbon steel shapes and hanger rods, nuts, saddles, and U-Bolts compliant with MSS SP-58.

C. Refrigerant Piping Hangers:
1. Conform to ASME B31.5, ASTM F708, MSS SP58, MSS SP69, and MSS SP89.
2. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Carbon steel, adjustable swivel, split ring.
3. Hangers for Pipe Sizes 2 inch and Larger: Carbon steel, adjustable, clevis.
4. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods or approved structural strut product.
5. Wall Support for Pipe Sizes 3 inch and Smaller: Cast iron hook.
6. Wall Support for Pipe Sizes 4 inch and Larger: Welded steel bracket and wrought steel clamp.
7. Vertical Support: Steel riser clamp.
8. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
9. Copper Pipe Support: Copper-plated carbon-steel ring.

2.2 PIPE STANDS

A. General Description: Shop or field fabricated assemblies made of corrosion resistant components to support roof or ground mounted piping.

B. Low-type, Single-Pipe Stand: One-piece plastic, stainless steel, or rubber base unit with a plastic roller for installation on a roof without penetrating the membrane. Include roof pads between stand and membrane.

C. High-Type, Single- or Multiple-Pipe Stands: Base or Assembly of bases, vertical and horizontal members, pipe supports, and pipe support accessories for hanging or setting pipe on a roof without penetrating a membrane.
1. Plastic, stainless steel, or rubber base, one or more.
2. Two or more vertical structural steel or channel, protectively coated.
3. Two or more horizontal structural steel or channel, protectively coated.
4. Pipe supports set on top of bottom horizontal member or hung from top horizontal member.

D. Curb Mounted Stands: Shop- or Field-fabricated pipe supports made from structural steel or channel, threaded rods, rollers, and other pipe hangers and accessories, mounted on a permanent, stationary roof curb.

2.3 PIPE SUPPORT ACCESSORIES

A. Hanger Rods: Mild steel threaded both ends, threaded on one end, or continuous threaded.

B. Thermal Shield Inserts
   1. Cold Pipe: ASTM C 552 Type II Cellular glass with 100-PSIG or ASTM C 591, Type VI Grade I polyisocyanurate with 125 PSIG minimum compressive strength vapor barrier.
   2. Hot Pipe: Water repellant treated, ASTM C 533, Type I Calcium silicate with 100-PSIG ASTM C 552, Type II cellular glass with 100 PSIG, or ASTM C 591, Type VI, Grade I, polyisocyanurate with 125-PSIG minimum compressive strength.
   3. Metal shield shall cover lower 180 degrees of pipe in clevis and band hangers, full pipe circumference for pipe in trapeze and clamp hangers.
   4. Insert shall extend a minimum of 2 inches beyond shield metal shield.

2.4 FLASHING

A. Metal Flashing: Minimum 26 gage thick galvanized steel unless otherwise indicated by the Architectural specifications and details.

B. Metal Counterflashing: Minimum 22 gage thick galvanized steel unless otherwise indicated by the Architectural specifications and details.

C. Flexible Flashing: Minimum 47 mil thick sheet unless otherwise indicated by the Architectural specifications and details, compatible with roofing.

D. Caps: Steel, minimum thickness 22 gage minimum; minimum thickness 16 gage at fire resistant elements.

2.5 EQUIPMENT CURBS

A. Acceptable Manufacturers: To all feasible extents, utilize the equipment manufacture’s curbs. When a third-party curb is required, then select from the Acceptable Manufacturers listed below. Other manufacturers of equivalent products may be submitted for review.
   1. LM Curbs
   2. Metal Form Manufacturing
   3. Pate Company
   4. Roof Products, Inc.

B. Fabrication: Welded 18 gage galvanized steel shell and base, mitered 3 inch cant, minimum 1-inch insulation, glued and pinned.

2.6 FORMED STEEL CHANNEL

A. Acceptable Manufacturers: Acceptable Manufacturers are listed below. Other manufacturers of equivalent products may be submitted for review.
   1. Unistrut
   2. B-line by Eaton

3. Hilti

B. Product Description: Galvanized 12 gage thick steel with holes at regular intervals, 2-inch or less, on center.

2.7 FIRESTOPPING

A. Firestopping Materials: Comply with requirements of Section 078400.

PART 3 EXECUTION

3.1 EXAMINATION

A. Section 013000 - Administrative Requirements: Verification of existing conditions before starting work.

B. Verify openings are ready to receive sleeves.

C. Verify openings are ready to receive firestopping.

3.2 PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other matter affecting bond of firestopping material.

B. Remove incompatible materials affecting bond.

C. Install damming materials to arrest liquid material leakage.

D. Obtain permission from Architect/Engineer before using powder-actuated anchors.

E. Do not drill or cut structural members.

3.3 INSTALLATION - INSERTS

A. Install inserts for placement in concrete forms.

B. Install inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

C. Provide hooked rod to concrete reinforcement section for inserts carrying pipe 4 inch (100 mm) and larger.

D. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.

E. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut recessed into and grouted flush with slab.

3.4 INSTALLATION - PIPE HANGERS AND SUPPORTS

A. Install in accordance with the same ASME B31 section as listed in common requirements, ASTM F708, MSS SP 58, MSS SP 69, and MSS SP 89.

B. Support horizontal piping as scheduled.

C. Install hangers with minimum 1/2 inch space between finished covering and adjacent work.

D. Place hangers within 12 inches of each horizontal elbow.

E. Use hangers with 1-1/2 inch minimum vertical adjustment.

F. Support vertical piping at every floor.

G. Where piping is installed in parallel and at same elevation, provide multiple pipe or trapeze hangers.

H. Support riser piping independently of connected horizontal piping.

I. Provide copper plated hangers and supports for copper piping.

J. Design hangers for pipe movement without disengagement of supported pipe.

K. Install hangers and supports to allow controlled thermal and seismic movement of piping systems, to permit freedom of movement between pipe anchors, and to facilitate action of expansion joints, expansion loops, expansion bends, and similar units.

L. Install lateral bracing with pipe hangers and supports to prevent swaying.

M. Prime coat exposed steel hangers and supports. Refer to Section 099000. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.

N. Pipe Stand Installation
   1. Pipe stand types except Curb-Mounted Type: Assemble components and mount on smooth roof surface. Do not penetrate roof membrane.
   2. Curb-Mounted-Type Pipe Stands: Assemble components or fabricate pipe stands and mount on permanent, stationary roof curb.

3.5 INSTALLATION - EQUIPMENT BASES AND SUPPORTS

A. Provide housekeeping pads of concrete, minimum 4-inch-thick and extending 6 inches beyond supported equipment.

B. Using templates furnished with equipment, install anchor bolts, and accessories for mounting and anchoring equipment.

C. Construct supports of steel members or formed steel channel. Brace and fasten with flanges bolted to structure.

D. Provide rigid anchors for pipes after vibration isolation components are installed.

3.6 INSTALLATION - FLASHING

A. Refer to Architectural specifications for Flashing and Waterproofing. When Architectural sections do not explicitly state requirements:
   1. Provide flexible flashing and metal Counterflashing where piping and ductwork penetrate weather or waterproofed walls, floors, and roofs.

2. Provide acoustical lead flashing around ducts and pipes penetrating equipment rooms for sound control.
3. Provide curbs for roof installations 14 inch minimum high above roofing surface. Flash and counter-flash with sheet metal; seal watertight. Attach Counterflashing to equipment and lap base flashing on roof curbs. Flatten and solder joints.
4. Adjust storm collars tight to pipe with bolts; caulk around top edge. Use storm collars above roof jacks. Screw vertical flange section to face of curb.

3.7 FIELD QUALITY CONTROL

A. Section 014000 - Quality Requirements: Requirements for inspecting, testing.

B. Section 017000 - Execution and Closeout Requirements: Requirements for testing, adjusting, and balancing.

C. Inspect installed firestopping for compliance with specifications and submitted schedule.

3.8 CLEANING

A. Section 017000 - Execution and Closeout Requirements: Requirements for cleaning.

B. Clean adjacent surfaces of firestopping materials.

3.9 PROTECTION OF FINISHED WORK

A. Section 017000 - Execution and Closeout Requirements: Requirements for protecting finished Work.

B. Protect adjacent surfaces from damage by material installation.

3.10 SCHEDULES

A. Copper Tube Hanger Spacing:
   1. Pipe Size 1-1/4 Inch and smaller:
      a. Maximum Horizontal Hanger Spacing: 6 feet.
      b. Maximum Vertical Spacing: 10 feet or at each floor penetration.
      c. Hanger Rod Diameter: 3/8 inch.
   2. Pipe Size 1-1/2 Inch and larger
      a. Maximum Horizontal Hanger Spacing: 10 feet.
      b. Maximum Vertical Spacing: 10 feet or at each floor penetration.
      c. Hanger Rod Diameter: 1/2 inch.

B. Steel Pipe Hanger Spacing:
   1. Pipe Size 3 inch and smaller:
      a. Maximum Horizontal Hanger Spacing: 10 feet.
      b. Maximum Vertical Spacing: 15 feet or at each floor penetration.
      c. Minimum Hanger Rod Diameter: 1/2 inch.
   2. Pipe Size over 3 inch and under 6 inch:
      a. Maximum Horizontal Hanger Spacing: 12 feet.
      b. Maximum Vertical Spacing: 15 feet or at each floor penetration.

c. Minimum Hanger Rod Diameter: 5/8 inch.

3. Pipe Size 6 inch and over but and under 10 inch:
   a. Maximum Hanger Spacing: 12 feet.
   b. Maximum Horizontal Vertical Spacing: 15 feet or at each floor penetration.
   c. Minimum Hanger Rod Diameter: 3/4 inch.
4. Pipe Size 10 inch and over but under 14 inch:
   a. Maximum Hanger Spacing: 12 feet.
   b. Maximum Horizontal Vertical Spacing: 15 feet or at each floor penetration.
   c. Minimum Hanger Rod Diameter: 7/8 inch.
5. Pipe Size 14 inch and over but under 20 inch:
   a. Maximum Hanger Spacing: 12 feet.
   b. Maximum Horizontal Vertical Spacing: 15 feet or at each floor penetration.
   c. Minimum Hanger Rod Diameter: 1 inch.

C. Plastic Pipe Hanger Spacing:
1. Pipe Material: ABS.
   a. Maximum Horizontal Hanger Spacing: 4 feet.
   b. Maximum Vertical Support Spacing: 10 feet or at each floor penetration.
   c. Minimum Hanger Rod Diameter: 1/2 inch.
2. Pipe Material: FRP.
   a. Maximum Horizontal Hanger Spacing: 4 feet.
   b. Maximum Vertical Support Spacing: 10 feet or at each floor penetration.
   c. Minimum Hanger Rod Diameter: 1/2 inch.
3. Pipe Material: PVC.
   a. Maximum Horizontal Hanger Spacing: 4 feet.
   b. Maximum Vertical Support Spacing: 10 feet or at each floor penetration.
   c. Minimum Hanger Rod Diameter: 1/2 inch.

SECTION 23 05 48.13
VIBRATION CONTROLS FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section includes vibration isolation devices for HVAC.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product.
      a. Include rated load, rated deflection, and overload capacity for each vibration isolation device.
      b. Illustrate and indicate style, material, strength, fastening provision, and finish for each type and size of vibration isolation device type required.
   2. Shop Drawings:
      a. Detail fabrication and assembly of equipment bases. Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
      b. Vibration Isolation Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment. Include adjustable motor bases, rails, and frames for equipment mounting.
   3. Delegated-Design Submittal: For each vibration isolation device.
      a. Include design calculations for selecting vibration isolators and for designing vibration isolation bases.

B. Informational Submittals:
   1. Coordination Drawings: Show coordination of vibration isolation device installation for HVAC piping and equipment with other systems and equipment in the vicinity, including other supports and restraints, if any.
   2. Qualification Data: For testing agency.
   3. Welding certificates.

1.3 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

PART 2 PRODUCTS

2.1 ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Kinetics Noise Control, Inc.
b. Mason Industries, Inc.
c. Novia; A Division of C&P.

2. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
3. Size: Factory or field cut to match requirements of supported equipment.
4. Pad Material: Oil and water resistant with elastomeric properties.
5. Surface Pattern: Smooth, ribbed, or waffle pattern.
6. Infused nonwoven cotton or synthetic fibers.
7. Load-bearing metal plates adhered to pads.
8. Sandwich-Core Material: Resilient.

2.2 ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
a. Kinetics Noise Control, Inc.
b. Mason Industries, Inc.
c. Novia; A Division of C&P.
2. Mounting Plates:
a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs or bolts.
b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
3. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.3 RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
a. Kinetics Noise Control, Inc.
b. Mason Industries, Inc.
c. Novia; A Division of C&P.
2. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
a. Housing: Cast-ductile iron or welded steel.
b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.4 OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
    a. Kinetics Noise Control, Inc.
    b. Mason Industries, Inc.
    c. Novia; A Division of C&P.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
7. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.5 HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
    a. Kinetics Noise Control, Inc.
    b. Mason Industries, Inc.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
6. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Top housing with attachment and leveling bolt.

2.6 RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
    a. Kinetics Noise Control, Inc.
    b. Mason Industries, Inc.
    c. Novia; A Division of C&P.
2. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.

a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
b. Top plate with threaded mounting holes.
c. Internal leveling bolt that acts as blocking during installation.

3. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
4. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
5. Minimum Additional Travel: 50 percent of the required deflection at rated load.
6. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
7. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.7 HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   a. Kinetics Noise Control, Inc.
   b. Mason Industries, Inc.
2. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
   a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
   b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.8 PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene.

1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
2. Maximum Load Per Support: 500 psig isolation material providing equal isolation in all directions.

2.9 RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch-thick neoprene.

1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.10 ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
      a. Kinetics Noise Control, Inc.
      b. Mason Industries, Inc.
      c. Novia; A Division of C&P.
   2. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
   3. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.11 SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
      a. Kinetics Noise Control, Inc.
      b. Mason Industries, Inc.
      c. Novia; A Division of C&P.
   2. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
   3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
   4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
   5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
   6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
   7. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.
   8. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
   9. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.12 VIBRATION ISOLATION EQUIPMENT BASES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Kinetics Noise Control, Inc.
   2. Mason Industries, Inc.
   3. Novia; A Division of C&P.

B. Steel Rails: Factory-fabricated, welded, structural-steel rails.
   1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide rails. Include supports for suction and discharge elbows for pumps.
   2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Rails shall have shape to accommodate supported equipment.
   3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

C. Steel Bases: Factory-fabricated, welded, structural-steel bases and rails.
   1. Design Requirements: Lowest possible mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
   2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
   3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.

D. Concrete Inertia Base: Factory-fabricated or field-fabricated, welded, structural-steel bases and rails ready for placement of cast-in-place concrete.
   1. Design Requirements: Low mounting height with not less than 1-inch clearance above the floor. Include equipment anchor bolts and auxiliary motor slide bases or rails. Include supports for suction and discharge elbows for pumps.
   2. Structural Steel: Steel shapes, plates, and bars complying with ASTM A 36/A 36M. Bases shall have shape to accommodate supported equipment.
   3. Support Brackets: Factory-welded steel brackets on frame for outrigger isolation mountings and to provide for anchor bolts and equipment support.
   4. Fabrication: Fabricate steel templates to hold equipment anchor-bolt sleeves and anchors in place during placement of concrete. Obtain anchor-bolt templates from supported equipment manufacturer.

2.13 RESTRAINED ISOLATION ROOF-CURB RAILS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Kinetics Noise Control, Inc.
   2. Mason Industries, Inc.
   3. Novia; A Division of C&P.
   4. Pate Company, The.
   5. Thybar Corporation.

B. Description: Factory-assembled, fully enclosed, insulated, air- and watertight curb rail designed to resiliently support equipment and to withstand seismic and wind forces.

C. Upper Frame: The upper frame shall provide continuous support for equipment and shall be captive to resiliently resist seismic and wind forces.

D. Lower Support Assembly: The lower support assembly shall be formed sheet metal section containing adjustable and removable steel springs that support the upper frame. The lower support assembly shall have a means for attaching to building structure and a wood nailer for attaching roof materials, and shall be insulated with a minimum of 2 inches of rigid, glass-fiber insulation on inside of assembly. Adjustable, restrained-spring isolators shall be mounted on elastomeric vibration isolation pads and shall have access ports, for level adjustment, with removable waterproof covers at all isolator locations. Isolators shall be located so they are accessible for adjustment at any time during the life of the installation without interfering with the integrity of the roof.

E. Snubber Bushings: All-directional, elastomeric snubber bushings at least 1/4 inch thick.

F. Water Seal: Galvanized sheet metal with EPDM seals at corners, attached to upper support frame, extending down past wood nailer of lower support assembly, and counter flashed over roof materials.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas and equipment to receive vibration isolation control devices for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in of reinforcement and cast-in-place anchors to verify actual locations before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 VIBRATION CONTROL DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 3 Sections.

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

3.3 VIBRATION ISOLATION EQUIPMENT BASES INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Division 3 Sections.

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Balancing air systems.

1.2 DEFINITIONS

A. AABC: Associated Air Balance Council.

B. NEBB: National Environmental Balancing Bureau.

C. TAB: Testing, adjusting, and balancing.

D. TAB Specialist: An entity engaged to perform TAB Work.

1.3 SUBMITTALS

A. Action Submittals:
   1. Certified TAB reports.

B. Informational Submittals:
   1. Qualification Data: Within 30 days of Contractor's Notice to Proceed, submit documentation that the TAB contractor and this Project's TAB team members meet the qualifications specified in "Quality Assurance" Article.
   2. Contract Documents Examination Report: Within 45 days of Contractor's Notice to Proceed, submit the Contract Documents review report as specified in Part 3.
   3. Strategies and Procedures Plan: Within 60 days of Contractor's Notice to Proceed, submit TAB strategies and step-by-step procedures as specified in "Preparation" Article.

1.4 QUALITY ASSURANCE

A. TAB Contractor Qualifications: Engage a TAB entity certified by AABC or NEBB.
   1. TAB Field Supervisor: Employee of the TAB contractor and certified by AABC or NEBB.
   2. TAB Technician: Employee of the TAB contractor and certified by AABC or NEBB as a TAB technician.

B. Certify TAB field data reports and perform the following:
   1. Review field data reports to validate accuracy of data and to prepare certified TAB reports.
   2. Certify that the TAB team complied with the approved TAB plan and the procedures specified and referenced in this Specification.

C. TAB Report Forms: Use standard AABC or NEBB TAB forms.

D. Instrumentation Type, Quantity, Accuracy, and Calibration: As described in ASHRAE 111, Section 5, "Instrumentation."

1.5 COORDINATION

A. Notice: Provide at least seven days' notice before each test. Include scheduled test dates and times.

B. Perform TAB after leakage and pressure tests on air and water distribution systems have been satisfactorily completed.

1.6 HVAC CONTRACTOR RESPONSIBILITIES

A. Provide TAB agency one complete set of contract documents, change orders, and approved submittals in digital pdf format.

B. Control contractor shall provide required BAS hardware, software, personnel, and assistance to TAB agency as required for TAB agency to balance the systems. Control contractor shall also provide trending reports as needed to demonstrate that systems are complete.

C. Coordinate meetings and assistance from suppliers and contractors as required by TAB agency.

D. Provide additional valves, dampers, sheaves and belts as required by TAB agency.

E. Flag all manual volume dampers with high-visibility tape.

F. Provide access to all dampers, valves, test ports, nameplates, and other appurtenances as required by TAB agency.

G. Remove and replace or repair insulation as needed to provide access for the TAB work.

H. Have the HVAC systems at complete operational readiness before TAB begins.

I. Promptly correct deficiencies identified during TAB.

J. Maintain a construction schedule that allows the TAB agency to complete work prior to occupancy.

PART 2 PRODUCTS (NOT APPLICABLE)

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine the Contract Documents to become familiar with Project requirements and to discover conditions in systems' designs that may preclude proper TAB of systems and equipment.

B. Examine systems for installed balancing devices, such as test ports, gage cocks, thermometer wells, flow-control devices, balancing valves and fittings, and manual volume dampers. Verify that these balancing devices are accessible.

C. Examine the approved submittals for HVAC systems and equipment.

D. Examine design data including HVAC system descriptions, statements of design assumptions for environmental conditions and systems' output, and statements of philosophies and assumptions about HVAC systems and equipment controls.

E. Examine ceiling plenums and underfloor air plenums used for supply, return, or relief air to verify that they are properly separated from adjacent areas. Verify that penetrations in plenums are sealed (and fire-stopped if required).

F. Examine equipment performance data including fan and pump curves.
   1. Relate performance data to Project conditions and requirements, including system effects that can create undesired or unpredicted conditions that might cause reduced capacities.
   2. Calculate system-effect factors to reduce performance ratings of HVAC equipment under actual installed conditions. Use tables and charts in AMCA 201, "Fans and Systems" or in SMACNA "HVAC Systems - Duct Design." Compare results with the design data and installed conditions.

G. Examine system and equipment installations and verify that field quality-control testing, cleaning, and adjusting specified in individual Sections have been performed.

H. Examine test reports specified in individual system and equipment Sections.

I. Examine HVAC equipment and filters and verify that bearings are greased, belts are aligned and tight, clean filters are installed, and equipment with functioning controls is ready for operation.

J. Examine terminal units, verifying that they are accessible and that their controls are connected, configured by the control contractor, and functioning.

K. Examine two-way control valves for proper installation and function.

L. Examine three-way valves for proper installation for their intended uses of diverting or mixing fluid flows and for proper function.

M. Examine all equipment items to verify correct piping arrangements.

N. Examine heat-transfer coils for correct piping connections and for clean and properly-spaced fins.

O. Report deficiencies discovered before and during performance of TAB procedures. Observe and record system reactions to changes in conditions. Record default set points if different from indicated values.

3.2 PREPARATION

A. Prepare a TAB plan that includes:
   1. Equipment and systems to be tested.
   2. Strategies and step-by-step procedures for balancing the systems.
   3. Instrumentation to be used.
   4. Sample forms with specific identification for each equipment item.

B. Complete system-readiness checks and prepare reports. Verify the following:
   1. General:
      a. Electrical power wiring is complete.

b. Control systems are operational.
c. Access is provided to balancing and control devices.
d. Variable frequency drive start-up procedures are complete.
e. Safety devices are operational and indicating normal status.

2. Air Side:
   a. Ductwork is complete with air terminals installed.
   b. Balance, fire, and smoke dampers are open and operational.
   c. Control dampers are in their normal (fail) positions.
   d. Equipment and duct access doors are securely closed.
   e. Clean filters are installed.
   f. Fans are operating and rotating in correct directions.
   g. Fan vibration levels are within tolerance limits.
   h. Building envelope is complete, and exterior windows and doors are closed.

3. Hydronics:
   a. Piping is complete with all terminal units installed.
   b. Systems are flushed, filled, and purged of free air.
   c. Strainers are clean, and startup strainer screens are removed.
   d. Water treatment is complete.
   e. Isolation and balance valves are open and operational. Drain valves are closed.
   f. Control valves are in their normal (fail) positions.
   g. Pumps are operating and rotating in correct directions.
   h. Pump vibration levels are within tolerance limits.

3.3 GENERAL PROCEDURES FOR TESTING AND BALANCING

A. Perform testing and balancing procedures on each system according to the procedures contained in AABC "National Standards for Total System Balance" or NEBB "Procedural Standards for Testing, Adjusting, and Balancing of Environmental Systems" and in this Section.

B. Cut insulation, ducts, pipes, and equipment cabinets for installation of test probes to the minimum extent necessary for TAB procedures.
   1. After testing and balancing, install test ports and duct access doors that comply with requirements in Division 23 Section "Air Duct Accessories."
   2. Install new insulation where insulation is removed for TAB to match removed materials. Restore insulation, coverings, vapor barrier, and finish.

C. Mark equipment and balancing devices, including damper-control positions, valve position indicators, fan-speed-control devices, and similar controls and devices, with paint or other suitable, permanent identification material to show final settings.

D. Take and report testing and balancing measurements in inch-pound (IP) units.

3.4 GENERAL PROCEDURES FOR BALANCING AIR SYSTEMS

A. Prepare test reports for both fans and outlets. Obtain manufacturer's outlet factors and recommended testing procedures. Crosscheck the summation of required outlet volumes with required fan volumes.

B. Prepare schematic diagrams of system "as-built" duct layouts with all components identified.

C. For variable-air-volume systems, develop a plan to simulate diversity.

D. Determine the best locations in main and branch ducts for accurate duct-airflow measurements.

E. Locate start-stop and disconnect switches, electrical interlocks, and motor starters.

F. Verify that motor starters are equipped with properly sized thermal protection.

G. Check condensate drains for proper connections and function.

H. Check for proper sealing of air-handling-unit components.

3.5 PROCEDURES FOR CONSTANT-VOLUME AND VARIABLE-VOLUME AIR SYSTEMS

A. Adjust fans to deliver total indicated airflows within the maximum allowable fan speed listed by fan manufacturer.
   1. Measure total airflow as follows:
      a. Set outdoor air, return air, and relief air dampers for proper positions that simulate minimum outdoor air conditions.
      b. Where conditions allow, measure airflow by Pitot-tube traverse. If necessary, perform multiple Pitot-tube traverses to obtain total airflow.
      c. Where conditions are not suitable for duct Pitot-tube traverse measurements, a coil traverse may be acceptable.
   2. Where sufficient space is unavailable for Pitot-tube traverse measurements, measure airflow at terminal outlets and inlets and calculate the total airflow. Measure fan static pressures as follows:
      a. Measure outlet static pressure as far downstream from the fan as practical and upstream from restrictions in ducts such as elbows and transitions.
      b. Measure static pressure directly at the fan outlet or through the discharge flexible connection.
      c. Measure inlet static pressure of single-inlet fan at the fan inlet or through the inlet flexible connection.
      d. Measure inlet static pressure of double-inlet fan through the wall of the plenum that houses the fan or through the inlet flexible connections.
   3. Measure static pressure across each component that makes up the air-handling unit, rooftop unit, or other air-handling equipment. Report the cleanliness status of filters and the time static pressures are measured. Measure static pressures entering and leaving other devices, such as sound traps, heat-recovery equipment, and air washers, under final balanced conditions.
   4. Adjust fan speed higher or lower than indicated speed as needed to achieve indicated air-handling-unit performance.
   5. Do not make fan-speed adjustments that result in motor overload. Consult equipment manufacturers about fan-speed safety factors. Modulate dampers and measure fan-motor amperage to ensure that no overload will occur. Measure amperage in full-cooling, full-heating, economizer, and any other operating mode to determine the maximum required brake horsepower.

B. Adjust volume dampers for ducts to indicated airflows within specified tolerances.
   1. Measure airflows of branch ducts.
   2. Adjust branch duct balance dampers for specified airflows.
   3. Re-measure each branch duct after all have been adjusted.

C. Adjust air outlets and inlets for each space to indicated airflows.
   1. Adjust each outlet in same room or space to indicated quantities without generating noise levels above the limitations prescribed by the Contract Documents.
   2. Adjust patterns of adjustable outlets for proper distribution without drafts.
   3. Measure airflows at all inlets and outlets.
   4. Adjust each inlet and outlet for specified airflow.
   5. Re-measure each inlet and outlet after all have been adjusted.

D. Verify final system conditions.
   1. Re-measure and confirm minimum outdoor air, return air, and relief air flow rates are within design tolerances. Readjust as necessary.
   2. Re-measure and confirm total airflow is within design tolerance.
   3. Re-measure all final fan operating data. Include fan speeds, motor voltages, motor amperages, and static profiles.
   4. Mark all final settings.
   5. Test system in economizer mode. Verify proper operation; adjust if necessary. Measure and record all operating data.
   6. Record final performance data.

3.6 ADDITIONAL PROCEDURES FOR VARIABLE- VOLUME AIR SYSTEMS

A. Variable-Air-Volume Systems: Adjust the variable-air-volume systems as follows:
   1. Set outdoor-air dampers at minimum, and set return- and exhaust-air dampers at a position that simulates full-cooling load.
   2. Verify that the duct static pressure sensors are installed and controlling the system.
   3. Select the terminal unit that is most critical to the supply-fan airflow and static pressure. Measure inlet static pressure. Adjust system static pressure so the entering static pressure for the critical terminal unit is not less than the sum of the terminal-unit manufacturer's recommended minimum inlet static pressure plus the static pressure needed to overcome terminal-unit discharge system losses.
   4. Calibrate and balance each terminal unit for maximum and minimum design airflow as follows:
      a. Adjust controls so terminal unit is calling for maximum airflow. Measure airflow and adjust calibration factor as required for design maximum airflow. Record calibration factor. When maximum airflow is correct, balance the air outlets downstream from the terminal unit.
      b. Adjust controls so terminal is calling for minimum airflow. Measure airflow and adjust calibration factor as required for design minimum airflow. Record calibration factor. Note any deviation from design airflow.
   5. After all terminal units have been calibrated and balanced, test and adjust system for total airflow. Adjust fans to deliver total design airflows within the maximum allowable fan speed listed by the fan manufacturer.
      a. Set outdoor air, return air, and relief air dampers for proper position that simulates minimum outdoor air conditions.
      b. Set terminals for maximum airflow. If system design includes diversity, adjust terminals for maximum and minimum airflows so connected total matches fan selection and simulates actual load in the building.
   6. Measure fan static pressure. Report any artificial loading of filters at the time static pressures are measured.

7. Set final return and outdoor airflow rates to the fan while operating at maximum return airflow and minimum outdoor airflow.
    a. Balance the return air ducts and inlets as described for constant-volume air systems.
    b. Verify all terminal units are meeting design airflow rates under system maximum airflow conditions.
8. Re-measure the inlet static pressure at the most critical air terminal unit and adjust the system static pressure setpoint to the most energy-efficient setpoint to maintain optimum system static pressure. Record setpoint.
9. Re-measure the final system conditions as follows:
    a. Re-measure and confirm minimum outdoor air, return air, and relief air flow rates are within design parameters. Readjust to design if necessary.
    b. Re-measure and confirm total airflow rates are within design parameters.
    c. Re-measure all final fan operating data.
    d. Mark all final settings.
    e. Test system in economizer mode. Verify proper operation and adjust, if necessary. Measure and record all operating data.
    f. Verify tracking between supply and return fans.
    g. Record final performance data.

3.7 TOLERANCES

A. Set HVAC system's air flow rates and water flow rates within the following tolerances:
1. Supply, Return, and Exhaust Fans and Other Equipment with Fans: Plus or minus 5 percent.
2. Air Outlets and Inlets: Plus or minus 10 percent.

3.8 FINAL REPORT

A. General: Prepare a certified written report; tabulate and divide the report into a separate section for each tested and balanced system. Provide a final report that is a complete record of the HVAC system performance, including conditions of operation, any outstanding items, and any deviations found during the testing and balancing process. The final report is to provide a reference of actual operating conditions for the owner and operations personnel. All measurements and test results that appear in the report must be made on site and dated by the responsible technician or test and balance engineer.

B. As a minimum the report shall include the following information:
1. Title page, including:
    a. TAB company name, address, and telephone number.
    b. Project name, client, identification number, and location.
    c. Project architectural firm, address, and telephone number.
    d. Project HVAC engineering firm, address, and telephone number.
    e. Project HVAC contracting firm, address, and telephone number.
    f. TAB certification statement.
    g. Test and balance engineer name, signature, and certification number.
    h. Report date.
2. Table of contents.
3. TAB national performance guarantee.

4. Report summary, including:
    a. List of items that do not meet specified tolerances.
    b. Information that may be considered in resolving deficiencies.
5. Instrument list, including:
    a. Type.
    b. Manufacturer.
    c. Model.
    d. Serial number.
    e. Calibration date.

C. TAB test data for all systems included in the Work.

3.9 INSPECTIONS

A. Initial Inspection:
1. After testing and balancing are complete, operate each system and randomly check measurements to verify that the system is operating according to the final test and balance readings documented in the final report.
2. Check the following for each system:
    a. Measure airflow of at least 10 percent of air outlets.
    b. Measure room temperature at each thermostat or temperature sensor. Compare the reading to the set point.
    c. Verify that balancing devices are marked with final balance positions.
    d. Note deviations from the Contract Documents in the final report.

B. Final Inspection:
1. After initial inspection is complete and documentation by random checks verifies that testing and balancing are complete and accurately documented in the final report, request that a final inspection be made by Owner’s Representative.
2. The TAB contractor's test and balance engineer shall conduct the inspection in the presence of Owner’s Representative.
3. Owner’s Representative shall randomly select measurements, documented in the final report, to be rechecked. Rechecking shall be limited to 10 percent of the total measurements recorded.
4. If rechecks yield measurements that differ from the measurements documented in the final report by more than the tolerances allowed, the measurements shall be noted as "FAILED."
5. If the number of "FAILED" measurements is greater than 10 percent of the total measurements checked during the final inspection, the testing and balancing shall be considered incomplete and shall be rejected.

C. TAB Work will be considered defective if it does not pass final inspections. If TAB Work fails, proceed as follows:
1. Recheck all measurements and adjust. Revise the final report and balancing device settings to include all changes; resubmit the final report and request a second final inspection.
2. If the second final inspection also fails, Owner may contract the services of another TAB contractor to complete TAB Work according to the Contract Documents and deduct the cost of the services from the original TAB contractor's payment.

D. Prepare test and inspection reports.

3.10 SCHEDULE

A. Provide hydronic and air balancing for each of the following equipment items as part of this work. Note that listing an item of equipment includes any motors, valves, dampers, and filters associated with that equipment:
   1. Control valves
   2. Control dampers
   3. Air outlets and inlets
   4. Power and Gravity ventilators
      a. Exhaust fans
      b. Intake / Exhaust louvers
   5. Split Systems
   6. Fan coil units

SECTION 23 07 13
HVAC DUCT INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes duct insulation and appurtenances.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory- and field-applied if any).

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

B. Protection: Do not permit mineral fiber insulation to get wet. Mineral fiber insulation that is or has been wet shall be removed from the project site.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields.

B. Coordinate clearance requirements with duct Installer for duct insulation application. Establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. 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.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type II for sheet materials.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
      a. Aeroflex USA, Inc.
      b. Armacell LLC.
      c. K-Flex USA.
   2. Properties:
      a. Maximum Operating Temperature: 180 deg F.
      b. Minimum Operating Temperature: -70 deg F.
      c. Maximum Thermal Conductivity at 75 deg F Mean Temperature: 0.245 Btu-in/hr-ft2-deg F.
      d. Maximum Water Vapor Permeability Thickness 1 Inch or Less: 0.05 perm-inches.
      e. Maximum Water Absorption by Volume: 0.2%.

F. Mineral-Fiber Blanket Insulation: Mineral or glass fibers bonded with a thermosetting resin in a flexible blanket. Comply with ASTM C 553, Type II and ASTM C 1290, Type III with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
      a. CertainTeed Corp.; SoftTouch Duct Wrap.
      b. Johns Manville; Microlite.
      c. Knauf Insulation; Atmosphere Duct Wrap.
      d. Manson Insulation Inc.; Alley Wrap.
      e. Owens Corning; SOFTR Duct Wrap FRK.
   2. Properties:
      a. Maximum Operating Temperature: 250 deg F.
      b. Maximum Compressed Thermal Conductivity at 75 deg F Mean Temperature:
         1) Density 0.75 PCF: 0.29 Btu-in/hr-ft2-deg F.
         2) Density 1.0 PCF: 0.27 Btu-in/hr-ft2-deg F.
         3) Density 1.5 PCF: 0.24 Btu-in/hr-ft2-deg F.

G. Mineral-Fiber Board Insulation: Mineral or glass fibers bonded with a thermosetting resin in a semi-rigid board. Comply with ASTM C 612, Type IA or Type IB. For duct and plenum applications, provide insulation with factory-applied ASJ or with factory-applied FSK jacket. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
      a. CertainTeed Corp.; CertaPro Commercial Board.
      b. Johns Manville; 800 Series Spin-Glas.
      c. Knauf Insulation; Earthwool Insulation Board.
      d. Manson Insulation Inc.; AK Board.
      e. Owens Corning; Fiberglas 700 Series.
   2. Properties:
      a. Maximum Operating Temperature: 450 deg F.
      b. Minimum Operating Temperature: 0 deg F.
      c. Maximum Thermal Conductivity at 75 deg F Mean Temperature:
         1) Density 3.0 PCF: 0.23 Btu-in/hr-ft2-deg F.
         2) Density 6.0 PCF: 0.23 Btu-in/hr-ft2-deg F.
      d. Minimum Compressive Strength at 10% Deformation:
         1) Density 3.0 PCF: 25 lb/ft2.
         2) Density 6.0 PCF: 200 lb/ft2.

2.2 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. For indoor applications, adhesives shall have VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Flexible Elastomeric and Polyolefin Adhesive: Comply with MIL-A-24179A, Type II, Class I.

D. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

E. ASJ Adhesive, and FSK Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

F. PVC Jacket Adhesive: Compatible with PVC jacket.

2.3 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below ambient services.
   1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
   2. Service Temperature Range: Minus 20 to plus 180 deg F.
   3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
   4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below ambient services.
   1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.
   2. Service Temperature Range: 0 to 180 deg F.
   3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
   4. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below ambient services.
   1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
   2. Service Temperature Range: Minus 50 to plus 220 deg F.
   3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
   4. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above ambient services.
   1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
   2. Service Temperature Range: Minus 20 to plus 180 deg F.
   3. Solids Content: 60 percent by volume and 66 percent by weight.
   4. Color: White.

2.4 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
   1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over duct insulation.
   2. Service Temperature Range: 0 to plus 180 deg F.
   3. Color: White.

2.5 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg F.
   4. Color: Aluminum.

B. ASJ Flashing Sealants, and PVC Jacket Flashing Sealants:
   1. Materials shall be compatible with insulation materials, jackets, and substrates.
   2. Fire- and water-resistant, flexible, elastomeric sealant.
   3. Service Temperature Range: Minus 40 to plus 250 deg F.
   4. Color: White.

2.6 FACTORY-APPLIED JACKETS

A. Insulation system specifications indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
   1. All-Service Jacket (ASJ): White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I. Maximum water vapor permeance 0.02 perms.

2. All-Service Jacket – Self-Sealing Lap (ASJ-SSL): ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I. Maximum water vapor permeance 0.02 perms.
3. Foil-Scrim Kraft (FSK) Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II. Maximum water vapor permeance 0.02 perms.

2.7 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 6 oz./sq. yd. with a thread count of 5 strands by 5 strands/sq. in. for covering ducts.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for ducts.

2.8 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.

2.9 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.
1. Color: White unless indicated otherwise.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as indicated; roll stock ready for shop or field cutting and forming. Adhesive as recommended by jacket material manufacturer.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   a. Johns Manville; Ceel-Co or Zeston.
   b. P.I.C. Plastics, Inc.; FG Series.
   c. Proto Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.
2. Color: White unless indicated otherwise.

D. Metal Jacket:
1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
   a. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper or 2.5-mil-thick polysurlyn.
   b. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper or 2.5-mil-thick polysurlyn].
2. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
   a. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper or 2.5-mil-thick polysurlyn.

b. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper or 2.5-mil-thick polysurlyn.

E. Self-Adhesive Indoor or Outdoor Jacket: Multiple-ply laminated vapor barrier and waterproofing membrane for installation over insulation; consisting of aluminum, Tedlar, or laminate sheet with integral acrylic peel-and-stick adhesive with white, silver, or black facing as indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   a. 3M; VentureClad.
   b. Polyguard Products, Inc.; Alumaguard 60.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.

1. Verify that systems to be insulated have been tested and are free of defects.
2. Verify that surfaces to be insulated are clean and dry.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation in accordance with manufacturers' instructions.

B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of ducts and fittings.

C. Install insulation materials, vapor barriers or retarders, jackets, and thicknesses required for each item of duct system.

D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

E. Install insulation with longitudinal seams at top and bottom of horizontal runs.

F. Install multiple layers of insulation with longitudinal and end seams staggered.

G. Keep insulation materials dry during application and finishing. Mineral fiber insulation that is or has been wet shall be removed from the job site.

H. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

I. Install insulation with least number of joints practical.

J. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

K. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

L. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches on center
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches on center
      a. For below ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to duct flanges and fittings.

M. Cut insulation in a manner to avoid compressing insulation to less than 75 percent of its nominal thickness.

N. Repair joint separations and cracking due to thermal movement.

O. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.

4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

C. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

D. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

E. Insulation Installation at Floor Penetrations:
   1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.
   2. Seal penetrations through fire-rated assemblies.

3.5 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation.

3.6 INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket or Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.
   1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 50 percent coverage of duct and plenum surfaces.
   2. Apply adhesive to all surfaces of ducts, fittings, and transitions.
   3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:
      a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches on center
      b. On duct sides with dimensions larger than 18 inches, place pins 16 inches on center each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.
      c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.
      d. Do not over compress insulation during installation.
      e. Impale insulation over pins and attach speed washers.

f. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with outward-clinching staples, 1 inch on center Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.
   a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.
   b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.
5. Overlap unfaced blankets a minimum of 2 inches on longitudinal seams and end joints. At end joints, secure with steel bands spaced a maximum of 18 inches on center.
6. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. For board insulation, groove and score insulation to fit to outside and inside radii of elbows. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.
7. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch-wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches on center.

3.7 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
   1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
   2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
   3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:
   1. Draw jacket material smooth and tight.
   2. Install lap or joint strips with same material as jacket.
   3. Secure jacket to insulation with manufacturer's recommended adhesive.
   4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch-wide joint strips at end joints.
   5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where PVC jackets are indicated, install with 1-inch overlap at longitudinal seams and end joints; for horizontal applications, install with longitudinal seams along top and bottom of tanks and vessels. Seal with manufacturer's recommended adhesive. Apply two continuous beads of adhesive to seams and joints, one bead under lap and the finish bead along seam and joint edge.

D. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof

sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches on center and at end joints.

3.8 FIRE-RATED INSULATION SYSTEM INSTALLATION

A. Where fire-rated insulation system is indicated, secure system to ducts and duct hangers and supports to maintain a continuous fire rating.

B. Insulate duct access panels and doors to achieve same fire rating as duct.

C. Install firestopping at penetrations through fire-rated assemblies.

3.9 FINISHES

A. Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below and as specified in painting specifications.
   1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
      a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as selected by Architect. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 INDOOR DUCT INSULATION SCHEDULE

A. Supply air and Return Air:
   1. Mineral-Fiber Blanket: 3 inches thick and 0.75-lb/cu. ft. nominal density (installed R8).
      a. Where ductwork is exposed to view: provide 20 mil PVC jacket. Paint per Architects instructions.

B. Exhaust Air:
   1. None

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SUMMARY

A. Section includes insulating HVAC piping systems.

1.2 SUBMITTALS

A. Action Submittals
   1. Product Data: For each type of product indicated. Include thermal conductivity, water-vapor permeance thickness, and jackets (both factory and field applied if any).

1.3 QUALITY ASSURANCE

A. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing and inspecting agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.
   1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.
   2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Packaging: Insulation material containers shall be marked by manufacturer with appropriate ASTM standard designation, type and grade, and maximum use temperature.

B. Protection: Do not permit mineral fiber or calcium silicate insulation to get wet. Mineral fiber or calcium silicate insulation that is or has been wet shall be removed from the project site.

1.5 COORDINATION

A. Coordinate sizes and locations of supports, hangers, and insulation shields.

B. Coordinate clearance requirements with piping Installer for piping insulation application.

1.6 SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

PART 2 PRODUCTS

2.1 INSULATION MATERIALS

A. Products shall not contain asbestos, lead, mercury, or mercury compounds.

B. 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.

C. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

D. Foam insulation materials shall not use CFC or HCFC blowing agents in the manufacturing process.

E. Flexible Elastomeric Insulation: Closed-cell, sponge- or expanded-rubber materials. Comply with ASTM C 534, Type I for tubular materials.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
      a. Aeroflex USA, Inc.
      b. Armacell LLC.
      c. K-Flex USA.
   2. Properties:
      a. Maximum Operating Temperature: 180 deg F.
      b. Minimum Operating Temperature: -70 deg F.
      c. Maximum Thermal Conductivity at 75 deg F Mean Temperature: Thickness 1 Inch or Less: 0.245 Btu-in/hr-ft2-deg F.
      d. Maximum Water Vapor Permeability Thickness 1 Inch or Less: 0.05 perm-inches.
      e. Maximum Water Absorption by Volume: 0.2%.

F. Mineral-Fiber, Preformed Pipe Insulation:
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
      a. CertainTeed Corp.
      b. Johns Manville.
      c. Knauf Insulation.
      d. Manson Insulation Inc.
   2. Type I, 850 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type I, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   3. Type II, 1200 deg F Materials: Mineral or glass fibers bonded with a thermosetting resin. Comply with ASTM C 547, Type II, Grade A, with factory-applied ASJ-SSL. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.
   4. Properties:
      a. Maximum Thermal Conductivity at 75 deg F Mean Temperature:
         1) Density 3.0 PCF: 0.23 Btu-in/hr-ft2-deg F.
         2) Density 6.0 PCF: 0.23 Btu-in/hr-ft2-deg F.
      b. Minimum Compressive Strength at 10% Deformation:
         1) Density 3.0 PCF: 25 lb/ft2.

2) Density 6.0 PCF: 200 lb/ft2.

G. Mineral-Fiber, Pipe and Tank Insulation: Mineral or glass fibers bonded with a thermosetting resin. Semirigid board material with factory-applied ASJ complying with ASTM C 1393, Type II or Type IIIA Category 2, or with properties similar to ASTM C 612, Type IB. Nominal density is 2.5 lb/cu. ft. or more. Thermal conductivity (k-value) at 100 deg F is 0.29 Btu x in./h x sq. ft. x deg F or less. Factory-applied jacket requirements are specified in "Factory-Applied Jackets" Article.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   a. CertainTeed Corp.
   b. Johns Manville.
   c. Knauf Insulation.
   d. Manson Insulation Inc.

2.2 INSULATING CEMENTS

A. Mineral-Fiber Insulating Cement: Comply with ASTM C 195.

B. Expanded or Exfoliated Vermiculite Insulating Cement: Comply with ASTM C 196.

C. Mineral-Fiber, Hydraulic-Setting Insulating and Finishing Cement: Comply with ASTM C 449.

2.3 ADHESIVES

A. Materials shall be compatible with insulation materials, jackets, and substrates and for bonding insulation to itself and to surfaces to be insulated unless otherwise indicated.

B. Flexible Elastomeric Adhesive: Comply with MIL-A-24179A, Type II, Class I.

C. Mineral-Fiber Adhesive: Comply with MIL-A-3316C, Class 2, Grade A.

D. ASJ Adhesive, and FSK and PVDC Jacket Adhesive: Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

E. PVC Jacket Adhesive: Compatible with PVC jacket.

2.4 MASTICS

A. Materials shall be compatible with insulation materials, jackets, and substrates; comply with MIL-PRF-19565C, Type II.

B. Vapor-Barrier Mastic: Water based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM E 96/E 96M, Procedure B, 0.013 perm at 43-mil dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: ASTM D 1644, 58 percent by volume and 70 percent by weight.
4. Color: White.

C. Vapor-Barrier Mastic: Solvent based; suitable for indoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 35-mil dry film thickness.

2. Service Temperature Range: 0 to 180 deg F.
3. Solids Content: ASTM D 1644, 44 percent by volume and 62 percent by weight.
4. Color: White.

D. Vapor-Barrier Mastic: Solvent based; suitable for outdoor use on below-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 0.05 perm at 30-mil dry film thickness.
2. Service Temperature Range: Minus 50 to plus 220 deg F.
3. Solids Content: ASTM D 1644, 33 percent by volume and 46 percent by weight.
4. Color: White.

E. Breather Mastic: Water based; suitable for indoor and outdoor use on above-ambient services.
1. Water-Vapor Permeance: ASTM F 1249, 1.8 perms at 0.0625-inch dry film thickness.
2. Service Temperature Range: Minus 20 to plus 180 deg F.
3. Solids Content: 60 percent by volume and 66 percent by weight.
4. Color: White.

2.5 LAGGING ADHESIVES

A. Description: Comply with MIL-A-3316C, Class I, Grade A and shall be compatible with insulation materials, jackets, and substrates.
1. Fire-resistant, water-based lagging adhesive and coating for use indoors to adhere fire-resistant lagging cloths over pipe insulation.
2. Service Temperature Range: 0 to plus 180 deg F.
3. Color: White.

2.6 SEALANTS

A. FSK and Metal Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: Aluminum.

B. ASJ Flashing Sealants, and Vinyl, PVDC, and PVC Jacket Flashing Sealants:
1. Materials shall be compatible with insulation materials, jackets, and substrates.
2. Fire- and water-resistant, flexible, elastomeric sealant.
3. Service Temperature Range: Minus 40 to plus 250 deg F.
4. Color: White.

2.7 FACTORY-APPLIED JACKETS

A. Insulation system schedules indicate factory-applied jackets on various applications. When factory-applied jackets are indicated, comply with the following:
1. All-Service Jacket (ASJ): White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I. Maximum water vapor permeance 0.02 perms.
2. All-Service Jacket – Self-Sealing Lap (ASJ-SSL): ASJ with self-sealing, pressure-sensitive, acrylic-based adhesive covered by a removable protective strip; complying with ASTM C 1136, Type I. Maximum water vapor permeance 0.02 perms.

3. Foil-Scrim Kraft (FSK) Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II. Maximum water vapor permeance 0.02 perms.

2.8 FIELD-APPLIED FABRIC-REINFORCING MESH

A. Woven Glass-Fiber Fabric: Approximately 2 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in. for covering pipe and pipe fittings.

B. Woven Polyester Fabric: Approximately 1 oz./sq. yd. with a thread count of 10 strands by 10 strands/sq. in., in a Leno weave, for pipe.

2.9 FIELD-APPLIED CLOTHS

A. Woven Glass-Fiber Fabric: Comply with MIL-C-20079H, Type I, plain weave, and presized a minimum of 8 oz./sq. yd.

2.10 FIELD-APPLIED JACKETS

A. Field-applied jackets shall comply with ASTM C 921, Type I, unless otherwise indicated.

B. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

C. PVC Jacket: High-impact-resistant, UV-resistant PVC complying with ASTM D 1784, Class 16354-C; thickness as scheduled; roll stock ready for shop or field cutting and forming. Adhesive as recommended by jacket material manufacturer.
1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   a. Johns Manville; Ceel-Co or Zeston.
   b. P.I.C. Plastics, Inc.; FG Series.
   c. Proto Corporation; LoSmoke.
   d. Speedline Corporation; SmokeSafe.
2. Color: White unless indicated otherwise.
3. Factory-fabricated fitting covers to match jacket if available; otherwise, field fabricate.

D. Metal Jacket:
1. Aluminum Jacket: Comply with ASTM B 209, Alloy 3003, 3005, 3105, or 5005, Temper H-14.
   a. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper or 2.5-mil-thick polysurlyn.
   b. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper or 2.5-mil-thick polysurlyn.
2. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M.
   a. Moisture Barrier for Indoor Applications: 1-mil-thick, heat-bonded polyethylene and kraft paper or2.5-mil-thick polysurlyn.
   b. Moisture Barrier for Outdoor Applications: 3-mil-thick, heat-bonded polyethylene and kraft paper or 2.5-mil-thick polysurlyn.

E. Self-Adhesive Indoor or Outdoor Jacket: Multiple-ply laminated vapor barrier and waterproofing membrane for installation over insulation; consisting of aluminum, Tedlar, or

laminate sheet with integral acrylic peel-and-stick adhesive with white, silver, or black facing as indicated.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
    a. 3M; VentureClad.
    b. Polyguard Products, Inc.; Alumaguard 60.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with requirements for installation tolerances and other conditions affecting performance of insulation application.
    1. Verify that systems to be insulated have been tested and are free of defects.
    2. Verify that surfaces to be insulated are clean and dry.
    3. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Surface Preparation: Clean and dry surfaces to receive insulation. Remove materials that will adversely affect insulation application.

B. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3 GENERAL INSTALLATION REQUIREMENTS

A. Install insulation in accordance with manufacturers' instructions.

B. Install insulation materials, accessories, and finishes with smooth, straight, and even surfaces; free of voids throughout the length of piping including fittings, valves, and specialties.

C. Install insulation materials, forms, vapor barriers or retarders, jackets, and thicknesses required for each item of pipe system.

D. Install accessories compatible with insulation materials and suitable for the service. Install accessories that do not corrode, soften, or otherwise attack insulation or jacket in either wet or dry state.

E. Install insulation with longitudinal seams at top and bottom of horizontal runs.

F. Install multiple layers of insulation with longitudinal and end seams staggered.

G. Do not weld brackets, clips, or other attachment devices to piping, fittings, and specialties.

H. Keep insulation materials dry during application and finishing. Mineral fiber or calcium silicate insulation that is or has been wet shall be removed from the job site.

I. Install insulation with tight longitudinal seams and end joints. Bond seams and joints with adhesive recommended by insulation material manufacturer.

J. Install insulation with least number of joints practical.

K. Where vapor barrier is indicated, seal joints, seams, and penetrations in insulation at hangers, supports, anchors, and other projections with vapor-barrier mastic.
   1. Install insulation continuously through hangers and around anchor attachments.
   2. For insulation application where vapor barriers are indicated, extend insulation on anchor legs from point of attachment to supported item to point of attachment to structure. Taper and seal ends at attachment to structure with vapor-barrier mastic.
   3. Install insert materials and install insulation to tightly join the insert. Seal insulation to insulation inserts with adhesive or sealing compound recommended by insulation material manufacturer.
   4. Cover inserts with jacket material matching adjacent pipe insulation. Install shields over jacket, arranged to protect jacket from tear or puncture by hanger, support, and shield.

L. Apply adhesives, mastics, and sealants at manufacturer's recommended coverage rate and wet and dry film thicknesses.

M. Install insulation with factory-applied jackets as follows:
   1. Draw jacket tight and smooth.
   2. Cover circumferential joints with 3-inch-wide strips, of same material as insulation jacket. Secure strips with adhesive and outward clinching staples along both edges of strip, spaced 4 inches on center.
   3. Overlap jacket longitudinal seams at least 1-1/2 inches. Install insulation with longitudinal seams at bottom of pipe. Clean and dry surface to receive self-sealing lap. Staple laps with outward clinching staples along edge at 4 inches on center.
      a. For below-ambient services, apply vapor-barrier mastic over staples.
   4. Cover joints and seams with tape, according to insulation material manufacturer's written instructions, to maintain vapor seal.
   5. Where vapor barriers are indicated, apply vapor-barrier mastic on seams and joints and at ends adjacent to pipe flanges and fittings.

N. Cut insulation in a manner to avoid compressing insulation to less than 75 percent of its nominal thickness.

O. Repair joint separations and cracking due to thermal movement.

P. Repair damaged insulation facings by applying same facing material over damaged areas. Extend patches at least 4 inches beyond damaged areas. Adhere, staple, and seal patches similar to butt joints.

Q. For above-ambient services, do not install insulation to the following:
   1. Vibration-control devices.
   2. Testing agency labels and stamps.
   3. Nameplates and data plates.
   4. Manholes.
   5. Handholes.
   6. Cleanouts.

3.4 PENETRATIONS

A. Insulation Installation at Roof Penetrations: Install insulation continuously through roof penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation above roof surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside roof flashing at least 2 inches below top of roof flashing.
   4. Seal jacket to roof flashing with flashing sealant.

B. Insulation Installation at Underground Exterior Wall Penetrations: Terminate insulation flush with sleeve seal. Seal terminations with flashing sealant.

C. Insulation Installation at Aboveground Exterior Wall Penetrations: Install insulation continuously through wall penetrations.
   1. Seal penetrations with flashing sealant.
   2. For applications requiring only indoor insulation, terminate insulation inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
   3. Extend jacket of outdoor insulation outside wall flashing and overlap wall flashing at least 2 inches.
   4. Seal jacket to wall flashing with flashing sealant.

D. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

E. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Install insulation continuously through penetrations of fire-rated walls and partitions.
   1. Comply with requirements in firestopping section.

F. Insulation Installation at Floor Penetrations:
   1. Pipe: Install insulation continuously through floor penetrations.
   2. Seal penetrations through fire-rated assemblies. Comply with requirements in firestopping section.

3.5 GENERAL PIPE INSULATION INSTALLATION

A. Requirements in this article generally apply to all insulation materials except where more specific requirements are specified in various pipe insulation material installation articles.

B. Insulation Installation on Fittings, Valves, Strainers, Flanges, and Unions:
   1. Install insulation over fittings, valves, strainers, flanges, unions, and other specialties with continuous thermal and vapor-retarder integrity unless otherwise indicated.
   2. Insulate pipe elbows using preformed fitting insulation or mitered fittings made from same material and density as adjacent pipe insulation. Each piece shall be butted tightly against adjoining piece and bonded with adhesive. Fill joints, seams, voids, and irregular surfaces with insulating cement finished to a smooth, hard, and uniform contour that is uniform with adjoining pipe insulation.

3. Insulate tee fittings with preformed fitting insulation or sectional pipe insulation of same material and thickness as used for adjacent pipe. Cut sectional pipe insulation to fit. Butt each section closely to the next and hold in place with tie wire. Bond pieces with adhesive.
4. Insulate valves using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is more. For valves, insulate up to and including the bonnets, valve stuffing-box studs, bolts, and nuts. Fill joints, seams, and irregular surfaces with insulating cement.
5. Insulate strainers using preformed fitting insulation or sectional pipe insulation of same material, density, and thickness as used for adjacent pipe. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is more. Fill joints, seams, and irregular surfaces with insulating cement. Insulate strainers so strainer basket flange or plug can be easily removed and replaced without damaging the insulation and jacket. Provide a removable reusable insulation cover. For below-ambient services, provide a design that maintains vapor barrier.
6. Insulate flanges and unions using a section of oversized preformed pipe insulation. Overlap adjoining pipe insulation by not less than two times the thickness of pipe insulation, or one pipe diameter, whichever is more.
7. Cover segmented insulated surfaces with a layer of finishing cement and coat with a mastic. Install vapor-barrier mastic for below-ambient services and a breather mastic for above-ambient services. Reinforce the mastic with fabric-reinforcing mesh. Trowel the mastic to a smooth and well-shaped contour.
8. For services not specified to receive a field-applied jacket, except for flexible elastomeric, install fitted PVC cover over elbows, tees, strainers, valves, flanges, and unions. Terminate ends with PVC end caps. Tape PVC covers to adjoining insulation facing using PVC tape.
9. Stencil or label the outside insulation jacket of each union with the word "union." Match size and color of pipe labels.

C. Insulate instrument connections for thermometers, pressure gages, pressure temperature taps, test connections, flow meters, sensors, switches, and transmitters on insulated pipes. Shape insulation at these connections by tapering it to and around the connection with insulating cement and finish with finishing cement, mastic, and flashing sealant.

D. Install removable insulation covers at locations indicated. Installation shall conform to the following:
1. Make removable flange and union insulation from sectional pipe insulation of same thickness as that on adjoining pipe. Install same insulation jacket as adjoining pipe insulation.
2. When flange and union covers are made from sectional pipe insulation, extend insulation from flanges or union long at least two times the insulation thickness over adjacent pipe insulation on each side of flange or union. Secure flange cover in place with stainless-steel or aluminum bands. Select band material compatible with insulation and jacket.
3. Construct removable valve insulation covers in same manner as for flanges, except divide the two-part section on the vertical center line of valve body.
4. When covers are made from block insulation, make two halves, each consisting of mitered blocks wired to stainless-steel fabric. Secure this wire frame, with its attached insulation, to flanges with tie wire. Extend insulation at least 2 inches over adjacent pipe

insulation on each side of valve. Fill space between flange or union cover and pipe insulation with insulating cement. Finish cover assembly with insulating cement applied in two coats. After first coat is dry, apply and trowel second coat to a smooth finish.

3.6 INSTALLATION OF FLEXIBLE ELASTOMERIC INSULATION

A. Seal longitudinal seams and end joints with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

B. Insulation Installation on Pipe Flanges:
   1. Install pipe insulation to outer diameter of pipe flange.
   2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
   3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with cut sections of sheet insulation of same thickness as pipe insulation.
   4. Secure insulation to flanges and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

C. Insulation Installation on Pipe Fittings and Elbows:
   1. Install mitered sections of pipe insulation.
   2. Secure insulation materials and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

D. Insulation Installation on Valves and Pipe Specialties:
   1. Install preformed valve covers manufactured of same material as pipe insulation when available.
   2. When preformed valve covers are not available, install cut sections of pipe and sheet insulation to valve body. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
   3. Install insulation to flanges as specified for flange insulation application.
   4. Secure insulation to valves and specialties and seal seams with manufacturer's recommended adhesive to eliminate openings in insulation that allow passage of air to surface being insulated.

3.7 INSTALLATION OF MINERAL-FIBER INSULATION

A. Insulation Installation on Straight Pipes and Tubes:
   1. Secure each layer of preformed pipe insulation to pipe with wire or bands and tighten bands without deforming insulation materials.
   2. Where vapor barriers are indicated, seal longitudinal seams, end joints, and protrusions with vapor-barrier mastic and joint sealant.
   3. For insulation with factory-applied jackets on above-ambient surfaces, secure laps with outward-clinched staples at 6 inches on center.
   4. For insulation with factory-applied jackets on below-ambient surfaces, do not staple longitudinal tabs. Instead, secure tabs with additional adhesive as recommended by insulation material manufacturer and seal with vapor-barrier mastic and flashing sealant.

B. Insulation Installation on Pipe Flanges:
   1. Install preformed pipe insulation to outer diameter of pipe flange.

2. Make width of insulation section same as overall width of flange and bolts, plus twice the thickness of pipe insulation.
3. Fill voids between inner circumference of flange insulation and outer circumference of adjacent straight pipe segments with mineral-fiber blanket insulation.
4. Install jacket material with manufacturer's recommended adhesive, overlap seams at least 1 inch, and seal joints with flashing sealant.

C. Insulation Installation on Pipe Fittings and Elbows:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed insulation elbows and fittings are not available, install mitered sections of pipe insulation, to a thickness equal to adjoining pipe insulation. Secure insulation materials with wire or bands.

D. Insulation Installation on Valves and Pipe Specialties:
1. Install preformed sections of same material as straight segments of pipe insulation when available.
2. When preformed sections are not available, install mitered sections of pipe insulation to valve body.
3. Arrange insulation to permit access to packing and to allow valve operation without disturbing insulation.
4. Install insulation to flanges as specified for flange insulation application.

3.8 FIELD-APPLIED JACKET INSTALLATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.
1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch-thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches on center and at end joints.

3.9 FINISHES

A. Pipe Insulation with ASJ, Glass-Cloth, or Other Paintable Jacket Material: Paint jacket with paint system identified below.
1. Flat Acrylic Finish: Two finish coats over a primer that is compatible with jacket material and finish coat paint. Add fungicidal agent to render fabric mildew proof.
a. Finish Coat Material: Interior, flat, latex-emulsion size.

B. Flexible Elastomeric Thermal Insulation: After adhesive has fully cured, apply two coats of insulation manufacturer's recommended protective coating.

C. Color: Final color as indicated. Vary first and second coats to allow visual inspection of the completed Work.

D. Do not field paint aluminum or stainless-steel jackets.

3.10 INDOOR PIPING INSULATION SCHEDULE

A. Condensate or Equipment Drain Water Below 60 Deg F, or Makeup Water:
   1. NPS 1-1/4 or Smaller: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1/2 inch thick.
   2. NPS 1-1/2 or Larger: Insulation shall be one of the following:
      a. Cellular Glass: 1-1/2 inches thick.
      b. Flexible Elastomeric: 1 inch thick.

B. Refrigerant Liquid:
   1. Flexible Elastomeric: 1/2 inch thick.

C. Refrigerant Hot-Gas:
   1. NPS 1-1/4 or Smaller: Insulation shall be the following:
      a. Flexible Elastomeric: 1 inch thick.
   2. NPS 1-1/2 or Larger: Insulation shall be the following:
      a. Flexible Elastomeric: 1 inches thick.

3.11 OUTDOOR, ABOVEGROUND PIPING INSULATION SCHEDULE

A. Refrigerant Liquid:
   1. Flexible Elastomeric: 1/2 inch thick

B. Refrigerant Hot-Gas:
   1. NPS 1-1/4 or Smaller: Insulation shall be the following:
      a. Flexible Elastomeric: 1-1/2 inches thick.
   2. NPS 1-1/2 or Larger: Insulation shall be the following:
      a. Flexible Elastomeric: 1-1/2 inches thick.

3.12 INDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Concealed: None.

D. Piping, Exposed:
   1. None.

3.13 OUTDOOR, FIELD-APPLIED JACKET SCHEDULE

A. Install jacket over insulation material. For insulation with factory-applied jacket, install the field-applied jacket over the factory-applied jacket.

B. If more than one material is listed, selection from materials listed is Contractor's option.

C. Piping, Exposed:
   1. UV resistant PVC Jacket 20 mils thick

SECTION 23 23 00
REFRIGERATION PIPING AND SPECIALTIES

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Check valves.

G. Pressure relief valves.

H. Filter-driers.

I. Solenoid valves.

J. Expansion valves.

K. Flexible connections.

1.2 SUBMITTALS

A. Submit shop drawings under provisions of Division 01.

B. Submit shop drawings indicating schematic layout of system, including equipment, critical dimensions, and sizes.

C. Submit product data under provisions of Division 01.

D. Submit product data indicating general assembly of specialties, including manufacturers catalogue information.

E. Submit manufacturer's installation instructions under provisions of Division 01.

F. Submit welders certification of compliance with ANSI/ASME Sec 9.

G. Submit design data as a submittal under provisions of Division 01.

H. Submit data indicating pipe sizing.

I. Submit test reports under provisions of Division 01.

J. Submit test reports indicating results of leak test, acid test.

1.3 PROJECT RECORD DOCUMENTS

A. Submit documents under provisions of Division 01.

B. Accurately record exact locations of equipment and refrigeration accessories on record drawings.

1.4 REGULATORY REQUIREMENTS

A. Conform to ANSI/ASME B31.9.

B. Conform to ANSI/ASME SEC 9 and applicable state labor regulations.

C. Welders Certification: In accordance with ANSI/ASME SEC 9, ANSI/AWS D1.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site under provisions of Division 01.

B. Deliver and store piping and specialties in shipping containers with labeling in place.

C. Store and protect products under provisions of Division 01.

D. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

PART 2 - PRODUCTS

2.1 PIPING

A. Copper Tubing: ASTM B280, Type ACR hard drawn.
   1. Fittings: ANSI/ASME B16.22 wrought copper.
   2. Joints: ANSI/AWS A5.8 BCup silver braze.

2.2 MOISTURE AND LIQUID INDICATORS

A. Indicators: Single port type, UL listed, with copper or brass body, flared or solder ends, sight glass, color coded paper moisture indicator with removable element cartridge and plastic cap; for maximum working pressure of 500 psi, and maximum temperature of 200 degrees F.

2.3 VALVES

A. Diaphragm Packless Valves: UL listed, globe or angle pattern, forged brass body and bonnet, phosphor bronze and stainless steel diaphragms, rising stem and handwheel, stainless steel spring, nylon seat disc, solder or flared ends, with positive backseating; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

B. Packed Angle Valves: Forged brass, forged brass seal caps with copper gasket, rising stem and seat with backseating, molded stem packing, solder or flared ends; for maximum working pressure of 500 psi and maximum temperature of 275 degrees F.

2.4 STRAINERS

A. Straight Line or Angle Line Type: Brass or steel shell, steel cap and flange, and
   1. replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

2.5 CHECK VALVES

A. Globe Type: Cast bronze or forged brass body, forged brass cap with neoprene seal, brass guide and disc holder, phosphor-bronze or stainless steel spring, teflon seat disc; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

2.6 PRESSURE RELIEF VALVES

A. Straight Thru or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB; for standard 450 psi setting, selected to ANSI/ASHRAE 15.

2.7 FILTER-DRIERS

A. ANSI/ARI 710, UL listed, brass shell and bronze cap, perforated brass shell and molded desiccant filter core; for maximum working pressure of 350 psi.

2.8 SOLENOID VALVES

A. Valve: ARI 760, pilot operated, copper or brass body and internal parts, synthetic seat, stainless steel stem and plunger assembly, with flared, solder, or threaded ends; for maximum working pressure of 500 psi. Stem shall permit manual operation in case of coil failure.

B. Coil Assembly: UL listed, replaceable with molded electromagnetic coil, moisture and fungus proof, with surge protector and color coded lead wires, integral junction box with pilot light; ANSI/UL 429.

2.9 EXPANSION VALVES

A. Angle or Straight Thru Type: ARI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with replaceable capillary tube and remote sensing bulb and remote bulb well.

B. Select valve for maximum load at design operating pressure and minimum 10 degrees F superheat. Select to avoid being undersized at full load and excessively oversized at part load.

2.10 FLEXIBLE CONNECTORS

A. Corrugated stainless steel hose with single layer of stainless steel exterior braiding, minimum 9 inches long with copper tube ends; for maximum working pressure 500 psi.

PART 3 - EXECUTION

3.1 PREPARATION

A. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.2 INSTALLATION

A. Install refrigeration specialties in accordance with manufacturer's instructions.

B. Route piping in orderly manner, with plumbing parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and not interfere with use of space.

D. Group piping whenever practical at common elevations and locations. Slope piping one percent in direction of oil return.

E. Provide non-conducting dielectric connections when joining dissimilar metals.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

G. Provide clearance for installation of insulation and access to valves and fittings.

H. Provide access to concealed valves and fittings.

I. Where pipe support members are welded to structural building frame, brush clean, and apply one coat of zinc rich primer to welding.

J. Prepare pipe, fittings, supports, and accessories not prefinished, ready for finish painting.

K. Insulate piping and equipment.

L. Locate expansion valve sensing bulb immediately downstream or evaporator on suction line.

M. Provide external equalizer piping on expansion valves with refrigerant distributor connected to evaporator.

N. Install flexible connectors at right angles to axial movement of compressor.

O. Fully charge completed system with refrigerant after testing.

P. Provide electrical connection to solenoid valves.

Q. During brazing, dry nitrogen shall be bled through piping to reduce scaling.

3.3 APPLICATION

A. Provide line size liquid indicators in main liquid line leaving condenser, or if receiver is provided, in liquid line leaving receiver.

B. Provide line size strainer upstream of each automatic valve. Where multiple expansion valves with integral strainers are used install single main liquid line strainer.

C. Provide shut-off valve on each side of strainer.

D. Provide replaceable cartridge filter-driers vertically in liquid line adjacent to receivers with three valve bypass assembly to permit isolation of driers for servicing.

E. Provide filter-driers for each solenoid valve.

F. Provide solenoid valves in liquid line of systems operating with single pump-out or pump-down compressor control, in liquid line of single or multiple evaporator systems, and in oil bleeder lines from flooded evaporators to stop flow of oil and refrigerant into the suction line when system shuts down.

G. Provide refrigerant charging (packed angle) valve connections in liquid between receiver shut-off valve and expansion valve.

H. Utilize flexible connectors at or near compressors where within piping configuration does not absorb vibration.

3.4 FIELD QUALITY CONTROL

A. Field inspection and testing will be performed under provisions of Division 01.

B. Test refrigeration system in accordance with ANSI/ASME B31.5.

C. Pressure test system with dry nitrogen to 300 psig. Perform final tests at 27 inches vacuum and 300 psig using halide torch. Test to no leakage.

SECTION 23 31 13
METAL DUCTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Sheet metal ducts and fittings.
2. Sheet metal materials.
3. Duct liner.
4. Rectangular duct connection systems.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Requirements
1. ANSI/SMACNA 006-2006 (SMACNA 006) HVAC Duct Construction Standards – Metal and Flexible Third Edition. All ductwork shall be in conformance with this standard.
2. Structural Performance: Duct hangers, supports, and seismic restraints (where applicable) shall withstand the effects of gravity, wind, and seismic loads and stresses within limits and under conditions described in SMACNA 006, ASCE/SEI 7, and local requirements.
3. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.2 SYSTEM DESCRIPTION

A. Duct system design, as indicated, has been used to select size and type of air-moving and distribution equipment and other air system components. Changes to layout or configuration of duct system must be specifically approved in writing by the Architect/Engineer. Accompany requests for layout modifications with calculations showing the proposed layout will provide original design results without increasing system total pressure.

1.3 SUBMITTALS

A. Action Submittals:
1. Product Data: For each type of the following products:
a. Prefabricated ductwork and fittings.
b. Liners and adhesives.
c. Rectangular duct connection systems.
d. Sealants and gaskets.
2. Shop Drawings:
a. Fabrication, assembly, and installation, including plans, elevations, sections, components, and attachments to other work.
b. Fittings, including details of construction.
c. Duct layout indicating sizes, configuration, liner material, and static-pressure classes.

d. Elevations of top and bottom of ducts along with applicable elevations of structural elements.
e. Dimensions of main duct runs from building grid lines.
f. Reinforcement and spacing.
g. Duct material and gauge thickness by pressure class.
h. Seam and joint construction.
i. Penetration details through fire-rated, smoke barriers and other rated partitions.
j. Equipment installation based on equipment being utilized on this project.
k. Duct accessories, including dampers, turning vanes, and duct access doors.
l. Length of application of acoustic duct liner where it will be applied.
m. Hangers and supports, including methods for duct and building attachment, seismic restraints, and vibration isolation.
n. Other systems installed in the same space as ducts where order of installation affects access.
o. Ceiling and wall mounted access doors and panels required to provide access to dampers, controls and other operating devices.
p. Ceiling mounted items, including light fixtures, diffusers, grilles, speakers, smoke detectors, sprinklers, other electrical devices, equipment and building structural members.
q. On each drawing, include a tabular list of each fan system's ductwork represented on that drawing and the total square foot surface area of each fan's duct system illustrated on the drawing.
r. Shop drawings shall be submitted prior to the fabrication or installation of the ductwork and serve as the foundation for coordination between various trades to maintain required ceiling heights.

3. Field Test Reports: Written reports of tests specified in Part 3 of this Section. Include the following:
   a. Test procedures used.
   b. Test results that comply with requirements.
   c. Failed test results and corrective action taken to achieve requirements.

B. Leakage Testing Documentation: Contractor shall submit a written report to the authority having jurisdiction in which ducts designed at static pressures more than 3" wg pressure class have been leak tested and that the air leakage class is less than 6.0 per the Energy Code. Provide duplicate submittal to the Owner and the Engineer.

1.4 QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:
   1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for steel hangers and supports.
   2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum hangers and supports.
   3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. NFPA Compliance: Applicable requirements in:
   1. NFPA 90A.
   2. NFPA 90B.
   3. NFPA 96 for grease ducts

C. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1.

D. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Damage: Handle, transport, and store ducts to avoid damage. Damaged ductwork is not acceptable.

B. Protection: Protect ducts from mechanical damage, weather, and exposure to chemicals (including road salt). Do not permit insulation materials to get wet under any circumstances. Remove insulation that is or has been wet from the project site, and replace the insulation with undamaged new materials.

C. Ductwork and associated components shall be stored on blocking in a clean dry area to prevent damage and to prevent the entrance of dirt, debris, foreign matter and moisture.

D. Ductwork shall be adequately supported during storage to prevent sagging or bending.

E. Provide temporary storage, delivery and handling in accordance with SMACNA Duct Cleanliness for New Construction Guidelines, Intermediate Level.

PART 2 PRODUCTS

2.1 SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA 006 based on indicated static-pressure class. The figure numbers below reference that standard.
   1. Transverse Joint: Figure 2-1.
   2. Longitudinal Seam: Figure 2-2.
   3. Pressure Class Gage and Reinforcement: Table 2-1 through Table 2-52 and Figure 2-3 through Figure 2-18.
   4. Elbow: Figure 4-2 (Use the following types only unless specifically approved by the Engineer.):
      a. Type RE 1 (radius elbow).
      b. Type RE 2 (square throat elbow with turning vanes).
      c. Type RE 3 (radius elbow with vanes).
      d. Type RE 5 (dual radius elbow).
      e. Type RE 6 (mitered elbow without turning vanes) only for angles not greater than 45 degrees.
   5. Turning Vanes: Figures 4-3 and 4-4. Figure 4-9 short radius vanes in accordance with Chart 4-1 are acceptable.
   6. Branch Connection:
      a. Diverging Flow: Figure 4-5 (all types). Figure 4-6 (following types only):
         1) 45-degree entry to rectangular branch.
         2) 45-degree lead-in to round branch.
         3) Conical connection.
         4) Bellmouth connection.
         5) Conical or bellmouth spin-in fitting only for pressure class 2” WG or less.
      b. Converging Flow: Figure 4-5 (all types) and Figure 4-6 (all types). Conical or bellmouth spin-in fitting is acceptable only for pressure class 2” WG or less.

7. Offset, Transition, or Obstruction: Figure 4-7 (all types) and Figure 4-8 (Figure B and C). Do not use Figure 4-8 Figure A (pipe through duct), Figure D (mitered offsets around obstruction, or Figure E (split duct around obstruction) unless specifically approved by the Engineer.

2.2 SINGLE-WALL ROUND OR FLAT-OVAL DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA 006 Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
      a. Eastern Sheet Metal.
      b. FlaktGroup SEMCO.
      c. Lindab Inc.
      d. McGill AirFlow LLC.
      e. Sheet Metal Connectors, Inc.
   2. Transverse Joint: Figure 3-1 (all types).
   3. Longitudinal Seam: Figure 3-2 (all types). Do not use type RL-5 (grooved seam pipe lock or flat lock), RL-6 (snaplock), RL-7 (snaplock), or RL-8 (snaplock) seam for duct over 1” WG pressure class. Fabricate round duct larger than 90-inch diameter with butt-welded longitudinal seam.
   4. Pressure Class Gage and Reinforcement: Table 3-2 through Table 3-15 and Figure 3-3.
   5. Elbow: Figure 3-4. Use centerline radius of 1.5 diameters for each elbow unless space constraints prevent a radius that large; in that event, the radius may be reduced to that indicated in Table 3-1 with mitered segments. If space constraints prevent a radius as large as indicated in Table 3-1, a mitered elbow with turning vanes similar to Figure 4-3 and Figure 4-4 may be used. Do not use an adjustable elbow for duct over 1” WG pressure class.
   6. Branch Connection with Diverging or Converging Flow: Figure 3-5 and Figure 3-6. All types are acceptable for pressure class 2” WG or less duct. For pressure class 3” WG or more duct, use 90-degree tee fitting with oval-to-round tap, 45-degree lateral fitting, conical fitting, or wye fitting. Reducers may be incorporated into the fitting. Use only factory-fabricated fittings, not saddles or field-fabricated taps, for pressure class 3” WG or more duct.
   7. Offset, Transition, or Obstruction: Figure 4-7 and Figure 4-8 modified for round or flat oval duct. Do not use Figure 4-8 Figure A (pipe through duct), Figure D (mitered offsets around obstruction), or Figure E (split duct around obstruction) unless specifically approved by the Engineer.
   8. Flat Oval: Figure 3-7 and applicable figures for equivalent round duct.

2.3 SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA 006 for material thicknesses and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90 unless otherwise indicated.
   2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Aluminum Sheets: Comply with ASTM B 209 Alloy 3003, H14 temper; with mill finish for concealed ducts, and standard, one-side bright finish for duct surfaces exposed to view.

D. Reinforcement Shapes and Plates:
   1. Steel Duct: ASTM A 36/A 36M, steel plates, shapes, and bars; black or galvanized.
   2. Aluminum Duct: ASTM B209 alloy 6061-T6 members or steel members isolated from the aluminum with butyl rubber, neoprene, or EPDM gasket materials.
   3. Other Duct Materials: Reinforcement materials compatible with the duct materials at contact points.

E. Tie Rods: Materials compatible with duct materials. Galvanized steel or stainless steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4 DUCT LINER

A. Fibrous-Glass Duct Liner: Comply with ASTM C 1071, NFPA 90A, and NAIMA AH124.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
      a. Owens Corning.
      b. CertainTeed Corporation: Insulation Group.
      c. Johns Manville.
      d. Knauf Insulation.
   2. Maximum Thermal Conductivity:
      a. Type I, Flexible: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
      b. Type II, Rigid: 0.23 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
   3. Antimicrobial Erosion-Resistant Coating: Apply to the surface of the liner that will form the interior surface of the duct to act as a moisture repellent and erosion-resistant coating. Antimicrobial compound shall be tested for efficacy and registered by the EPA for use in HVAC systems.
   4. Surface-Burning Characteristics: Flame-spread index no greater than 25 and smoke-developed index no greater than 50 when tested according to UL 723; certified by a nationally recognized testing laboratory.
   5. Water-Based Liner Adhesive: Comply with NFPA 90A and with ASTM C 916.
      a. For indoor applications, adhesive shall have a VOC content of 80 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
      b. Adhesive shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

B. Flexible Elastomeric Duct Liner: Preformed, cellular, closed-cell, sheet materials complying with ASTM C 534, Type II, Grade 1; and with NFPA 90A.
   1. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
      a. Aeroflex USA Inc.
      b. Armacell LLC.
      c. Rubatex International, LLC.

2. Maximum Thermal Conductivity: 0.27 Btu x in./h x sq. ft. x deg F at 75 deg F mean temperature.
3. Surface-Burning Characteristics: Flame-spread index no greater than 25 and smoke-developed index no greater than 50 when tested according to UL 723; certified by a nationally recognized testing laboratory.
4. Liner Adhesive: As recommended by insulation manufacturer and complying with NFPA 90A. For indoor applications, adhesive with a VOC content of 50 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Insulation Pins and Washers:
1. Cupped-Head, Capacitor-Discharge-Weld Pins: Copper- or zinc-coated steel pin, fully annealed for capacitor-discharge welding, 0.106-inch- or 0.135-inch diameter shank, length to suit depth of insulation indicated with integral galvanized carbon-steel washer.
2. Insulation-Retaining Washers: Self-locking washers formed from 0.016-inch-thick galvanized steel, aluminum, or stainless steel (as appropriate); with beveled edge sized as required to hold insulation securely in place but not less than 1-1/2 inches in diameter.

D. Shop Application of Duct Liner: Comply with SMACNA 006 Figure 7-11, "Flexible Duct Liner Installation."
1. Adhere a single layer of indicated thickness of duct liner with at least 90 percent adhesive coverage at liner contact surface area. Attaining indicated thickness with multiple layers of duct liner is prohibited.
2. Apply adhesive to transverse edges of liner facing upstream that do not receive metal nosing.
3. Butt transverse joints without gaps, and coat joint with adhesive.
4. Fold and compress liner in corners of rectangular ducts or cut and fit to ensure butted-edge overlapping.
5. Do not install liner in rectangular ducts with longitudinal liner joints at locations other than corners of ducts, unless duct size and dimensions of standard liner make longitudinal joints necessary.
6. Apply adhesive coating on longitudinal seams.
7. Secure liner with mechanical fasteners 4 inches from corners and at intervals not exceeding 12 inches transversely; at 3 inches from transverse joints and at intervals not exceeding 18 inches longitudinally.
8. Secure transversely oriented liner edges facing the airstream with metal nosings that have either channel or "Z" profiles or are integrally formed from duct wall. Fabricate edge facings at the following locations:
    a. Fan discharges.
    b. Lined duct following unlined duct.
    c. Upstream edges of transverse joints in ducts where air velocities are 2500 fpm or more.
    d. Other locations as indicated.
9. Terminate liner with buildouts (metal hat sections) at dampers, turning vane assemblies, or other devices. Secure buildouts to duct walls with bolts, screws, rivets, or welds.

2.5 RECTANGULAR DUCT CONNECTION SYSTEMS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Ductmate Industries, Inc.
   2. Hart & Cooley, Inc. Ward Industries.
   3. McGill Airflow LLC.

B. Connection System: Rectangular duct transverse joint connection, reinforcement, and sealing system with roll-formed metal flanges, metal corner pieces, sealants, gaskets, and cleats.

2.6 SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a flame-spread index no greater than 25 and a smoke-developed index no greater than 50 when tested according to UL 723; certified by a nationally recognized testing laboratory.

B. Two-Part Tape Sealing System:
   1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.
   2. Sealant: Modified styrene acrylic.
   3. Water resistant.
   4. Mold and mildew resistant.
   5. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
   6. Service: Indoor and outdoor.
   7. Service Temperature: Minus 40 to plus 200 deg F.
   8. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.
   9. For indoor applications, sealant with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). For school projects, sealant complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

C. Water-Based Joint and Seam Sealant:
   1. Application Method: Brush on.
   2. Solids Content: Minimum 65 percent.
   3. Shore A Hardness: Minimum 20.
   4. Water resistant.
   5. Mold and mildew resistant.
   6. VOC: Maximum 75 g/L (less water).
   7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
   8. Service: Indoor or outdoor.
   9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Flanged Joint Sealant: Comply with ASTM C 920.
   1. General: Single-component, acid-curing, silicone, elastomeric.
   2. Type: S.

3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant with a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24). For school projects, sealant complying with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."

E. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

F. Round Duct Joint O-Ring Seals:
1. Seal shall provide maximum leakage class of 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for 10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.7 HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts or other materials compatible with duct materials.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods; galvanized rods with threads painted with zinc-chromate primer after installation; or stainless steel all-thread rods and nuts.

C. Strap and Rod Sizes: Comply with SMACNA 006 Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Cables:
1. Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.
2. Stainless-Steel Ducts: Stainless steel complying with ASTM A 492.
3. End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

E. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

F. Trapeze and Riser Supports: Structural shapes and plates of materials compatible with duct materials and environmental conditions. Support material shall match duct construction material.

2.8 CASINGS

A. Fabricate casings according to SMACNA 1966 and construct for indicated operating pressures.

B. Doors:
1. Reinforce access door frames with steel angles tied to horizontal and vertical plenum supporting angles.
2. Furnish hinged access doors where indicated or required for access to equipment for cleaning and inspection.

C. Casings:
   1. Fabricate acoustic casings with reinforcing turned inward.
   2. Furnish 18-gage back facing and front facing.
   3. Construct panels 3 inches thick and packed with 4.5-pcf minimum glass-fiber media, on 16-gage inverted channels.

PART 3 EXECUTION

3.1 DUCT INSTALLATION GENERAL REQUIREMENTS

A. Static-Pressure Classes: Unless otherwise indicated, construct ducts according to the following:
   1. Supply ducts (Associated with FCUs): 2-inch wg.
   2. Return ducts (Assiciated with FCUs): 2-inch wg. (neg pressure)
   3. General exhaust ducts (negative pressure): 2-inch wg.

B. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction losses for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings or Coordination Drawings.

C. Install ducts according to SMACNA 006 unless otherwise indicated.

D. Unless otherwise indicated, install ducts vertically plumb or horizontally level, and parallel and perpendicular to building lines. Avoid diagonal runs to maximum extent possible.

E. Install ducts with a minimum clearance of 2 inch plus allowances for insulation thickness and access requirements.

F. Cable hangers may only be used on low pressure (2” wg construction and lower) round spiral ductwork which is not insulated and has a diameter 10” or less. Utilize the double lock method such that the lower loop is clinched tight to the ductwork and the cable is vertical. Utilize manufacturer’s top attachment device.

G. Provide duct offsets needed to avoid interferences with structure, finishes, piping, other ducts, conduit, etc. Coordinate the work with all trades to minimize such offsets. Install ducts with fewest joints possible.

H. Do not penetrate ducts with conduit or piping.

I. Seal all joints and seams. Apply sealant to male end connectors before insertion, and afterward to cover entire joint and sheet metal screws.

J. Secure couplings with sheet metal screws. Install screws at maximum intervals of 12”, with a minimum of 3 screws in each round metallic duct coupling.

K. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections. Do not field-cut taps for branch connections in ducts with SMACNA pressure class magnitude more than 2 in wg.

L. Install round or flat-oval ducts in maximum practical lengths to minimize joints.

M. Do not install any duct in an electrical equipment room unless that duct serves that room.

N. Do not install any duct in an elevator equipment room unless that duct serves that room.

O. Do not install any duct over an electrical transformer, electrical switchgear, or an electrical panel unless approved in writing by the Engineer.

P. Maintain clearances required in the National Electric Code for electrically-powered items.

Q. Where ducts pass through interior partitions or exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal type and thickness as the duct. Overlap openings on all sides by at least 1-1/2 inches.

R. Where ducts pass through fire-rated partitions, install fire dampers unless otherwise indicated. Comply with requirements in other Division 23 Sections for fire dampers.

S. Where ducts pass through smoke partitions, install smoke dampers unless otherwise indicated. Comply with requirements in other Division 23 Sections for smoke dampers.

T. Install ductwork takeoffs at smoke dampers such that there is a minimum of 24” between the damper and the start of the first takeoff.

U. Protect duct interiors from moisture, construction debris and dust, and other foreign materials. Comply with SMACNA "IAQ Guidelines for Occupied Buildings Under Construction," Appendix G, "Duct Cleanliness for New Construction Guidelines."

3.2 INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts that are to be exposed in finished spaces from damage including dents, surface scratches, and markings. Exposed ducts must be undamaged and present a clean, neat appearance in materials and workmanship.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system in finished spaces.

C. Grind welds to provide smooth surfaces free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets and inlets.

E. Repair or replace ducts that do not comply with these requirements.

3.3 DUCT SEALING

A. In accordance with ASHRAE 90.1, seal all ducts to SMACNA 006 seal class A with all transverse joints, longitudinal seams, and duct wall penetrations sealed. Seal openings for rotating shafts (including dampers) with bushings or other devices. However, do not seal an opening if sealing the opening would void a manufacturer’s listing. Spiral lock seams in round or flat oval ducts do not require sealing unless leakage is detected.

3.4 HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA 006 Chapter 5, "Hangers and Supports."

B. Building Attachments: Concrete inserts, powder-actuated fasteners, or structural-steel fasteners appropriate for construction materials to which hangers are being attached.
   1. Where practical, install concrete inserts before placing concrete.
   2. Install powder-actuated concrete fasteners after concrete is placed and completely cured.
   3. Use powder-actuated concrete fasteners for standard-weight aggregate concretes or for slabs more than 4 inches thick.
   4. Do not use powder-actuated concrete fasteners for seismic restraints.

C. Hanger Spacing: Comply with SMACNA 006 Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

D. Hangers Exposed to View: Threaded rod and angle or channel supports. Other types of hangers may be used if so indicated or if approved by Engineer.

E. Vertical Ducts: Support vertical ducts with steel angles or channel secured to the sides of the ducts with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at maximum intervals of 16 feet.

F. Upper Attachments: Install upper attachments secured to structural members. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials. Do not attach duct supports to roof decks.

G. Engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, conduit, and piping

3.5 CONNECTIONS

A. Make connections to motorized equipment with flexible connectors complying with other Division 23 Sections. Comply with SMACNA 006 for branch, outlet, inlet, and terminal unit connections.

3.6 CASINGS

A. Floor Mounting:
   1. Install on 4 -INCH high concrete curbs as specified in Section 033000 - Cast-in-Place Concrete.
   2. At floor, rivet panels to angles 8 inches o.c.
   3. If floors are acoustically insulated, provide liner of 18-gage supported 12 inches o.c. and turned up 12 inches sides with sheet metal shields

3.7 PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a primer compatible with the duct material.

3.8 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Leakage Tests:
   1. Comply with SMACNA "HVAC Air Duct Leakage Test Manual." Submit a test report for each test.
   2. Test ductwork sections that have a design static pressure class magnitude of 4-inch wg or more regardless of duct locations. Test representative duct sections totaling no less than 25 percent of total installed duct area. Obtain Engineer's approval of specific sections to be tested beforehand.
   3. Test all ductwork located outdoors.
   4. Disassemble, reassemble, and seal segments of systems to accommodate leakage testing and for compliance with test requirements.
   5. Test for leaks before applying external insulation.
   6. Conduct tests at static pressures equal to maximum design pressure of system or section being tested. If static-pressure classes are not indicated, test system at maximum system design pressure. Do not pressurize systems above maximum design operating pressure.
   7. Give at least seven days notice for testing.
   8. Tests must demonstrate that tested ducts meet SMACNA leakage class 4 or less. If any tested section of ductwork fails to meet this requirement, perform the following at no additional cost to the Owner:
      a. Leak test 100 percent of the ductwork in every duct system with any failed section.
      b. Provide additional sealing of ductwork to eliminate excessive leakage in failed sections. If necessary, replace duct sections.
      c. Retest 100 percent of the ductwork in every duct system with any failed section.
      d. Continue sealing and retesting until the entire system is proven to meet the leakage requirement. Note that once a section is proven to meet the leakage requirement that section does not need to be tested again unless it is damaged later.

C. Duct System Cleanliness Tests:
   1. Visually inspect duct system to ensure that no visible contaminants are present.

D. Duct system will be considered defective if it does not pass tests and inspections.

E. Prepare test and inspection reports.

3.9 DUCT CLEANING

A. Clean duct system(s) before testing, adjusting, and balancing in accordance with other Division 23 Sections.

3.10 DUCT CONSTRUCTION REQUIREMENTS

A. Fabricate ducts with materials, pressure classes, and insulations indicated on Drawings.

SECTION 23 33 00
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
1. Manual volume dampers.
2. Curtain-type fire dampers.
3. Multiple-blade type fire dampers.
4. Ceiling radiation dampers.
5. Smoke dampers.
6. Combination fire and smoke dampers.
7. Flange connectors.
8. Turning vanes.
9. Duct-mounted access doors.
10. Duct access panel assemblies.
11. Flexible connectors.
12. Duct security bars.
13. Duct accessory hardware.

1.2 SUBMITTALS

A. Action Submittals:
1. Product Data: For each type of product.
a. For fire-dampers, smoke-dampers, combination fire- and smoke-dampers, and ceiling dampers include installation instructions.
b. For smoke-dampers and combination fire- and smoke-dampers include power, signal, and control wiring diagrams.

B. Closeout Submittals:
1. Operation and Maintenance Data: For air duct accessories to include in operation and maintenance manuals.

C. Maintenance Material Submittals:
1. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.
2. Fusible Links: Furnish quantity equal to at least 10 percent of amount installed.

PART 2 PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A and NFPA 90B.

B. Comply with SMACNA 006 for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

2.2 MATERIALS

A. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.
   1. Galvanized Coating Designation: G90.
   2. Exposed-Surface Finish: Mill phosphatized.

B. Stainless-Steel Sheets: Comply with ASTM A 480/A 480M, Type 304 or Type 316 as indicated. Unless indicated otherwise, No. 2 finish for concealed ducts and No. 4 finish for exposed ducts.

C. Aluminum Sheets: Comply with ASTM B 209, Alloy 3003, Temper H14; with mill finish for concealed ducts and standard, 1-side bright finish for exposed ducts.

D. Extruded Aluminum: Comply with ASTM B 221, Alloy 6063, Temper T6.

E. Reinforcement Shapes and Plates: Galvanized-steel reinforcement where installed on galvanized sheet metal ducts; compatible materials for aluminum and stainless-steel ducts.

F. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.3 MANUAL VOLUME DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Ruskin Company.
   2. American Warming and Ventilating.
   3. Greenheck Fan Corporation.
   4. McGill Airflow LLC.
   5. Nailor Industries Inc.
   6. NCA.
   7. Pottorff.
   8. Safe Air – Dowco Products.
   9. Vent Products Co., Inc.

B. Round Manual Volume Damper: Diameter 20 inches or less, air velocity 1500 fpm or less, and duct static pressure class 2-inch or less. Galvanized steel sleeve with reinforcing beads. Single galvanized steel blade on axle with molded synthetic bearing at each end of axle and locking quadrant on standoff bracket. Basis of design Ruskin MDRS25.

C. Round or Oval Manual Volume Damper: Diameter 48 inches or less, air velocity 4000 fpm or less, and duct static pressure class 10-inch or less. Galvanized steel construction for galvanized steel duct. Type 304 stainless steel construction for type 304 stainless steel or aluminum duct. Type 316 stainless steel construction for type 316 stainless steel duct. Rolled hat channel frame arranged for slip-in mounting. Single blade (or dual blades with center mullion for oval duct over 36 inches wide). Neoprene blade edge seals. Class II leakage rating. Blade mounted on axle with stainless steel sleeve bearing at each end of axle and locking quadrant on standoff bracket. Basis of design Ruskin CDR25 or CDO25.

D. Rectangular Manual Volume Damper: Height 12 inches or less, air velocity 1500 fpm or less, and duct static pressure class 1-inch or less. Galvanized steel sleeve with blade stop. Single galvanized steel blade on axle with molded synthetic bearings and locking quadrant on standoff bracket. Basis of design Ruskin MD25.

E. Rectangular Manual Volume Dampers: Height 5 inches or more, air velocity 1500 fpm or less., and duct static pressure class 3-inch or less. Galvanized steel hat channel frame with mitered and welded corners and blade stop. Flanged for attaching to wall and flangeless for installing in duct. Multiple single-thickness formed galvanized steel blades with opposed blade linkage enclosed in frame. Blades mounted on axles with molded synthetic bearings. Control shaft extended beyond frame with locking quadrant on standoff bracket. Basis of design Ruskin MD35.

2.4 CURTAIN-TYPE FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Ruskin Company DIBD series.
   2. American Warming and Ventilating.
   3. Greenheck Fan Corporation.
   4. Nailor Industries Inc.
   5. NCA.
   6. Pottorff.
   7. Safe Air – Dowco Products.
   8. Vent Products Co., Inc.

B. Type: Static or dynamic as indicated on Drawings; rated and labeled according to UL 555.

C. Fire Damper Dynamic Closure Rating: At least 2000-fpm velocity for all sizes and mounting arrangements at 4-inch wg static pressure.

D. Fire Rating: 1-1/2 or 3 hours as indicated on Drawings.

E. Mounting Orientation: Vertical or horizontal as indicated.

F. Frame and Blade Material: Galvanized steel (or stainless steel for aluminum or stainless steel duct).

G. Frame: Frame roll-formed in gages required by UL listing; with mitered and interlocking corners. Blade lock.

H. Blades: Roll-formed interlocking curtain blades operated by fusible link and stainless-steel closure spring. Link temperature rating 165 or 212 deg F as indicated on Drawings.

I. Mounting Sleeve: Factory-installed, galvanized steel in length required for installation. Steel mounting angles. Ends of sleeve act as duct collars for Style A or B. Integral duct collars at ends of sleeve for Style C, CR, or CO.

2.5 MULTIPLE-BLADE-TYPE FIRE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Ruskin Company DFD60 series.
   2. American Warming and Ventilating.
   3. Greenheck Fan Corporation.
   4. Nailor Industries Inc.
   5. NCA.
   6. Pottorff.
   7. Safe Air – Dowco Products.
   8. Vent Products Co., Inc.

B. Type: Dynamic; rated and labeled according to UL 555.

C. Fire Damper Dynamic Closure Rating: At least 2000-fpm velocity for all sizes and mounting arrangements at 4-inch wg static pressure.

D. Fire Rating: 1-1/2 or 3 hours as indicated.

E. Mounting Orientation: Vertical or horizontal as indicated.

F. Frame and Blade Material: Galvanized steel.

G. Frame: Hat channel frame, minimum 16 gage, with mitered and interlocking corners.

H. Blades: Single-piece airfoil blades equivalent to 14-gage strength, mounted on plated steel axles with permanently-lubricated stainless steel sleeve bearings pressed into frame. Parallel-blade-operation linkage concealed in frame.

I. Fusible Link: Temperature rating 165 or 212 deg F as indicated on Drawings.

J. Closure Spring: Stainless steel.

K. Mounting Sleeve: Factory-installed, galvanized steel in length required for installation. Steel mounting angles. Ends of sleeve act as duct collars for Style A or B. Integral duct collars at ends of sleeve for Style C, CR, or CO.

2.6 CEILING RADIATION DAMPERS

A. Manufacturers:
   1. Ruskin Company CFD series.
   2. American Warming and Ventilating.
   3. Nailor Industries Inc.
   4. NCA.
   5. Pottorff.
   6. Safe Air – Dowco Products.

B. General Requirements:
   1. Labeled according to UL 555C.
   2. Comply with construction details for tested floor- and roof-ceiling assemblies as indicated in UL's "Fire Resistance Directory."

C. Frame: Galvanized sheet steel, round or rectangular, style to suit ceiling construction.

D. Blades: Galvanized sheet steel with refractory insulation.

E. Heat-Responsive Device: Replaceable, 165 deg F or 212 deg F rated, fusible links.

F. Fire Rating: 1, 2, or 3 hours as indicated.

2.7 SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Ruskin Company SD60 series.
   2. American Warming and Ventilating.
   3. Greenheck Fan Corporation.
   4. Nailor Industries Inc.
   5. NCA.
   6. Pottorff.
   7. Safe Air – Dowco Products.

B. General Requirements: Label according to UL 555S.

C. Damper Closure Rating: At least 2000-fpm velocity for all sizes and mounting arrangements at 4-inch wg static pressure.

D. Frame: Hat channel frame, minimum 16 gage, with mitered and interlocking corners.

E. Blades: Single-piece airfoil blades equivalent to 14-gage strength, mounted on plated steel axles with permanently-lubricated stainless steel sleeve bearings pressed into frame. Parallel-blade-operation linkage concealed in frame.

F. Seals: Flexible stainless steel compression jamb seals. Silicone blade edge seals mechanically fastened to blades; suitable for temperatures 450 deg F or less.

G. Leakage: Class I.

H. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application; thickness to meet UL requirements.

I. Damper Motors: Modulating or two-position action as indicated.

J. Smoke Detector: Integral, factory wired for single-point connection.

K. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in other Division 23 Sections.

L. Accessories:
   1. Auxiliary switches for position indication.
   2. Test and reset switches, damper or remote mounted as indicated.

2.8 COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Ruskin Company FSD60 series.
   2. American Warming and Ventilating.
   3. Greenheck Fan Corporation.
   4. Nailor Industries Inc.
   5. NCA.
   6. Pottorff.
   7. Safe Air – Dowco Products.

B. Type: Dynamic; rated and labeled according to UL 555 and UL 555S.

C. Damper Closure Rating: At least 2000-fpm velocity for all sizes and mounting arrangements at 4-inch wg static pressure.

D. Fire Rating: 1-1/2 or 3 hours as indicated.

E. Frame: Hat channel frame, minimum 16 gage, with mitered and interlocking corners.

F. Blades: Single-piece airfoil blades equivalent to 14-gage strength, mounted on plated steel axles with permanently-lubricated stainless steel sleeve bearings pressed into frame. Parallel-blade-operation linkage concealed in frame.

G. Seals: Flexible stainless steel compression jamb seals. Silicone blade edge seals mechanically fastened to blades; suitable for temperatures 450 deg F or less.

H. Leakage: Class I.

I. Mounting Sleeve: Factory-installed, galvanized sheet steel; length to suit wall or floor application; thickness to meet UL requirements.

J. Damper Motors: Modulating or two-position action as indicated.

K. Smoke Detector: Integral, factory wired for single-point connection.

L. Heat-Responsive Device: Resettable, 165 deg F or 212 deg F as indicated rated, fire-closure device and switch package, factory installed.

M. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors specified in other Division 23 Sections.

N. Master control panel for use in dynamic smoke-management systems.

O. Accessories:
   1. Auxiliary switches for position indication.
   2. Test and reset switches, damper or remote mounted as indicated.

2.9 FLANGE CONNECTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Ductmate Industries, Inc.

2. Ward Industries; a brand of Hart & Cooley, Inc.

B. Description: Add-on, factory-fabricated, slide-on transverse flange connectors, gaskets, and components.

C. Material: Galvanized steel.

D. Gage and Shape: Match connecting ductwork.

2.10 TURNING VANES

A. Manufactured Turning Vanes for Metal Ducts: Curved blades of galvanized sheet steel; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.
1. Acoustic Turning Vanes: Fabricate airfoil-shaped aluminum extrusions with perforated faces and fibrous-glass fill.

B. Manufactured Turning Vanes for Nonmetal Ducts: Fabricate curved blades of resin-bonded fiberglass with acrylic polymer coating; support with bars perpendicular to blades set; set into vane runners suitable for duct mounting.

C. General Requirements: Comply with SMACNA 006.

D. Vane Construction: Single wall for vanes up to 48 inches wide and double wall for larger dimensions.

2.11 DUCT-MOUNTED ACCESS DOORS

A. Duct-Mounted Access Doors: Fabricate access panels according to SMACNA 006. Double wall, rectangular door. Galvanized sheet steel with insulation fill and thickness as indicated for duct pressure class. Butt or piano hinges and cam locks, quantities as indicated in SMACNA 006. Doors airtight and suitable for duct pressure class. Galvanized sheet steel frame with bend-over tabs and foam gaskets. Vision panel where indicated.

B. Pressure Relief Access Door: Door and frame of galvanized sheet steel. Double wall door with insulation fill and metal thickness applicable for duct pressure class. Open outward for positive-pressure duct and inward for negative-pressure duct. Factory set at 3.0-inch to 8.0-inch wg positive or negative. Door retaining device. Neoprene or foam rubber seal.

2.12 DUCT ACCESS PANEL ASSEMBLIES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
1. Ductmate Industries, Inc.
2. Approved equal.

B. Labeled according to UL 1978. Double-wall panel with two layers of steel, minimum 11 gage (0.12-inch thick) carbon or 11 gage (0.13-inch) stainless, steel type to match duct material. Carbon or stainless steel panel fasteners welded to inner wall and attached by threaded fasteners to outer wall. Fasteners shall not penetrate duct wall. Gasket complying with NFPA 96; grease-tight and airtight, high-temperature ceramic fiber, rated for minimum 2000 deg F. Minimum pressure rating 10-inch wg, positive or negative.

2.13 FLEXIBLE CONNECTORS

A. Materials: Flame-retardant or noncombustible fabrics.

B. Coatings and Adhesives: Comply with UL 181, Class 1.

C. Metal-Edged Connectors: Fabricated with a fabric strip 5-3/4 inches wide attached to two strips of 2-3/4-inch-wide, 0.028-inch-thick, galvanized sheet steel or 0.032-inch-thick aluminum sheets. Provide metal compatible with connected ducts.

D. Indoor System, Flexible Connector Fabric: Glass fabric double coated with neoprene. Minimum weight 26 oz./sq. yd. Minimum tensile strength 480 lbf/inch in the warp and 360 lbf/inch in the filling. Service temperature range minus 40 to plus 200 deg F.

E. Outdoor System, Flexible Connector Fabric: Glass fabric double coated with weatherproof, synthetic rubber resistant to UV rays and ozone. Minimum weight 24 oz./sq. yd. Tensile strength 530 lbf/inch in the warp and 440 lbf/inch in the filling. Service temperature range minus 50 to plus 250 deg F.

2.14 DUCT SECURITY BARS

A. Configuration:
   1. Frame: 2 by 1/4 inch flat frame with all joints fully welded.
   2. Sleeve: 10 gage (0.1345-inch thick) continuously welded steel frames with 1-1/2-by-1-1/2-by-1/8-inch angle frame furnished loose for field welding to sleeve to be poured in place or set with concrete block or welded or bolted to wall, one side only. Duct connections on both sides.
   3. Bars: 1/2 inch diameter.
   4. Bar Spacing: 6-inch centers in both directions. All bars welded into frame and welded at all intersection points.

2.15 DUCT ACCESSORY HARDWARE

A. Instrument Test Holes: Cast iron or cast aluminum to suit duct material, including screw cap and gasket. Size to allow insertion of pitot tube and other testing instruments and of length to suit duct-insulation thickness.

B. Adhesives: High strength, quick setting, neoprene based, waterproof, and resistant to gasoline and grease.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install duct accessories in accordance with manufacturers' instructions.

B. Install duct accessories according to applicable details in SMACNA 006 for metal ducts and in NAIMA AH116 for fibrous-glass ducts.

C. Install duct accessories of materials suited to duct materials; use galvanized-steel accessories in galvanized-steel and fibrous-glass ducts, stainless-steel accessories in stainless-steel ducts, and aluminum accessories in aluminum ducts.

D. Compliance with ASHRAE/IESNA 90.1 restricts the use of backdraft dampers, and requires control dampers for certain applications. Install backdraft or control damper (as indicated) at inlet of exhaust fan or in exhaust duct close to exhaust fan unless otherwise indicated.

E. Install volume dampers only in ducts constructed to magnitude 2" pressure class or less. Provide at points on supply, return, and exhaust systems where branches extend from larger ducts. Where dampers are installed in ducts having duct liner, install dampers with hat channels of same depth as liner, and terminate liner with nosing at hat channel.

F. Set each damper fully open position before testing, adjusting, and balancing.

G. Install test holes at fan inlets and outlets and elsewhere as indicated.

H. Install fire or smoke damper according to UL listing.

I. Install duct security bars. Connect duct security bars to ducts with flexible connections. Provide access door in duct on each side of sleeve.

J. Install duct access doors on sides of ducts to allow for inspecting, adjusting, and maintaining accessories and equipment at the following locations:
   1. On both sides of duct coil.
   2. Upstream and downstream from duct filter.
   3. At outdoor-air intake and mixed-air plenum.
   4. At drain pan.
   5. Downstream from manual volume damper, control damper, backdraft damper, and equipment.
   6. Adjacent to and close enough to fire or smoke damper to reset or reinstall fusible link. Door for access to fire or smoke damper having fusible link shall be pressure relief access door and shall be outward operation for access door installed upstream from damper and inward operation for access door installed downstream from damper.
   7. Upstream and downstream from duct silencer.
   8. At each control device requiring inspection.
   9. Elsewhere as indicated.

K. Install access door with swing against duct static pressure.

L. Access Door Sizes:
   1. One-Hand or Two-Hand Access: 12 by 12 inches.
   2. Head and Hand Access: 18 by 12 inches.
   3. Head and Shoulders Access: 24 by 18 inches.
   4. Body Access: 30 by 18 inches.
   5. Body plus Ladder Access: 30 by 30 inches.
   6. Where duct width does not permit door size specified above, one dimension of door size may be reduced to 2 inches less than duct width.

M. Label access door as specified in another Division 23 Section to indicate the purpose of the access door.

N. Install flexible connectors to connect ducts to equipment. If vibrating equipment is internally isolated from casing, provide rigid duct connections.

O. For fan developing static pressure of 5-inch wg or more, cover flexible connector with loaded vinyl sheet held in place with metal straps.

P. Connect terminal unit to supply ductwork directly or with maximum 12-inch length of flexible duct. Do not use flexible duct to change directions or to correct misalignment of duct and terminal unit inlet.

Q. Connect diffuser or register to duct directly or with maximum 60-inch length of flexible duct clamped or strapped in place.

R. Connect flexible duct to metal duct with liquid adhesive plus tape.

S. Install duct test hole where required for testing and balancing purposes.

3.2 FIELD QUALITY CONTROL

A. Tests and Inspections:
   1. Operate each damper to verify full range of movement.
   2. Inspect locations of access doors and verify that purpose of access door can be performed and that door can open fully.
   3. Operate fire, smoke, and combination fire and smoke damper to verify full range of movement and verify that proper heat-response or smoke-sensing device is installed.
   4. Inspect turning vanes for proper and secure installation.
   5. Operate remote damper operator to verify full range of movement of operator and damper.

SECTION 23 33 46
FLEXIBLE DUCTS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Insulated flexible ducts.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product.
   2. Shop Drawings: For flexible ducts. Include plans showing locations and mounting and attachment details.

PART 2 PRODUCTS

2.1 ASSEMBLY DESCRIPTION

A. Comply with NFPA 90A, "Installation of Air Conditioning and Ventilating Systems," and with NFPA 90B, "Installation of Warm Air Heating and Air Conditioning Systems."

B. Comply with SMACNA 006 "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

C. Comply with Air Diffusion Council "ADC Flexible Air Duct Test Code FD 72-R1."

D. Comply with ASTM E 96/E 96M, "Test Methods for Water Vapor Transmission of Materials."

2.2 INSULATED FLEXIBLE DUCTS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Flexmaster U.S.A., Inc.
   2. McGill Airflow LLC.
   3. Thermaflex; a Flex-Tek Group.
   4. Ward Industries; a brand of Hart & Cooley, Inc.

B. Insulated, Flexible Duct: UL 181, Class 1, two-ply vinyl film supported by helically wound, spring-steel wire; fibrous-glass insulation; aluminized vapor-barrier film.
   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
   2. Maximum Air Velocity: 4000 fpm.
   3. Temperature Range: Minus 10 to plus 160 deg F.

4. Insulation R-Value: R6.

C. Insulated, Flexible Duct: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound, spring-steel wire; fibrous-glass insulation; polyethylene aluminized vapor-barrier film.
   1. Pressure Rating: 10-inch wg positive and 1.0-inch wg negative.
   2. Maximum Air Velocity: 4000 fpm.
   3. Temperature Range: Minus 20 to plus 210 deg F.
   4. Insulation R-Value: R6.

2.3 FLEXIBLE DUCT CONNECTORS

A. Clamps: Stainless-steel band with cadmium-plated hex screw to tighten band with a worm-gear action in sizes 3 through 18 inches, to suit duct size.

B. Non-Clamp Connectors: Liquid adhesive plus tape.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install flexible ducts according to applicable details in SMACNA006 for metal ducts and in NAIMA AH116 for fibrous-glass ducts.

B. Install in indoor applications only. Flexible ductwork should not be exposed to UV lighting.

C. Connect terminal units to supply ducts directly or with maximum 12-inch lengths of flexible duct. Do not use flexible ducts to change directions or correct misalignments.

D. Connect diffusers or light troffer boots to ducts directly or with maximum 60-inch lengths of flexible duct clamped or strapped in place.

E. Connect flexible ducts to metal ducts with liquid adhesive plus tape or draw bands.

F. Installation:
   1. Install ducts fully extended.
   2. Do not bend ducts across sharp corners.
   3. Centerline radius of bends of flexible ducting shall not be less than one duct diameter.
   4. Avoid contact with metal fixtures, water lines, pipes, or conduits.
   5. Install flexible ducts in a direct line, without sags, twists, or turns except as noted elsewhere.

G. Supporting Flexible Ducts:
   1. Suspend flexible ducts with bands 1-1/2 inches wide or wider and spaced a maximum of 48 inches apart. Maximum centerline sag between supports shall not exceed 1/2 inch per 12 inches.
   2. Install extra supports at bends approximately one duct diameter from center line of the bend.
   3. Ducts may rest on ceiling joists or truss supports. Spacing between supports shall not exceed the maximum spacing per manufacturer's written installation instructions.

4. Vertically installed ducts shall be stabilized by support straps at a maximum of 72 inches on center.

SECTION 23 34 23
HVAC POWER VENTILATORS

PART 1 GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Centrifugal roof ventilators.
   2. Ceiling Exhaust Fans
   3. Wall Propeller Fans
   4. High Volume, Low Speed Ceiling Fans

1.2 PERFORMANCE REQUIREMENTS

A. Project Altitude: Base fan-performance ratings on actual Project site elevation.

B. Operating Limits: Classify according to AMCA 99.

1.3 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product indicated. Include rated capacities, operating characteristics, and furnished specialties and accessories. Also include the following:
      a. Certified fan performance curves with system operating conditions indicated.
      b. Certified fan sound-power ratings.
      c. Motor ratings and electrical characteristics, plus motor and electrical accessories.
      d. Material thickness and finishes, including color charts.
      e. Dampers, including housings, linkages, and operators.
      f. Roof curbs.
   2. Seismic Qualification Data: Certificates for indoor, basic air-handling units, accessories, and components, from manufacturer.
      a. Basis for Certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.
      b. Dimensioned Outline Drawings of Equipment Unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
      c. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

B. Informational Submittals:
   1. Field quality-control reports.

C. Closeout Submittals:
   1. Operation and Maintenance Data: For power ventilators to include in emergency, operation, and maintenance manuals.

D. Maintenance Material Submittals:
   1. Belts: One spare set for each belt-driven unit.

1.4 QUALITY ASSURANCE

A. AMCA Compliance:
   1. Comply with AMCA performance requirements and bear the AMCA-Certified Ratings Seal.
   2. Operating Limits: Classify according to AMCA 99.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. UL Standards: Power ventilators shall comply with UL 705. Power ventilators for use for restaurant kitchen exhaust shall also comply with UL 762.

PART 2 PRODUCTS

2.1 CENTRIFUGAL ROOF VENTILATORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Greenheck Fan Corporation.
   2. Loren Cook Company.
   3. New York Blower Company.
   4. PennBarry.
   5. Twin City Fan & Blower.
   6. Captiveaire

B. Housing: Removable, spun-aluminum, dome top and outlet baffle; square, one-piece, aluminum base with venturi inlet cone.
   1. Downblast Units: Provide spun-aluminum discharge baffle to direct discharge air downward.
   2. Upblast Units: Provide spun-aluminum discharge baffle to direct discharge air upward, with rain and snow drains.

C. Fan Wheels: Aluminum hub and wheel with backward-inclined blades.

D. Direct Drive (Where Applicable): Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

E. Belt Drives (Where Applicable):
   1. Resiliently mounted to housing.
   2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
   3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
   4. Pulleys: Cast-iron, adjustable-pitch motor pulley. Spring-loaded idler pulley for automatic belt tensioning.
   5. Fan and motor isolated from exhaust airstream.

F. Accessories:
   1. Disconnect Switch: Nonfusible type, with thermal-overload protection, NEMA 3r mounted on fan housing, factory wired through an internal aluminum conduit.
   2. Bird Screens: Removable, 1/2-inch mesh, aluminum or stainless steel wire.

3. Dampers: Counterbalanced, parallel-blade, backdraft dampers mounted in curb base; factory set to close when fan stops.
4. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

G. Roof Curbs: Galvanized steel; mitered and welded corners; 1-1/2-inch-thick, rigid, fiberglass insulation adhered to inside walls; and 1-1/2-inch wood nailer. Size as required to suit roof opening and fan base. Self-flashing without a cant strip configuration, with mounting flange.
1. Overall Height: 18 inches unless indicated otherwise.
2. Sloped Roof Mounting (Where Applicable): Manufacture curb for roof slope.
3. Burglar Bars: 1/2-inch-thick steel bars welded in place on 6-inch centers both directions.

2.2 Ceiling Exhaust Fans

A. Manufacturers:
1. Broan-NuTone
2. Carnes
3. Greenheck
4. Panasonic
5. PennBarry
6. Twin City Fan & Blower

B. Centrifugal Fan Unit: V-belt or direct driven with galvanized steel housing, resiliently mounted motor, gravity backdraft damper in discharge.

C. Disconnect Switch: Cord and plug-in housing for thermal overload protected motor and wall mounted switch.

D. Grille: Molded white plastic.

E. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is reached with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

F. Performance Ratings: As indicated on drawings.

2.3 HVLS Fans

A. Manufacturers:
1. Big Ass Fans

B. Performance:
1. Provide air performance, dimensions, and electrical characteristics as scheduled on drawings.

C. Provide remote fan speed controller.

D. Provide factory mounted and wired disconnect.

2.4 AXIAL WALL FANS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Greenheck Fan Corporation.
   2. Loren Cook Company.
   3. New York Blower Company.
   4. PennBarry.
   5. Twin City Fan & Blower.
   6. Captiveaire

B. Equipment listed in schedules shall be considered basis of design. Alternative manufactureres may be approved given similar form, finish, options, and perfomance.

C. Provide equipment meeting the dimensions, airflow performance, and options as listed on design schedules.

D. Direct Drive (Where Applicable): Motor mounted in airstream, factory wired to disconnect switch located on outside of fan housing.

E. Belt Drives (Where Applicable):
   1. Resiliently mounted to housing.
   2. Fan Shaft: Turned, ground, and polished steel; keyed to wheel hub.
   3. Shaft Bearings: Permanently lubricated, permanently sealed, self-aligning ball bearings.
   4. Pulleys: Cast-iron, adjustable-pitch motor pulley. Spring-loaded idler pulley for automatic belt tensioning.
   5. Fan and motor isolated from exhaust airstream.

F. Accessories:
   1. Disconnect Switch: Nonfusible type, with thermal-overload protection, NEMA 3r mounted on fan housing, factory wired through an internal aluminum conduit.
   2. Bird Screens: Removable, 1/2-inch mesh, aluminum or stainless steel wire.
   3. Exterior discharge weatherhood.
   4. Motorized Dampers: Parallel-blade dampers mounted in curb base with electric actuator; wired to close when fan stops.

2.5 MOTORS

A. Comply with NEMA designation, temperature rating, service factor, enclosure type, and efficiency requirements for motors as indicated on Drawings and specified in another Division 23 Section. Minimum size as indicated. If not indicated, large enough so driven load will not require motor to operate in service factor range above 1.0.

2.6 SOURCE QUALITY CONTROL

A. Certify sound-power level ratings according to AMCA 301. Factory test fans according to AMCA 300. Label fans with the AMCA-Certified Ratings Seal.

B. Certify fan performance ratings, including flow rate, pressure, power, air density, speed of rotation, and efficiency by factory tests according to AMCA 210. Label fans with the AMCA-Certified Ratings Seal.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install fans and accessories in accordance with manufacturer’s instructions.

B. Install power ventilators level and plumb.

C. Lift and support units with manufacturer's designated lifting or supporting points.

D. Secure roof-mounted fans to roof curbs with cadmium-plated hardware. Coordinate roof curb installation with General Contractor.

E. Support suspended units from structure using threaded steel rods and spring hangers with vertical-limit stops having a static deflection of 2 inches specified in another Division 23 Section.

F. Install units with clearances for service and maintenance.

3.2 CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors.

B. Install ducts adjacent to power ventilators to allow service and maintenance.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Perform the following tests and inspections with the assistance of a factory-authorized service representative:
   1. Verify that shipping, blocking, and bracing are removed.
   2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
   3. Verify that cleaning and adjusting are complete.
   4. Disconnect fan drive from motor, verify proper motor rotation direction, and verify fan wheel free rotation and smooth bearing operation. Reconnect fan drive system, align and adjust belts, and install belt guards.
   5. Adjust belt tension where applicable.
   6. Adjust damper linkages for proper damper operation.
   7. Provide and verify lubrication for bearings and other moving parts.
   8. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
   9. Disable automatic temperature-control operators, energize motor and adjust fan to indicated rpm, and measure and record motor voltage and amperage.
   10. Shut unit down and reconnect automatic temperature-control operators.
   11. Remove and replace malfunctioning units and retest as specified above.

C. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

D. Prepare test and inspection reports.

SECTION 23 35 16
ENGINE EXHAUST SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Centrifugal fans.

B. Ductwork and duct accessories.

C. Exhaust system accessories.

1.2 RELATED REQUIREMENTS

A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Fan motors.

B. Section 23 05 48 - Vibration and Seismic Controls for HVAC: Vibration isolators.

C. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2016.

C. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016.

D. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

E. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2020.

H. SMACNA (ROUND) - Round Industrial Duct Construction Standards; 2013.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers literature and data sheets indicating rated capacities, dimensions, weights and point loadings, accessories, electrical characteristics and connection requirements, wiring diagrams, and location and sizes of field connections.
   1. Provide fan curves with specified operating point clearly plotted.
   2. Submit sound power levels for both fan inlet and outlet at rated capacity.

C. Shop Drawings: Indicate dimensions, sizes, weights and point loadings, and locations and sizes of field connections. Provide final ductwork and equipment layout shop drawings for review and approval.

D. Manufacturer's Installation Instructions: Include assembly and installation instructions.

E. Operation and Maintenance Data: Include instructions for fan lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.5 System Design

A. The drawings and specifications are intended to indicate general locations, system types, hose drop quantities, preliminary locations, and a required exhaust performance based on 600 CFM per hose drop at 4" ESP. However, exhaust system manufacturer shall be responsible for detailed design of system. Vehicle exhaust system manufacturer shall meet with owner to confirm vehicle information and intended layout, and shall submitt to the engineer a full set of shop drawings indicated ductwork sizes, elevations, equipment layout, fan information, airflow performance, and all products necessary as part of the system. Exhaust system manufacturer responsible for providing and installing all aspects of the system necessary for system operation.

1.6 QUALITY ASSURANCE

A. Fan Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.

B. Fan Sound Ratings: AMCA 301, tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.

C. Fan Fabrication: Comply with AMCA 99.

D. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

E. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.7 Warranty

A. Provide 1 year parts and labor warranty for complete system package.

1.8 FIELD CONDITIONS

A. Permanent exhaust system may not be used for ventilation during construction.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Basis of Design: Monoxivent

B. Approved Alternates

1. Plymovent
2. Magnegri

C. Substitutions: Not permitted.

2.2 System Description

A. The vehicle exhaust system shall be a source capture system designed to handle exhaust from diesel engines.

B. The system shall be provided with 3 drops all tied to a single exhaust fan.

C. System shall be a motorized hoze reel system with 36 feet hoses.

D. Bid shall include the furnishing and installation of all components necessary for successful system operation, including all required ductwork, structural supports/attachments, and controls devices/wiring.

2.3 CENTRIFUGAL FANS

A. Performance: Performance to be as scheduled modified by system provider recommendations for the number of drops and vehicles present. Notify engineer of any recommended changes to fan performance.

B. Wheel and Inlet: Steel construction with smooth curved inlet flange, heavy back plate, backwardly curved blades welded to flange and back plate; cast iron hub riveted to back plate and keyed to shaft with set screws.

C. Housing: Heavy gauge steel, spot welded with inlet bell and shaped cut-off, factory finished with enamel or prime coat.

D. Motors and Drives:
1. Motors: As indicated, in compliance with Section 23 05 13.
2. Electrical Characteristics: As scheduled
3. Bearings: Heavy duty pillow block type, self-aligning, grease-lubricated ball bearings or roller bearings.
4. Shafts: Hot rolled steel, ground and polished, with key-way, protectively coated with lubricating oil.

E. Electrical
1. Manufacturer to provide disconnect / motor starter. Provide all necessary controls / accessories for fan operation.

2.4 DUCTWORK AND DUCT ACCESSORIES

A. Materials:
1. Galvanized Steel Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Ductwork:
1. Fabricate and support in accordance with:
a. SMACNA Standards

2. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline.
3. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.
4. Fabricate continuously welded round and oval duct fittings two gauges heavier than duct gauges indicated in SMACNA (ROUND).

C. Flexible Connectors: UL-listed, fire-retardant, polyethylene-impregnated fabric, minimum density 20 oz per sq yd (0.68 kg per sq m), approximately 2 inches (50 mm) wide, crimped into metal edging strip.

2.5 EXHAUST SYSTEM ACCESSORIES

A. Tail Pipe Adapters: Provide adapter size(s) as required for owner equipment. Any required modifications to apparatus tail pipes to be included in scope. Utilize similar size nozles and adapters to allow fexibility in vehicle location. - 3 total, one for each drop

B. Vertical stack exhaust adapter with rolling base support - 2 total

C. Flexible Exhaust Hose: Heat resistant capable of withstanding 400 degree temperatures. The bottom section of hose shall be capable of withstanding 1000 degrees.

D. Control System: Provide an automatic control system and associated panel. Electrical enclosure must be UL-508 listed. Enclosure must be NEMA4X rated. System shall automatically detect output pressure of engines for system enable and control.

E. Remote operation switch for each motorized hose reel - 3 total.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Install fans with resilient mounting and flexible electrical leads. See Section 23 05 48 and Section 26 05 83.

C. Install flexible connections at fan inlet and discharge. Ensure metal bands of connectors are parallel with minimum 1-inch (25 mm) flex between ductwork and fan while running.

D. Provide pitot tube openings where required for testing of systems, complete with metal cap with spring device or screw to ensure against air leakage.

E. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

SECTION 23 37 01
EXTRUDED ALUMINUM STATIONARY LOUVERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Extruded aluminum stationary louvers with drainable blades.

1.2 RELATED SECTIONS

A. Section 03300 - Cast-In-Place Concrete.

B. Section 04200 - Masonry Units.

C. Section 05100 - Structural Metal Framing.

D. Section 06100 - Rough Carpentry.

E. Section 07600 - Flashing and Sheet Metal.

F. Section 07920 - Joint Sealants.

G. Section 09910 - Paints.

1.3 REFERENCES

A. AAMA 605.2 - High Performance Organic Coatings on Architectural Extrusions and Panels.

B. AMCA 500 - Test Methods for Louvers, Dampers and Shutters.

C. AMCA 511 - Certified Ratings Program for Air Control Devices.

1.4 SUBMITTALS

A. Comply with requirements of Section 01330 - Submittal Procedures.

B. Product Data: Submit manufacturer's product data including performance data.

1.5 QUALITY ASSURANCE

A. Louvers licensed to bear AMCA Certified Ratings Seal. Ratings based on tests and procedures performed in accordance with AMCA 511 and comply with AMCA Certified Ratings Program. AMCA Certified Ratings Seal applies to air performance and water penetration ratings.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly indicating manufacturer and material.

B. Storage: Store materials in a dry area indoors, protected from damage and in accordance with manufacturer's instructions.

C. Handling: Protect materials and finishes during handling and installation to prevent damage.

PART 2 PRODUCTS

2.1 MANUFACTURER

A. Ruskin Manufacturing

B. Arrow

C. Cesco

D. Greenheck

E. Pottorff

F. Approved Equal

2.2 EXTRUDED ALUMINUM STATIONARY LOUVERS

A. Fabrication:
   1. Performance Ratings: AMCA licensed.
   2. Frame:
      a. Material: Extruded aluminum, Alloy 6063-T5.
      b. Wall Thickness: 0.125 inch (3.2 mm), nominal.
      c. Depth: 6 inches (152 mm).
      d. Downspouts and caulking surfaces.
   3. Blades:
      a. Style: Drainable.
      b. Material: Extruded aluminum, Alloy 6063-T5.
      c. Wall Thickness: 0.125 inch (3.2 mm), nominal.
      d. Angle: 37.5 degrees.
      e. Centers: 5-29/32 inches (150 mm), nominal.
   4. Bird Screen:
      a. Material: Aluminum, [3/4 inch x 0.051 inch (19 mm x 1.3 mm), expanded, flattened] [1/2 inch mesh x 0.063 inch (13 mm mesh x 1.6 mm), intercrimp].
      b. Frame: Removable, rewireable.
   5. Gutters: Drain gutter in head frame and each blade.
   6. Downspouts: Downspouts in jambs to drain water from louver for minimum water cascade from blade to blade.
   7. Vertical Supports: Hidden vertical supports to allow continuous line appearance up to 120 inches (3,048 mm).
   8. Sill: Steeply angled integral sill eliminating areas of standing or trapped moisture where mold or mildew may thrive and effect indoor air quality.
   9. Assembly: Factory assemble louver components. All welded construction.

B. Design Load: Incorporate structural supports required to withstand wind load of 20.

2.3 ACCESSORIES

A. Bird Screens:

B. Insect Screens:

C. Extended Sills: Extruded aluminum, Alloy 6063-T5. Minimum nominal wall thickness 0.060 inch (1.5 mm).

D. Visible Mullions: Manufacturer's standard horizontal or vertical visible mullions for architectural accent as indicated on drawings.

2.4 FACTORY FINISH

A. Color Anodize Finish:
   1. Comply with Aluminum Association AA-C22A44.

B. Apply finish following chemical etching and pretreatment.
   1. Electrolytically deposited color anodized finish.
   2. Minimum Thickness: 0.7 mils (0.018 mm).

C. Clear Anodize Finish:
   1. Comply with Aluminum Association AA-C22A31. Clear anodize finish 204-R1.
   2. Apply finish following chemical etching and pretreatment.
   3. Minimum Thickness: 0.4 mils (0.01 mm), 30 minute anodizing process.

PART 3 EXECUTION

3.1 EXAMINATION

A. Inspect areas to receive louvers. Notify the Architect of conditions that would adversely affect the installation or subsequent utilization of the louvers. Do not proceed with installation until unsatisfactory conditions are corrected.

3.2 INSTALLATION

A. Install louvers at locations indicated on the drawings and in accordance with manufacturer's instructions.

B. Install louvers plumb, level, in plane of wall, and in alignment with adjacent work.

C. Install joint sealants as specified in Section 07920.

3.3 CLEANING

A. Clean louver surfaces in accordance with manufacturer's instructions.

B. Repair minor damaged surfaces as directed by Architect.

SECTION 23 37 13
DIFFUSERS, REGISTERS, AND GRILLES

PART 1 GENERAL

1.1 SUMMARY

A. This Section includes ceiling- and wall-mounted diffusers, registers, and grilles.

1.2 SUBMITTALS

A. Action Submittal:
   1. Product Data: For each product indicated, include the following:
      a. Data Sheet: Indicate materials of construction, finish, and mounting details; and performance data including throw and drop, static-pressure drop, and noise ratings.
      b. Diffuser, Register, and Grille Schedule: Indicate Drawing designation, room location, quantity, model number, size, and accessories furnished.
   2. Coordination Drawings: Reflected ceiling plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:
      a. Ceiling suspension assembly members.
      b. Method of attaching hangers to building structure.
      c. Size and location of initial access module for acoustical tile.
      d. Ceiling-mounted items including lighting fixtures, diffusers, grilles, speakers, sprinklers, access panels, and special moldings.
      e. Duct access panels.
   3. Color Samples for Initial Selection: For each product with factory-applied color finishes.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Titus.
   2. Price.
   3. Krueger.
   4. Hart & Cooley.
   5. Metalaire.
   6. Tuttle & Bailey.
   7. AJ Manufacturing.
   8. Gordon INC.
   9. KEES.

B. See drawing schedules, plans and details for required materials, finishes, style, sizes , pattern performance and additional accessories.

1. Provide all supply diffusers with R-6 formed thermal insulation blanket.
2. Internal insulation of slot diffuser plenums is not allowed. All slot diffuser plenums shall be externally insulated.

2.2 SOURCE QUALITY CONTROL

A. Verification of Performance: Rate diffusers, registers, and grilles according to ASHRAE 70, "Method of Testing for Rating the Performance of Air Outlets and Inlets."

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas where diffusers, registers, and grilles are to be installed for compliance with requirements for installation tolerances and other conditions affecting performance of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install diffusers, registers, and grilles level and plumb.

B. Ceiling-Mounted Outlets and Inlets: Drawings indicate general arrangement of ducts, fittings, and accessories. Air outlet and inlet locations have been indicated to achieve design requirements for air volume, noise criteria, airflow pattern, throw, and pressure drop. Make final locations where indicated, as much as practicable. For units installed in lay-in ceiling panels, locate units in the center of panel. Where architectural features or other items conflict with installation, notify Architect for a determination of final location.

C. Install diffusers, registers, and grilles with airtight connections to ducts and to allow service and maintenance of dampers, air extractors, and fire dampers.

D. For all supply diffusers, install R-6 insalation blanket securely to the back of the diffuser/grille. Insulation shall be continuous and tightly sealed to back of diffuser/grille.

E. Provide sponge rubber gasket, mounting frame, and concealed fastener mounting on all surface mounted grilles and registers.

F. Paint inside portion on all ductwork and plenums visible behind air device non-specular flat black enamel.

G. Provide additional support for grilles, registers, and diffusers mounted in lay-in ceiling.

H. Provide non-specular flat black steel blank-offs behind all unused portions of linear air devices.

I. Coordinate exact location of Diffusers, Grilles and Registers with area smoke detectors, lights, and electrical devices. Air devices shall not be closer than 3 feet from area smoke detector.

J. Final location of diffusers, registers and grilles shall be from architectural reflected ceiling plans.

3.3 ADJUSTING

A. After installation, adjust diffusers, registers, and grilles to air patterns indicated, or as directed, before starting air balancing.

SECTION 23 40 00
FUME EXTRACTORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Welding Fume extractors.

1.2 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of fume extractors with welding booth layout and equipment.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Fume extractor(s) dimensions and construction, utility and service requirements and locations, reach range diagrams.

C. Shop Drawings: Indicate locations, large scale plans, elevations, cross sections, rough-in dimensions and tolerances, clearances required, locations and types of mounting accessories.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Manufacturer's Installation Instructions: Indicate special installation requirements.

F. Operation Data: Include description of fume extractor(s) operation and required adjusting and testing.

G. Maintenance Data: Identify system maintenance requirements, servicing cycles, lubrication types required and local spare part sources.

H. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.4 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect finished surfaces during handling and installation with protective covering of polyethylene film or another suitable material.

1.6 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide two-year manufacturer warranty for manufacturer's standard items (listed by part number in manufacturer's official publication).

PART 2 PRODUCTS

2.1 MANUFACTURED UNITS

A. Basis of Design Manufacturer: FILTAIR - SWX-D

B. Other Acceptable Manufacturers:
   1. Substitutions: Not permitted.

C. Fume Extraction Arms - General: Local exhaust ventilation device connected to facility air exhaust system.
   1. Extraction systems consisting of:
      a. Multiple articulated rigid arms connected with rotating joints. 10 feet total length and 8" diameter duct
      b. Fume collection nozzel
      c. Mounting connectors and brackets.
      d. Fan filter cabinet with disposable filters. System must be purpose built for welding fume extraction.
   2. System capable of 360 degrees rotation at joints, with a damper at one of the joints, and thumbscrews for fixing the angle of each arm.
   3. Fume Extraction Arm: Standard
      a. Application: Welding Processes including: stick, flux-cored, MIG, and TIG welding
      b. System Diameter: 8"
      c. Exhaust Capacity (Optimal Airflow Range): 875 CFM
      d. Maximum Noise: Noise at maximum airflow: 75 dB(A).

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 fume extractors.

B. Coordinate locations with welding booth casework. Confirm installed fume extractor will allow opening doors, and access to contents, of adjacent wall (upper) cabinets.

C. Coordinate location of fume extractor with finalized locations of Owner's equipment requiring local exhaust. Obtain necessary information from Owner.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and shop drawings.

B. Interface With Other Work: Interface with installation of above-ceiling supports and/or bracing, ceilings, casework, and other types of ventilation equipment and systems.

3.3 ADJUSTING

A. Adjust moving parts for smooth, near silent, operation with one hand.

3.4 CLEANING

A. Clean finished surfaces, touch up as required; and remove or refinish damaged or soiled areas to match original factory finish, as approved by Architect.

3.5 CLOSEOUT ACTIVITIES

A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.

B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

C. Final Acceptance:
   1. Remove labels, fingerprints, and clean all surfaces both inside and out.
   2. Repair any marred or damaged surfaces that affect appearance, such as both interior and exterior of extractors in a manner acceptable to Owner.
   3. Replace any parts that cannot be repaired in such a manner.

D. Demonstration: Demonstrate operation of fume extractors to Owner's personnel.
   1. Use operation and maintenance data as reference during demonstration.
   2. Briefly describe function, operation, and maintenance of each component.

3.6 PROTECTION

A. Protect installed local fume extractors from subsequent construction operations.

SECTION 23 55 33
FUEL-FIRED UNIT HEATERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Waste Oil fired unit heaters.

B. Room thermostats.

1.2 REFERENCE STANDARDS

A. NFPA 31 - Standard for the Installation of Oil-Burning Equipment; 2024.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2021.

D. NFPA 211 - Standard for Chimneys, Fireplaces, Vents, and Solid Fuel-Burning Appliances; 2024.

E. UL (DIR) - Online Certifications Directory; Current Edition.

F. UL 727 - Oil-Fired Central Furnaces; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's literature and data indicating rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate assembly, required clearances, and locations and sizes of field connections.

D. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements - Project Requirements, for additional provisions.

1.4 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for heat exchangers.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Comply with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

2.2 WASTE OIL FIRED UNIT HEATERS

A. Unit Heaters: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heat exchanger, burner, oil storage tank and tank mounted heater supports, all piping, pumps, controls, and accessories. Heater shall be purpose build for operation with used motor oil.
   1. System shall be complete equipment package including the heater, oil storage tank, tank mounted heater support kit, all required piping and pumps between the tank and heater, and all required controls/accessories.

B. APPROVED MANUFACTURERS
   1. LANAIR
   2. Other Manufacturers may be submitted to engineer / owner prior to bid for consideration.

C. Cabinet: Galvanized steel with baked enamel finish, easily removed and secured access doors, glass fiber insulation and reflective liner.

D. Supply Fan: Propeller type with direct drive, variable pitch motor pulley.

E. Combustion Chamber: UL 727 welded stainless steel.

F. Oil Burner: High pressure atomizing type, rubber mounted, adjustable combustion air blower, integrated fuel pump, hinged flame inspection port, cadmium sulfide flame sensor, electrodes, ignition transformer, oil nozzle.
   1. Barometric draft regulator in flue.
   2. Non-corrosive combustion air blower with permanently lubricated motor.

G. Oil Burner Safety Controls:
   1. Time delay relay limits time for establishment of main flame.
   2. Flame sensor monitors flame continuously during burner operation and stops burner on flame failure with manual reset.

H. Burner Operating Controls:
   1. Room Thermostat: Cycles burner to maintain room temperature setting.
   2. Supply Fan Control: Energize from bonnet temperature independent of burner controls, with fixed timed on delay, with manual switch for continuous fan operation. Provide continuous low speed fan operation.

I. Performance and additional options:

1. Refer to schedules

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that space is ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available.

C. Verify that proper fuel supply is available for connection.

3.2 INSTALLATION

A. Install in accordance with NFPA 90A.

B. Install oil fired units in accordance with NFPA 31 and applicable codes.

C. Provide vent connections in accordance with NFPA 211 and manufacturer instructions.

SECTION 23 81 26.13
SMALL-CAPACITY SPLIT-SYSTEM AIR CONDITIONERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Air-source heat pumps.

B. Indoor air handling (fan and coil) units for ducted systems.

C. Indoor air handling (fan and coil) units for ductless systems.

D. Controls.

1.2 REFERENCE STANDARDS

A. AHRI 210/240 - Performance Rating of Unitary Air-Conditioning and Air-Source Heat Pump Equipment; 2023.

B. AHRI 520 - Performance Rating of Positive Displacement Condensing Units; 2004.

C. ASHRAE Std 15 - Safety Standard for Refrigeration Systems; 2024, with Errata (2025).

D. ASHRAE Std 23 - Methods for Performance Testing Positive Displacement Refrigerant Compressors and Compressor Units; 2022.

E. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2021.

F. NFPA 90B - Standard for the Installation of Warm Air Heating and Air-Conditioning Systems; 2021.

G. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, accessories, electrical nameplate data, and wiring diagrams.

C. Shop Drawings: Indicate assembly, required clearances, and location and size of field connections.

D. Design Data: Indicate refrigerant pipe sizing.

E. Manufacturer's Instructions: Indicate rigging, assembly, and installation instructions.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

G. Warranty: Submit manufacturers warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Extra Filters: One for each unit.

1.4 WARRANTY

A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturers warranty for heat exchangers, condensing units, and compressors.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Carrier Corporation

B. Rheem Manufacturing Company Inc

C. Trane Technologies, PLC

D. York International Corporation / Johnson Controls

E. Mitsubishi

F. LG

2.2 SYSTEM DESIGN

A. Split-System Heating and Cooling Units: Self-contained, packaged, matched factory-engineered and assembled, pre-wired indoor and outdoor units; UL listed.
   1. Heating: Heat Pump (see drawings chedules)
   2. Cooling: Outdoor electric condensing unit with evaporator coil in central ducted indoor unit.
   3. Provide refrigerant lines internal to units and between indoor and outdoor units, factory cleaned, dried, pressurized and sealed, with insulated suction line.

B. Performance Requirements: See Drawings for additional requirements.

2.3 INDOOR AIR HANDLING UNITS FOR DUCTED SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, heating and cooling element(s), controls, and accessories; wired for single power connection with control transformer.
   1. Air Flow Configuration: Upflow.
   2. Cabinet: Steel with baked enamel finish, easily removed and secured access doors with safety interlock switches, glass fiber insulation with reflective liner.

B. Supply Fan: Centrifugal type rubber mounted with direct or belt drive with adjustable variable pitch motor pulley.

C. Air Filters: 1 inch (25 mm) thick urethane, washable type arranged for easy replacement.

D. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturers: System manufacturer.

2.4 INDOOR AIR HANDLING UNITS FOR DUCTLESS SYSTEMS

A. Indoor Units: Self-contained, packaged, factory assembled, pre-wired unit consisting of cabinet, supply fan, evaporator coil, and controls; wired for single power connection with control transformer.

B. Evaporator Coils: Copper tube aluminum fin assembly, galvanized or polymer drain pan sloped in all directions to drain, drain connection, refrigerant piping connections, restricted distributor or thermostatic expansion valve.
   1. Construction and Ratings: In accordance with AHRI 210/240 and UL 207.
   2. Manufacturer: System manufacturer.

2.5 Outdoor Units

A. Outdoor Units: Self-contained, packaged, pre-wired unit consisting of cabinet, with compressor and condenser.
   1. Refrigerant: A2L
   2. Construction and Ratings: In accordance with AHRI 210/240 with testing in accordance with ASHRAE Std 23 and UL 207.

B. Air Cooled Condenser: Aluminum fin and copper tube coil, AHRI 520 with direct drive axial propeller fan resiliently mounted, galvanized fan guard.

C. Accessories: Filter drier, high-pressure switch (manual reset), low pressure switch (automatic reset), service valves and gauge ports, thermometer well (in liquid line).
   1. Provide thermostatic expansion valves.

D. Operating Controls:
   1. Control by room thermostat to maintain room temperature setting.

2.6 ACCESSORY EQUIPMENT

A. Room Thermostat: Wall-mounted, electric solid state microcomputer based room thermostat with remote sensor to maintain temperature setting; low-voltage; with following features:
   1. Automatic switching from heating to cooling.
   2. Preferential rate control to minimize overshoot and deviation from setpoint.
   3. 7-Day Programming
   4. Thermostat Display:
      a. Actual room temperature.

b. System Mode Indication: Heating, Cooling, Fan Auto, Off, and On, Auto or On, Off.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that substrates are ready for installation of units and openings are as indicated on shop drawings.

B. Verify that proper power supply is available and in correct location.

C. Verify that proper fuel supply is available for connection.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions and requirements of local authorities having jurisdiction.

B. Install in accordance with NFPA 90A and NFPA 90B.

C. Install refrigeration systems in accordance with ASHRAE Std 15.

SECTION 23 82 39.19
ELECTRIC UNIT HEATERS

PART 1 GENERAL

1.1 SUMMARY

A. Section includes unit heaters heaters with propeller fans and electric-resistance heating coils.

1.2 SUBMITTALS

A. Action Submittals:
   1. Product Data: For each type of product.
      a. Include rated capacities, operating characteristics, furnished specialties, and accessories.
   2. Shop Drawings:
      a. Include plans, elevations, sections, and details.
      b. Include details of equipment assemblies. Indicate dimensions, weights, loads, required clearances, method of field assembly, components, and location and size of each field connection.
      c. Include equipment schedules to indicate rated capacities, operating characteristics, furnished specialties, and accessories.
      d. Wiring Diagrams: Power, signal, and control wiring.

B. Closeout Submittals:
   1. Operation and Maintenance Data: For unit heaters to include in emergency, operation, and maintenance manuals.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following. Where a specific manufacturer is listed in the Drawings, this shall be considered the Basis-of-Design.
   1. Berko; Marley Engineered Products.
   2. INDEECO.
   3. Markel Products; TPI Corporation.
   4. QMark; Marley Engineered Products.
   5. Trane.

2.2 DESCRIPTION

A. Assembly including chassis, electric heating coil, fan, motor, and controls. Comply with UL 2021.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.3 CABINET

A. Front Panel: Stamped-steel louver, with removable panels fastened with tamperproof fasteners.

B. Finish: Baked enamel over baked-on primer with manufacturer's standard color selected by Architect, applied to factory-assembled and -tested wall and ceiling heaters before shipping.

C. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

D. Surface-Mounted Cabinet Enclosure: Steel with finish to match cabinet.

2.4 COIL

A. Electric-Resistance Heating Coil: Nickel-chromium heating wire, free from expansion noise and 60-Hz hum, embedded in magnesium oxide refractory and sealed in corrosion-resistant metallic sheath. Terminate elements in stainless-steel, machine-staked terminals secured with stainless-steel hardware, and limit controls for high-temperature protection. Provide integral circuit breaker for overcurrent protection.

2.5 FAN AND MOTOR

A. Fan: Aluminum propeller directly connected to motor.

B. Motor: Permanently lubricated. Comply with requirements in other Division 23 Sections.

2.6 CONTROLS

A. Controls: Built in tamper-resistant thermostat for wall mounted units. Wall mounted thermostats for hung models.

B. Electrical Connection: Factory wire motors and controls for a single field connection with disconnect switch.

PART 3 EXECUTION

3.1 EXAMINATION

A. Examine areas to receive unit heaters for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Examine roughing-in for electrical connections to verify actual locations before unit-heater installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install unit heaters to comply with NFPA 90A.

B. Install wall unit heaters level and plumb.

C. Ground equipment according to Division 26.

D. Connect wiring according to Division 26.

SECTION 26 05 00 - COMMON WORK RESULTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes the following:

1. Electrical equipment coordination and installation.
2. Grout.
3. Common electrical installation requirements.
4. Typical device mounting heights.
5. Cutting and patching for electrical construction.

B. The work under the contract includes furnishing all materials and components shown on the drawings and listed in the specifications for the installation and operation of complete electrical systems.

C. All wiring associated with Division 26 scope of work, with the exception of low voltage lighting control wiring above accessible ceilings, shall be installed in conduit. Any other use of open-to-air wiring will not be permitted.

1.3 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction and marked for intended used.

B. Comply with NFPA 70.

C. Include in the Work, as a part of the Bid Proposal, labor, materials, services, apparatus, drawings (in addition to the Contract Documents) as required to complete the intended work.

D. Work for the Project must be performed in accordance with Federal, State and Local Laws, Ordinances, Codes, Rules and Regulations, pertaining to the Work which are hereby made a part of the Contract Documents by reference, the same as if repeated herein in their entirety. Where Contract Documents exceed these requirements, the Contract Documents shall govern. In no case shall Work be installed contrary to or below the minimum legal standards.

1.4 COORDINATION

A. Coordinate arrangement, mounting, and support of electrical equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting raceways, cables, wire-ways and cable trays will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for electrical items that are behind finished surfaces or otherwise concealed. Refer to Division 08 Section “Access Doors and Frames”.

D. Coordinate selection and application of firestopping. Refer to Division 07 Section "Firestopping."

1.5 COMMISSIONING

A. Commissioning of components, equipment and/or system specified in this division is part of the construction process. Project closeout is dependent on successful completion of all commissioning procedures, documentation and issue closure. See Section 01 91 13 for detailed commissioning requirements.

PART 2 - PRODUCTS

2.1 GENERAL

A. All electrical systems shall be fully-rated. Series rated systems are not acceptable.

B. All materials and components shall conform with the Underwriters Laboratories Standards when such standards have been established for the particular materials to be furnished under the contract.

2.2 ADHESIVES AND SEALANTS

A. Adhesives - General: Do not use adhesives that contain urea formaldehyde.

B. VOC Limits for Installation Adhesives, Glues, and Sealants used on the Interior of the Building: Use installation adhesives that comply with SCAQMD Rule 1168 limits for VOC content, calculated in accordance with Rule 1168, less water and exempt compounds:

1. Wood glues: 30 g/L.
2. Contact adhesive: 250 g/L.

3. Dry wall and panel adhesives: 50 g/L.
4. Multipurpose construction adhesives: 70 g/L.
5. PVC welding: 510 g/L.
6. CPVC welding: 490 g/L.
7. ABS welding: 325 g/L.
8. Plastic cement welding: 250 g/L.
9. Adhesive primer for plastic: 550 g/L.
10. Special purpose contact adhesive: 250 g/L.
11. Adhesives, adhesive bonding primers, applied to substrates not listed above. If an adhesive is used to bond dissimilar substrates together, the adhesive with the highest VOC content shall be allowed.

    a. Metal to metal: 30 g/L.
    b. Plastic foams: 50 g/L.
    c. Porous material (except wood): 50 g/L.
    d. Wood: 30 g/L.
    e. Fiberglass: 80 g/L.

12. Aerosol adhesives: Comply with GreenSeal GS-36 – Standard for Commercial Adhesives, VOC content by weight, minus water.

    a. General purpose mist spray: 65 percent.
    b. General purpose web spray: 55 percent.
    c. Special purpose aerosol adhesives, all types: 70 percent.

13. Sealants and sealant primers:

    a. Sealants: 250 g/L.
    b. Sealant primers, non-porous substrates: 250 g/L.
    c. Sealant primers, porous substrates: 775 g/L.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, non-corrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 ELECTRICAL PENETRATIONS

A. Electrical penetrations occurs when raceways and cables penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

D. Cut sleeves to length for mounting 2 inches extending out of both surfaces of walls.

E. Extend sleeves installed in floors 2 inches above finished floor level.

F. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at raceway and cable penetrations. Comply with requirements in Division 7 Section "Firestopping."

G. Roof-Penetration Sleeves: Seal penetration of individual raceways and cables with flexible boot-type flashing units applied in coordination with roofing work.

3.3 ACCESS DOORS AND FRAMES

A. Refer to Division 08 Section “Access Doors and Frames” for additional information.

B. Provide access doors and frames as required for all Division 26 components requiring access, maintenance, etc.

3.4 TYPICAL MOUNTING HEIGHTS

A. Devices shall be installed at the mounting heights indicated below unless otherwise noted on the Contract Documents or as required to accommodate equipment, casework or where in conflict with wall treatment at the installation locations. Notify A/E about devices that will be in conflict with wall components (white boards, flat panels, screens, etc.) prior to rough-in for clarification of device location. Refer to the Architectural elevations and details for additional

information on device placement. All heights shall be measured from finished floor unless noted otherwise.

1. Electrical receptacles: +1'-6" to center of device box.
2. Electrical receptacles at counters: +0'-4" above top of backsplash to center of device box.
3. Miscellaneous controls for screens, shades, etc.: +3'-10" to center of device box.
4. Light switches: +3'-10" to center of device box.
5. Dimmer switches: +3'-10" to center of device box.
6. Other lighting control stations: +3'-10" to center of device box.
7. Enclosed switches and motor controllers: +6'-0" top of equipment shall be utilized as a typical mounting height, however, is dependent upon size of equipment. The center of the grip of the operating handle of the switch or circuit breaker, when in its highest position, shall not be higher than +6'-7" above the floor or working platform.
8. Electrical panels: The center of the grip of the top most switch or circuit breaker, when in its highest position, shall not be higher than +6'-7" above the floor or working platform.

3.5 CUTTING AND PATCHING

A. Refer to Division 2 for general cutting and patching requirements and procedures.

B. Cut, channel, chase and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

C. Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.6 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for electrical installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Firestopping."

3.7 CLEANING AND PROTECTION

A. On completion of installation, including outlets, fittings and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.

B. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION 26 05 00

SECTION 26 05 13 ELECTRICAL UTILITY SERVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes arrangement with Utility Company for permanent electric service; payment of Utility Company charges for service; service provisions; and utility metering equipment.

1.2 SYSTEM DESCRIPTION

A. Power Utility Company: Duke Energy
   1. System Characteristics: 208/120 volts, three phase, four- wire, 60 Hertz.

B. Voice / Telephone Utility Company: AT&T
   1. System Characteristics: Copper and Fiber as coordinated by owner outside this contract.
   2. Service Entrance: Underground, from utility structure as coordinated by this contract.
   3. Underground Service Provisions: Underground service entrance to building service entrance equipment as coordinated by this contractor.

1.3 SUBMITTALS

A. Submit Utility-Company-prepared drawings.

B. A list of all the utilities requirements that they are asking for a complete installation.

1.4 QUALITY ASSURANCE

A. Perform Work in accordance with Utility Company’s written requirements.
B. Maintain one copy of each document on site.

1.5 FIELD MEASUREMENTS

A. Verify field measurements are as indicated on Drawings.

1.6 COORDINATION

A. Items to be coordinated by the Utility Company: (This contractor shall verify all requirements prior to bidding. This list is a guide.)

   1. Provide and install new primary cable conductors.

2. Provide new transformer.
3. Provide primary and secondary connections on new transformer lugs.
4. Provide pad and cable vault.
5. Provide meter cabinet and meter.

B. Items to be coordinated by the Contractor:

1. Provide pad per utility company.
2. Provide secondary conductors and conduit from transformer to switchgear.
3. Make secondary cable connections to switchgear.
4. Contractor per Utility Companies Requirements, shall provide and install meter and cabinet on transformer pad or on building if indicated on plans.

PART 2 - PRODUCTS

2.1 UTILITY METER BASE

A. Meter Furnished by Utility Company

B. Base furnished by this contractor unless Utility provides it.

C. Meter stand provided by this contractor.

PART 3 - EXECUTIMON

3.1 EXAMINATION

A. Verify service equipment is ready to be connected and energized.

3.2 INSTALLATION

A. Install service entrance conduits to building service entrance equipment. Utility Company will connect service lateral conductors to transformers lugs.

B. Install meter cabinet and stand if required.

C. Provide all trenching and backfill.

D. Provide complete service as indicated and provide spare raceways from transformer to service gear room for a 20% service size increase, or a minimum of (2) spare 4" conduits.

END OF SECTION 26 05 13

SECTION 26 05 19 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Building wires and cables rated 600 V and less.
2. Connectors, splices, and terminations rated 600 V and less.

B. Related Sections include the following:

1. Division 26 Section "Identification for Electrical Systems" for color-coding and other identification requirements.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Field quality-control test reports.

1.4 QUALITY ASSURANCE

A. Contractor with qualifications and minimum ten (10) years experience in installation, splicing and testing of low voltage power conductors may be considered at discretion of Architect/Engineer, as acceptable agency.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. All products shall be UL listed and labeled.

1.5 COMMISSIONING

A. Commissioning of components, equipment and/or system specified in this division is part of the construction process. Project closeout is dependent on successful completion of all

commissioning procedures, documentation and issue closure. See Section 01 91 13 for detailed commissioning requirements.

PART 2 - PRODUCTS

2.1 CONDUCTORS AND CABLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Encore Wire Corporation.
2. General Cable Technologies Corporation.
3. Southwire Company.

B. Conductors:

1. Type THHN/THWN-2: UL Listed; NEMA WC70; VW-1; Solid, uncoated copper conductors per ASTM-B3; stranded, uncoated copper conductors per ASTM-B3, ASTM-B787, and ASTM-B8; ROHS compliant; 600-volt rated; color-coded PVC insulation; rated for use in wet or dry locations at temperatures not to exceed 90 deg C.
2. Type XHHW-2: UL listed, NEMA WC70; VW-1; stranded, uncoated copper conductors per ASTM-B3, ASTM B787, and ASTM-B8; ROHS compliant; 600-volt rated; color-coded cross-linked polyethylene insulation; rated for use in wet or dry locations at temperatures not to exceed 90 deg. C.

2.2 CONNECTORS AND SPLICES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Hubbell Power Systems, Inc.
2. O-Z/Gedney; EGS Electrical Group LLC.
3. 3M; Electrical Products Division.
4. Tyco Electronics Corp.

B. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.1 CONDUCTOR MATERIAL APPLICATIONS

A. Feeders: Copper, stranded.

B. Branch Circuits:

1. Sizes #10 AWG and smaller: Copper, solid or stranded, but shall be consistent throughout the entire project. Do not mix the use of solid and stranded.
2. Sizes #8 AWG and larger: Copper, stranded.

C. The minimum conductor size shall be #12 AWG.

D. Voltage Drop: Branch circuit conductors shall be sized for a maximum voltage drop of 3 percent to comply with the requirements of ASHRAE Standard 90.1-2007. The following are minimum allowable conductor sizes based on circuit length. The circuit length shall be measured from the branch panelboard to the furthest device in that circuit. The phase and neutral conductors shall be sized as indicated the entire length of that circuit unless a larger size conductor is indicated on the drawings.

1. Conductor sizes for 20A/1-Phase/120V circuits shall be as follows unless noted otherwise:

a. Circuit length of 0 to 95 feet: #12 AWG.
b. Circuit length of 96 to 150 feet: #10 AWG.
c. Circuit length of 151 to 235 feet: #8 AWG.
d. Circuit length 236 to 380 feet: #6 AWG.

2. Conductor sizes for 20A/1-Phase/277V circuits shall be as follows unless noted otherwise:

a. Circuit length of 0 to 200 feet: #12 AWG.
b. Circuit length of 201 to 350 feet: #10 AWG.
c. Circuit length 351 to 550 feet: #8 AWG.
d. Circuit length 551 to 850 feet: #6 AWG.

3.2 CONDUCTOR INSULATION AND WIRING METHODS

A. Feeders:

1. General use: Type THHN/THWN-2, single conductors in raceway.
2. Underground or below slab: Type XHHW-2, single conductors in raceway.
3. Fire pump ATS feeders (normal and emergency): Type XHHW-2 underground, encased in concrete and single conductors in raceway.

B. Branch Circuits:

1. General use: Type THHN/THWN-2, single conductors in raceway.
2. Underground or below slab: Type XHHW-2, single conductors in raceway

C. Control Circuits, Lighting Control Device Wiring, and Other Division 26 Low Voltage Wiring: Type THHN-THWN, in raceway.

3.3 INSTALLATION OF CONDUCTORS AND CABLES

A. All cables and conductors shall be installed in conduit. The use of exposed (open) wiring will not be permitted. This shall include all lighting control wiring for occupancy sensors, 0-10V control, etc.

B. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

C. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips that will not damage cables or raceway.

D. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

1. Colors shall be continuous through the insulation from end to end. Field marking is not acceptable.

E. Each branch circuit shall be provided with a dedicated, 100 percent neutral conductor. Sharing of the neutral conductor between multiple circuits will not be allowed. Each neutral shall be clearly identified with its associated phase conductor.

F. A single raceway shall be limited to a maximum of six current carrying conductors.

G. Each branch circuit conduit shall contain a separate green equipment grounding conductor sized per NEC.

3.4 CONNECTIONS

A. 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.

B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.

C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.5 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

B. Tests and Inspections:

1. After installing conductors and cables and before electrical circuitry has been energized, test feeder conductors for compliance with requirements.

a. Megger test for insulation integrity.

2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

C. Test Reports: Prepare a written report to record the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.

D. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION 26 05 19

SECTION 26 05 26 - GROUNDING AND BONDING FOR ELECTRICAL 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. This Section includes methods and materials for grounding systems and equipment. Also includes common ground bonding with lightning protection systems.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Operation and Maintenance Data: For grounding to include the following in emergency, operation, and maintenance manuals:

1. Instructions for periodic testing and inspection of grounding features at test wells based on NFPA 70B.

    a. Tests shall be to determine if ground resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if they do not.
    b. Include recommended testing intervals.

1.4 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.1 CONDUCTORS

A. Insulated Conductors: Comply with Division 26 Section “Low Voltage Electrical Power Conductors and Cables.”

B. Bare Copper Conductors:

1. Solid conductors: ASTM B 3.
2. Stranded conductors: ASTM B 8.
3. Tinned conductors: ASTM B 33.
4. Bonding cable: 28 kcmil, 14 strands of No. 17 AWG conductor and 1/4 inches in diameter.
5. Bonding conductor: No. 4 or No. 6 AWG, stranded conductor.
6. Bonding jumper: Copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.
7. Tinned bonding jumper: Tinned-copper tape, braided conductors, terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

C. Grounding Bus: Rectangular bars of annealed copper, 1/4-inch thick X 4-inch high X 24-inch long with holes, unless otherwise indicated; with insulators.

2.2 CONNECTORS

A. Listed and labeled by a nationally recognized testing laboratory acceptable to authorities having jurisdiction for applications in which used, and for specific types, sizes, and combinations of conductors and other items connected.

B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, bolted pressure-type, with at least two bolts.

1. Pipe connectors: Clamp type, sized for pipe.

C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.3 GROUNDING ELECTRODES

A. Ground Rods: Copper-clad steel, 3/4 inch in diameter by 10 feet long.

2.4 GROUNDING OF SPECIAL CABINETS

A. At all flammable materials storage cabinets, solvent storage cabinets, corrosive storage cabinets and gas safety cabinets, provide a (minimum) #12 AWG copper, insulated green grounding conductor from the equipment grounding conductor of the nearest available 120 volt circuit.

B. Extend cabinet bonding conductor from the nearest circuit outlet box via 3/4-inch conduit concealed in wall and stubbed out behind the respective cabinet. Conduit shall be converted to flexible metal conduit where exposed, and shall terminate with a UL listed bushing. Where indicated on the drawings, provide a flush wall box with cover plate (with grommeted hole, 3/4-inch diameter) and extend bonding conductor from wall box to equipment terminal.

C. Bonding conductor shall be secured to bonding terminal of the cabinet. If the cabinet is not equipped with a bonding terminal, provide a UL listed screw terminal and permanently secure it

to the metallic cabinet with a screw, lockwasher and bolt. Self-tapping sheet metal screws will not be accepted as the means of attachment.

PART 3 - EXECUTION

3.1 APPLICATIONS

A. Conductors: Comply with Division 26 Section "Low Voltage Electrical Power Conductors and Cables."

B. Underground Grounding Conductors: Install bare tinned-copper conductor, No. 3/0 AWG minimum.

1. Bury at least 24 inches below grade.

C. Grounding Bus: Install in electrical rooms, telecommunication rooms, systems rooms, fire pump room and elsewhere as indicated.

1. Install bus on insulated spacers 1 inch minimum from wall 6 inches above finished floor, unless otherwise indicated.
2. All connections at each ground bus shall be labeled to identify source.

D. Conductor Terminations and Connections:

1. Pipe and equipment grounding conductor terminations: Bolted connectors.
2. Underground connections: Welded connectors, except at test wells and as otherwise indicated.
3. Connections to structural steel: Welded connectors.
4. Water service: Bolted connectors.
5. Fire protection service: Bolted connectors.
6. Natural gas service: Bolted connectors.

3.2 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

A. Comply with IEEE C2 grounding requirements.

B. Grounding Hand-Holes: Install a driven ground rod in hand-hole, close to wall, and set rod depth so 4 inches will extend above finished floor. If necessary, install ground rod before hand-hole is placed and provide No. 1/0 AWG bare, tinned-copper conductor from ground rod into hand-hole through a waterproof sleeve in hand-hole wall. Protect ground rods passing through concrete floor with a double wrapping of pressure-sensitive insulating tape or heat-shrunk insulating sleeve from 2 inches above to 6 inches below concrete.

C. Utility Transformers: Coordinate grounding and pad requirements at utility transformers with utility. Furnish and install as directed by Utility.

3.3 EQUIPMENT GROUNDING

A. Install insulated equipment grounding conductors for all electrical distribution, in addition to those required by NFPA 70 and as follows:

1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.
5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.

B. Metal Poles Supporting Outdoor Lighting Fixtures: Install as per pole mounting detail shown on drawing.

3.4 INSTALLATION

A. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

B. Common Ground Bonding with Lightning Protection System: Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system. Bond electrical power system ground directly to lightning protection system grounding conductor at closest point to electrical service grounding electrode. Use bonding conductor sized same as system grounding electrode conductor, and install in conduit.

C. Ground Rods: Drive rods until tops are 6 inches below finished floor or final grade, unless otherwise indicated.

1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating, if any.

D. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance, except where routed through short lengths of conduit.

1. Bonding to structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to equipment mounted on vibration isolation hangers and supports: Install so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations, but if a disconnect-type connection is required, use a bolted clamp.

E. Grounding and Bonding for Piping:

1. Metal water service pipe: Provide bonding as per NEC 250, install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes, using a bolted clamp connector or by bolting a lug-type

connector to a pipe flange, using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.

2. Water meter piping: Use braided-type bonding jumpers to electrically bypass water meters. Connect to pipe with a bolted connector.
3. Bond each above ground portion of gas piping system downstream from equipment shutoff valve.

F. Grounding for Steel Building Structure: Install a driven ground rod at base of each corner column and at intermediate exterior columns at distances not more than 60 feet apart.

G. Ground Ring: Install a grounding conductor, electrically connected to each building structure ground rod and to each indicated steel column, extending around the perimeter of building.

1. Install tinned-copper conductor not less than No. 3/0 AWG for ground ring and for taps to building steel.
2. Bury ground ring not less than 24 inches from building foundation.

H. Building Footing Ground: Provide per NEC 250.

I. Standby Emergency Generator Grounding Requirements: Provide four (4) ground rods, one at each corner of the generator set. Provide bare No. 3/0 AWG conductors underground interconnecting these ground rods forming a ring around the generator. Bond to the generator with No. 3/0 AWG from two (2) opposite corners. Also, bond neutral and ground at generator to form a separately derived system.

J. Pull Boxes:

1. Provide grounding type bushings on conduit entrance into pull boxes. The equipment grounding conductor shall be bonded to the box via threaded, locking type ground bushing at the conduit entrance.

K. Junction Boxes and Device Boxes:

1. Bond junction boxes and device boxes to the equipment grounding conductor within the branch circuit serving the box via an approved method.

L. Panelboards:

1. Bond panelboards to the equipment grounding conductor within the feeder conduit by a threaded grounding type insulated bushing at the conduit entrance into the tub. The equipment grounding conductor shall continue from the bushing to the panelboard ground bus and be bonded.
2. Bond the equipment grounding buses of normal and essential branch circuit panelboards serving the same patient care areas as required by NEC 517. Bond with a minimum #10 awg insulated continuous copper conductor routed in conduit.

3.5 FIELD QUALITY CONTROL

A. Perform the following tests and inspections and prepare test reports:

1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
2. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal, at ground test wells, and at individual ground rods. Make tests at ground rods before any conductors are connected.

    a. Perform tests by fall-of-potential method according to IEEE 81 and submit test.

B. Report measured ground resistances that exceed the following values:

1. Power and lighting equipment or system: 5 ohms.
2. Power distribution units or panelboards serving electronic equipment: 3 ohms.
3. Pad-mounted equipment: 5 ohms.

C. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Architect promptly and include recommendations to reduce ground resistance.

D. Documentation of the Ground and Neutral Bond Jumper: Provide a digital photograph documenting the location of each ground to neutral bond at each separately derived system. Shall include photograph of bonding location and a second photograph confirming the system is not bonded at another location. Label each photograph accordingly. For example, provide a photograph of the bond within transformer secondary and second photograph confirming distribution panel is not bonded. Include these in the Operation and Maintenance Manuals.

END OF SECTION 26 05 26

SECTION 26 05 29 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Hangers and supports for electrical equipment and systems.
2. Construction requirements for concrete bases.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. IMC: Intermediate metal conduit.

C. GRC: Galvanized rigid metal conduit.

1.4 PERFORMANCE REQUIREMENTS

A. Design supports for multiple raceways capable of supporting combined weight of supported systems and its contents.

B. Design equipment supports capable of supporting combined operating weight of supported equipment and connected systems and components.

1.5 QUALITY ASSURANCE

A. Welding: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

B. Comply with NFPA 70.

C. Comply with IBC and UBC.

1.6 COORDINATION

A. Coordinate size and location of concrete bases. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.7 COMMISSIONING

A. Commissioning of components, equipment and/or system specified in this division is part of the construction process. Project closeout is dependent on successful completion of all commissioning procedures, documentation and issue closure. See Section 01 91 13 for detailed commissioning requirements.

PART 2 - PRODUCTS

2.1 SUPPORT, ANCHORAGE, AND ATTACHMENT COMPONENTS

A. Steel Slotted Support Systems: Comply with MFMA-4, factory-fabricated components for field assembly.

1. Manufacturers: Subject to compliance with requirements, provide product by one of the following:

a. Allied Tube & Conduit.
b. Cooper B-Line, Inc.; a division of Cooper Industries.
c. ERICO International Corporation.
d. GS Metals Corp.
e. Thomas & Betts Corporation.
f. Unistrut; Tyco International, Ltd.

2. Metallic coatings: Hot-dip galvanized after fabrication and applied according to MFMA-4.
3. Nonmetallic coatings: Manufacturer's standard PVC, polyurethane, or polyester coating applied according to MFMA-4.
4. Painted coatings: Manufacturer's standard painted coating applied according to MFMA-4.
5. Channel dimensions: Selected for applicable load criteria.

B. Raceway and Cable Supports: As described in NECA 1 and NECA 101.

C. Conduit and Cable Support Devices: Steel and malleable-iron hangers, clamps, and associated fittings, designed for types and sizes of raceway or cable to be supported.

D. Support for Conductors in Vertical Conduit: Factory-fabricated assembly consisting of threaded body and insulating wedging plug or plugs for non-armored electrical conductors or cables in riser conduits. Plugs shall have number, size, and shape of conductor gripping pieces as required to suit individual conductors or cables supported. Body shall be malleable iron.

E. Structural Steel for Fabricated Supports and Restraints: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

F. Mounting, Anchoring, and Attachment Components: Items for fastening electrical items or their supports to building surfaces include the following:

1. Mechanical-expansion anchors: Insert-wedge-type, stainless steel, for use in hardened Portland cement concrete with tension, shear, and pullout capacities appropriate for supported loads and building materials in which used.

a. Available manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

1) Cooper B-Line, Inc.; a division of Cooper Industries.
2) Empire Tool and Manufacturing Co., Inc.
3) Hilti Inc.
4) ITW Ramset/Red Head; a division of Illinois Tool Works, Inc.
5) MKT Fastening, LLC.

2. Concrete inserts: Steel or malleable-iron, slotted support system units similar to MSS Type 18; complying with MFMA-4 or MSS SP-58.
3. Clamps for attachment to steel structural elements: MSS SP-58, type suitable for attached structural element.
4. Through bolts: Structural type, hex head, and high strength. Comply with ASTM A 325.
5. Toggle bolts: All-steel springhead type.
6. Hanger rods: Threaded steel.

G. Install no anchors in the underside of concrete joists or beams. All anchors must be set horizontally as near as possible to the neutral axis of the structural member. Drill and set anchors in beams.

H. Powder driven anchors or studs will not be allowed.

2.2 FABRICATED METAL EQUIPMENT SUPPORT ASSEMBLIES

A. Description: Welded or bolted, structural-steel shapes, shop or field fabricated to fit dimensions of supported equipment.

B. Materials: Comply with requirements in Division 5 Section "Metal Fabrications" for steel shapes and plates.

PART 3 - EXECUTION

3.1 APPLICATION

A. Comply with NECA 1 and NECA 101 for application of hangers and supports for electrical equipment and systems except if requirements in this Section are stricter.

B. Maximum Support Spacing and Minimum Hanger Rod Size for Raceway: Space supports for EMT, IMC, and GRC as required by NFPA 70. Minimum rod size shall be 1/4 inch in diameter. Support conduit within 10 inches from box and bend, maximum 10 feet apart and

minimum of one support for conduit length. The maximum support for conduits 1 inch and smaller shall be 5 feet, and for conduits larger than 1 inch shall be 8 feet.

C. Multiple Raceways or Cables: Install trapeze-type supports fabricated with steel slotted support system, sized so capacity can be increased by at least 25 percent in future without exceeding specified design load limits.

1. Secure raceways and cables to these supports with single-bolt conduit clamps using spring friction action for retention in support channel.

D. Single Conduits 1-1/2-Inch and Smaller: Conduit clamps for supporting single conduits shall be with bolt type clamps. The use of spring type clamps will not be permitted. This requirement shall apply to conduits above suspended ceilings and for fastening raceways to trapeze supports.

3.2 SUPPORT INSTALLATION

A. Comply with NECA 1 and NECA 101 for installation requirements except as specified in this Article.

B. Raceway Support Methods: In addition to methods described in NECA 1, EMT, IMC, and GRC may be supported by openings through structure members, as permitted in NFPA 70.

C. Strength of Support Assemblies: Where not indicated, select sizes of components so strength will be adequate to carry present and future static loads within specified loading limits. Minimum static design load used for strength determination shall be weight of supported components plus 200 lb.

D. Mounting and Anchorage of Surface-Mounted Equipment and Components: Anchor and fasten electrical items and their supports to building structural elements by the following methods unless otherwise indicated by code:

1. To wood: Fasten with lag screws or through bolts.
2. To new concrete: Bolt to concrete inserts.
3. To masonry: Approved toggle-type bolts on hollow masonry units and expansion anchor fasteners on solid masonry units.
4. To existing concrete: Expansion anchor fasteners.
5. To steel: Beam clamps (MSS Type 19, 21, 23, 25, or 27) complying with MSS SP-69.
6. To light steel: Sheet metal screws.
7. Items mounted on hollow walls and non-structural building surfaces: Mount cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices on slotted-channel racks attached to substrate by means that meet seismic-restraint strength and anchorage requirements.

E. Powder-actuated driven anchors or studs will not be allowed.

F. Drill holes for expansion anchors in concrete at locations and to depths that avoid reinforcing bars.

3.3 INSTALLATION OF FABRICATED METAL SUPPORTS

A. Comply with installation requirements in Division 5 Section "Metal Fabrications" for site-fabricated metal supports.

B. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to support and anchor electrical materials and equipment.

C. Field Welding: Comply with AWS D1.1/D1.1M.

3.4 CONCRETE BASES

A. Construct concrete bases of dimensions indicated but not less than 4 inches larger in both directions than supported unit. Anchors shall be a minimum of 10 bolt diameters from edge of the base. Chamfer concrete pad 3/4 inch.

1. All floor mounted electrical equipment installed in mechanical rooms, electrical rooms, boiler rooms, penthouse, below grade spaces and exterior to the building shall be furnished with a housekeeping pad.
2. Interior pads shall be Class 2 concrete, shall extend 4 inches beyond all accessible sides of the equipment footprint, shall be 4 inches high and shall have 3/4 inch chamfered edges. Pads shall be doweled to the floor in at least four places (each conduit penetration may be counted for one dowel). Pads shall have heavy mesh reinforcing and have any existing floor coating re-extended to the lower edge of the chamfer. Pads sized or detailed on the Drawings and/or in job scope, shall be constructed as indicated or as required by the application.

B. Use 4000-psi, 28-day compressive-strength concrete. Concrete materials, reinforcement, and placement requirements are specified in Division 3 Section "Cast-in-Place Concrete."

C. Anchor equipment to concrete base.

1. Place and secure anchorage devices. Use supported equipment manufacturer's setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
2. Install anchor bolts to elevations required for proper attachment to supported equipment.
3. Install anchor bolts according to anchor-bolt manufacturer's written instructions.

3.5 PAINTING

A. Refer to Division 26 Section “Identification for Electrical Systems” for additional painting requirements.

B. Touchup: Clean field welds and abraded areas of shop paint. Paint exposed areas immediately after erecting hangers and supports. Use same materials as used for shop painting. Comply with SSPC-PA 1 requirements for touching up field-painted surfaces.

1. Apply paint by brush or spray to provide minimum dry film thickness of 2.0 mils. Retain first paragraph below if a Division 9 painting Section is in Project Manual.

C. Touchup: Comply with requirements in Division 9 painting sections for cleaning and touchup painting of field welds, bolted connections, and abraded areas of shop paint on miscellaneous metal.

D. Galvanized Surfaces: Clean welds, bolted connections, and abraded areas and apply galvanizing-repair paint to comply with ASTM A 780.

END OF SECTION 26 05 29

SECTION 26 05 33 - RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
2. Surface raceway.
3. Conduit sleeve and firestop.
4. Core drill for electrical work.

B. Related Section includes the following:

1. Division 26 Section "Underground Utility Structures for Electrical Systems."

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.

B. GRC: Galvanized rigid metal conduit.

C. IMC: Intermediate metal conduit.

D. LFMC: Liquid-tight flexible metal conduit.

E. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For raceways, wireways, fittings, enclosures, and cabinets.

B. Coordination Drawings: Conduit routing plans, drawn to scale, on which the following items are shown and coordinated with each other, based on input from installers of the items involved:

1. Structural members in the paths of conduit groups with common supports.
2. HVAC and plumbing items and architectural features in the paths of conduit groups with common supports.

C. Source quality-control test reports.

D. Manufacturer Seismic Qualification Certification: Submit certification that enclosures and cabinets and their mounting provisions, including those for internal components, will withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems." Include the following:

1. Basis for certification: Indicate whether withstand certification is based on actual test of assembled components or on calculation.

a. The term "withstand" means "the cabinet or enclosure will remain in place without separation of any parts when subjected to the seismic forces specified and the unit will retain its enclosure characteristics, including its interior accessibility, after the seismic event."

2. Dimensioned outline drawings of equipment unit: Identify center of gravity and locate and describe mounting and anchorage provisions.
3. Detailed description of equipment anchorage devices on which the certification is based and their installation requirements.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70, 79.

C. Products shall be UL listed and labeled.

D. Comply with ANSI C2.

1.6 COMMISSIONING

A. Commissioning of components, equipment and/or system specified in this division is part of the construction process. Project closeout is dependent on successful completion of all commissioning procedures, documentation and issue closure. See Section 01 91 13 for detailed commissioning requirements.

PART 2 - PRODUCTS

2.1 METAL CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide product by one of the following:

1. Allied Tube & Conduit; a Tyco International Ltd. Co.
2. Maverick Tube Corporation.
3. O-Z Gedney; a unit of General Signal.
4. Wheatland Tube Company.

B. Galvanized Rigid Steel Conduit: ANSI C80.1.

C. IMC: ANSI C80.6.

D. EMT: ANSI C80.3.

E. LFMC: Flexible steel conduit with PVC jacket and UL label.

F. Fittings for Conduit (Including all Types and Flexible and Liquid-tight): NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.

1. Fittings for EMT: Steel set screw, insulated throat, concrete tight couplings and connectors. Other type fittings will not be acceptable.
2. Fittings for rigid steel and intermediate steel conduit: Threaded.
3. Flexible conduit connectors: UL listed for grounding, squeeze type, malleable iron with insulated throat and one or two screw types. Set screw type, die-cast, or screw-in type will not be allowed.
4. Liquid-tight fittings: UL listed for grounding, ferrule, and sleeve type with insulated throat.

G. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.2 NONMETALLIC CONDUIT AND TUBING

A. Manufacturers: Subject to compliance with requirements, provide product by one of the following:

1. CANTEX Inc.
2. Lamson & Sessions; Carlon Electrical Products.
3. Manhattan/CDT/Cole-Flex.
4. RACO; a Hubbell Company.
5. Thomas & Betts Corporation.

B. RNC: NEMA TC 2, Heavy wall type EPC-40-PVC, unless otherwise indicated.

C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.

2.3 METAL WIREWAYS

A. Manufacturers: Subject to compliance with requirements, provide product by one of the following:

1. Cooper B-Line, Inc.
2. Hoffman.
3. Square D; Schneider Electric.

B. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.

1. Indoor, JIC type, minimum 16 gage, 14 gage for 6” X 6” or larger, finish with gray enamel finish.

C. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

D. Wire-way Covers: As indicated.

E. Finish: Manufacturer's standard enamel finish.

2.4 BOXES, ENCLOSURES, AND CABINETS

A. Manufacturers: Subject to compliance with requirements, provide product by one of the following:

1. Cooper Crouse-Hinds; Div. of Cooper Industries, Inc.
2. Hoffman.
3. Hubbell Incorporated; Killark Electric Manufacturing Co. Division.
4. O-Z/Gedney; a unit of General Signal.
5. RACO; a Hubbell Company.
6. Spring City Electrical Manufacturing Company.
7. Thomas & Betts Corporation.

B. Sheet Metal Outlet and Device Boxes: NEMA OS 1, minimum 4" X 4" X 2-1/8" deep. Provide with single gang plaster ring unless two gang plaster ring is specifically noted elsewhere to be provided.

C. Cast-Metal Outlet and Device Boxes: NEMA FB 1, Type FD, with gasketed cover. Minimum 4" X 4" X 2-1/8" deep. Provide with single gang plaster ring unless two gang plaster ring is specifically noted elsewhere to be provided.

D. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.

E. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1 gasketed cover.

F. Stainless Steel Boxes: NEMA 4X; Grade 316L.

G. Device rough-in boxes shall be securely and rigidly attached between two structural members and supported plumb, level and true to the building lines using one of the following:

1. Extension plate bracket: Allow outlet boxes 12" or 18" offset from either metal stud track or a stud. Allow 4" or 4-11/16" outlet boxes, 2-1/8" deep.
2. Device box brackets attaching to only one metal stud will not be allowed.

PART 3 - EXECUTION

3.1 RACEWAY AND BOX APPLICATION

A. Outdoors: Apply raceway and box products as specified below, unless otherwise indicated:

1. Exposed conduit: GRC.
2. Concealed conduit, above ground: GRC.
3. Underground conduit:

    a. Utility transformer secondary building entrances: PVC Schedule 80.
    b. Generator service entrance: PVC Schedule 40 in a concrete encased duct bank.
    c. Fire pump ATS service: PVC Schedule 40 in a concrete encased duct bank.
    d. Other: PVC Schedule 80, direct bury conduit, unless noted otherwise.

4. Connection to vibrating equipment (including transformers and hydraulic, pneumatic, electric solenoid, or motor-driven equipment): LFMC.
5. Boxes and enclosures, above ground: NEMA 250, Type 4X, stainless steel.

B. Indoors: Apply raceway and box products as specified herein, unless otherwise indicated:

1. Exposed in mechanical room: IMC, unless GRC is required as directed by any of the categories below.
2. Below grade: GRC.
3. Branch circuit: EMT. Where branch circuits fall into one of the other categories listed, that category's specification shall be followed. For example, branch circuits in a concrete wall shall utilize type GRC.
4. Concrete wall/column: GRC.
5. Panel or equipment feeder:

    a. Less than 100 amps: EMT unless IMC or GRC is required as directed by any of the other categories.
    b. 100 amps and larger: IMC unless GRC is required as directed by any of the other categories.

6. Connection to vibrating equipment (including transformers and hydraulic, pneumatic, electric solenoid, or motor-driven equipment): LFMC.
7. Damp or wet location: GRC.
8. Fire pump ATS service: PVC Schedule 40 under-slab in a concrete encased duct bank.
9. Boxes and enclosures: Rated for the environmental conditions at the installed location.

    a. Dry and clean locations: NEMA 250, Type 1.
    b. Damp or wet locations: NEMA 250, Type 4X, stainless steel.

C. Minimum Raceway Size: 3/4-inch trade size.

3.2 INSTALLATION

A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.

B. All conductors for every electrical system shall be installed in a raceway.

C. A single raceway shall be limited to a maximum of six current carrying conductors.

D. Separate conduit systems shall be provided for each electrical system category.

E. Keep raceways at least 6 inches away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Complete raceway installation before starting conductor installation.

G. Support raceways as specified in Division 26 Section "Hangers and Supports for Electrical System."

H. Arrange stub-ups so curved portions of bends are not visible above the finished slab.

I. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.

J. Conceal conduit within finished walls and ceilings, unless otherwise indicated.

K. Raceways embedded in slabs or below slab inside the building envelope are not permitted unless shown on Contract Documents.

L. RNC Installation:

1. Entire installation shall be watertight.
2. Where exiting or entering a concrete slab, PVC shall be adapted to rigid conduit at least 12 inches prior to entering or exiting.

M. Threaded Conduit Joints Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.

N. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including bushing for size No. 6 AWG and larger conductors.

O. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.

P. Raceways for Optical Fiber and Communications Cable: Install raceways as follows:

1. 3/4-Inch trade size and smaller: Install raceways in maximum lengths of 50 feet.
2. 1-Inch trade size and larger: Install raceways in maximum lengths of 75 feet.
3. Install with a maximum of two 90-degree bends or equivalent for each length of raceway unless Drawings show stricter requirements. Separate lengths with pull or junction boxes

or terminations at distribution frames or cabinets where necessary to comply with these requirements.

Q. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

R. Flexible Conduit Connections: Use maximum of 72 inches of flexible conduit for recessed and semi-recessed lighting fixtures, use maximum of 36 inches of LFMC for equipment subject to vibration, noise transmission, or movement; transformers, motors and damp/wet location. Support within 72 inches of light fixture and 36 inches of motor terminals.

S. Recessed Boxes in Masonry Walls: Saw-cut opening for box in center of cell of masonry block, and install box flush with surface of wall.

T. Conduits Penetrating Roof:

1. One conduit per sleeve. Minimum height of sleeve not less than 8 inches above roof membrane.
2. Provided rain shield on conduit overlapping sleeve a minimum of 2 inches. Secure rain shield to conduit with stainless steel pressure clamps and provide flashing as required.

U. Expansion coupling/fitting shall be installed for conduit passing through building expansion joint. Provide bonding jumper with conduit/pipe clamp to maintain raceway as grounding continuity. The expansion fitting shall be similar to O-Z/Gedney EX Series. Expansion fitting/coupling length and diameter shall be as required for the application.

V. Raceways shall run parallel and perpendicular to the building surface walls or exposed structural members and follow the surface contours to present a neat appearance. This shall apply to exposed structure, accessible ceiling and hard ceiling area of the facility.

W. Junction Boxes: Do not locate junction boxes above hard (gypsum) ceilings.

3.3 DEVICE ROUGH-IN BOX

A. Finish plates shall not span different types of wall finishes either vertically or horizontally. Plates shall cover mortar joints and cut openings completely.

B. Outlet, junction and pull boxes, and their covers shall have corrosion protection suitable for the atmosphere in which they are installed. Provide gaskets for all boxes installed outside and other wet or damp locations (tunnels, crawl spaces, pits, etc.).

C. Outlet boxes shall be protected to prevent entrance of plaster, and debris shall be thoroughly cleaned from the box prior to installation of conductors.

D. Single gang opening outlet boxes shall be mounted with the long axis vertical unless otherwise noted for horizontal mounting. Three or more gang boxes shall be mounted with the long axis horizontal.

E. Finish plates shall be a type designed, intended, and appropriate for the use and location.

F. Provide outlet box with barrier for grouped or ganged light switched where voltage between adjacent switches exceeds 300 volt AC per NEC Article 380.

G. Provide outlet box with barrier and separate conduit feed for switches grouped or ganged where connected to utility power and standby power.

3.4 METAL RACEWAY

A. Metal raceway duct shall be installed level and true to building construction lines such that removable or hinged covers can be operated to be fully accessible.

B. Routing shall be pre-planned by the Contractor to assure right-of-way and accessibility; routing indicated by Contract Documents shall be considered schematic in nature and may require job site alteration to avoid interference.

C. Metal raceway duct shall be adequately supported at not more than 5'-0" intervals. The support accessories shall be of the same manufacturer as metal raceway.

D. Metal raceway duct penetrations of walls shall be unbroken lengths, scaled to the wall opening; dead ends shall be closed with manufactured closures.

E. Metal raceway duct to be installed surface mounted; flush in wall or in floor as indicated by the Contract Documents.

F. Provide approved wall flanges and fully seal all penetrations of fire and smoke rated walls and partitions, cutting and patching as needed.

G. Provide divider to compartment the metal raceway duct as indicated by Contract Documents.

3.5 INSTALLATION OF UNDERGROUND CONDUIT

A. Concrete-Encased Duct Bank: Refer to the requirements in Division 26 Section “Underground Ducts and Raceways for Electrical Systems”.

B. Direct-Buried Conduit:

1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
2. Install backfill as specified in Division 31 Section "Earth Moving."
3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12

inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."

4. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.

    a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
    b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

5. Warning Tape: Bury warning tape approximately 12 inches below grade. Align tape along the width and along the centerline of conduit.

3.6 FIRESTOPPING

A. Apply firestopping to electrical penetrations of fire-rated floor and wall assemblies to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 7 Section "Firestopping."

END OF SECTION 26 05 33

SECTION 26 05 53 – IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes electrical identification requirements.

B. Related Sections include the following:

1. Division 26 Section "Electrical System Fault Analysis, Coordination and Arc Flash Study" for labeling requirements.

1.3 SUBMITTALS

A. Product Data: For each electrical identification product indicated.

B. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.4 QUALITY ASSURANCE

A. Comply with ANSI A13.1 and ANSI C2.

B. Comply with NFPA 70.

C. Comply with 29 CFR 1910.145.

1.5 COORDINATION

A. Coordinate identification names, abbreviations, colors, and other features with requirements in the Contract Documents, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual, and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.

B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.

C. Coordinate installation of identifying devices with location of access panels and doors.

D. Install identifying devices before installing acoustical ceilings and similar concealment.

1.6 COMMISSIONING

A. Commissioning of components, equipment and/or system specified in this division is part of the construction process. Project closeout is dependent on successful completion of all commissioning procedures, documentation and issue closure. See Section 01 91 13 for detailed commissioning requirements.

PART 2 - PRODUCTS

2.1 RACEWAY IDENTIFICATION MATERIALS

A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.

B. Color for Printed Legend:

1. Power circuits:

a. Utility power: Black letters on a white field.
b. Standby power: White letters on a red field.

2. Legend: Indicate system or service and voltage, if applicable.

C. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.2 CONDUCTOR IDENTIFICATION MATERIALS

A. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.3 UNDERGROUND-LINE WARNING TAPE

A. Description: Permanent, bright-colored, detectable-type, continuous-printed, polyethylene tape.

1. Not less than 6 inches wide by 4 mils thick.
2. Compounded for permanent direct-burial service.
3. Embedded continuous metallic strip or core.
4. Printed legend shall indicate type of underground line.

2.4 WARNING LABELS AND SIGNS

A. Comply with NFPA 70 and 29 CFR 1910.145.

B. Metal-Backed, Butyrate Warning Signs: Weather-resistant, non-fading, preprinted, cellulose-acetate butyrate signs with 0.0396-inch galvanized-steel backing; and with colors, legend, and size required for application. 1/4-inch grommets in corners for mounting. Nominal size, 10 by 14 inches.

C. Warning label and sign shall include, but are not limited to, the following legends:

1. Multiple power source warning: "DANGER - ELECTRICAL SHOCK HAZARD - EQUIPMENT HAS MULTIPLE POWER SOURCES."
2. Workspace clearance warning: "WARNING - OSHA REGULATION - AREA IN FRONT OF ELECTRICAL EQUIPMENT MUST BE KEPT CLEAR FOR 42."

2.5 INSTRUCTION SIGNS

A. Engraved, laminated acrylic or melamine plastic, minimum 1/16 inch thick for signs up to 20 sq. in. and 1/8 inch thick for larger sizes.

1. Engraved legend with black letters on white face.
2. Punched or drilled for mechanical fasteners.
3. Framed with mitered acrylic molding and arranged for attachment at applicable equipment.

2.6 EQUIPMENT IDENTIFICATION LABELS

A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. Black letters on a white background for utility power white letters on a red background for standby power. Minimum letter height shall be 3/8 inch.

1. Label shall identify equipment served, source of feed and circuit number.

2.7 DEVICE, RECEPTACLE AND SWITCH LABELS

A. Label shall be self-adhesive vinyl and shall be computer or machine printed. Minimum size shall be 1/4-inch label with 1/8-inch letters.

1. Label background shall be clear or match to device plate.
2. Black lettering.
3. Legend: Indicates panel and circuit number.

B. Special Receptacles:

1. Special purpose receptacles shall include an engraved or embossed legend appropriate for load serviced and labeled as specified in Paragraph A.

2.8 MISCELLANEOUS IDENTIFICATION PRODUCTS

A. Cable Ties: Fungus-inert, self-extinguishing, 1-piece, self-locking, Type 6/6 nylon cable ties.

1. Minimum width: 3/16 inch.
2. Tensile strength: 50 pound minimum.
3. Temperature range: Minus 40 to plus 185 deg F (minus 40 to plus 85 deg C).
4. Color: Black, except where used for color-coding.

B. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

2.9 PAINTING

A. Refer to Division 09 Section “Painting” for product and material requirements for preparing and painting of exposed electrical raceways and boxes.

PART 3 - EXECUTION

3.1 APPLICATION

A. Accessible Raceways, 600 V or Less, for Feeder and Branch Circuits: Identify with preprinted self-adhesive vinyl label based on voltage contained and as follows:

1. 120/208 volt system: Black letters on a white field for normal power and white letters on a red field for emergency power. Shall read as "120/208 VOLTS."
2. 277/480 volt system: Black letters on a white field for normal power and white letters on a red field for emergency power. Shall read as "277/408 VOLTS."

B. Raceways and Junction Boxes for the Fire Alarm System: All conduits associated with the fire alarm system shall be fire alarm EMT conduit with a bright red topcoat. All junction boxes shall be painted to match the red conduit.

C. Conductors:

1. Feeder wires shall be identified with voltage, phase, and destination at each access point. Each phase conductors shall be identified with colored insulation its entire length.
2. Wiring shall be identified with wrap-on wire markers. Wire markers shall be vinyl cloth with factory painted letters and numbers. Number shall indicate associated terminal in starter, panelboard, etc.
3. All transformers, distribution panels, feeders, power sub-feeds to motors, etc., shall be completely phased out as to sequence and rotation and so labeled.
4. Neutral conductors at each panel, junction box, etc., shall be permanently and effectively identified with its branch circuit conductor taped together and labeled with circuit number. The neutral shall have a colored strip that corresponds to the phase color of the non-grounded conductor.

D. Pull and Junction Boxes, Feeder Bus Taps:

1. Identify by stenciling on the boxes, system use, etc. as directed.
2. Covers for pull and junction boxes shall be marked with felt tip pen or other approved permanent marking means, including system type, i.e., lighting, power, emergency, etc.,

panel and circuit number, if applicable designation, etc. Example: Room C703, Panel 1-LN-1, Circuit #12.

E. Device Cover Plates:

1. Receptacle cover plates shall be identified by a clear label with black lettering indicating panel and circuit.
2. Switch cover plates shall be identified by a clear label with black lettering indicating panel and circuit.

F. Conductors to Be Extended in the Future: Attach write-on tags to conductors and list source and circuit number.

G. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, and control wiring.

H. Warning Labels for Indoor Cabinets, Boxes, and Enclosures for Power and Lighting: Comply with 29 CFR 1910.145 and apply self-adhesive warning labels. Apply to exterior of door, cover, or other access.

1. Equipment with multiple power or control sources: Apply to door or cover of equipment including, but not limited to, the following:

a. Power transfer switches.
b. Controls with external control power connections.
c. Emergency power system.

2. Equipment requiring workspace clearance according to NFPA 70: Unless otherwise indicated, apply to door or cover of equipment but not on flush panelboards and similar equipment in finished spaces.

I. Arc Flash Labeling: Comply with the requirements of Division 26 Section "Electrical System Fault Analysis, Coordination and Arc Flash Study."

J. Instruction Signs:

1. Operating instructions: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
2. Emergency operating instructions: Install instruction signs with white legend on a red background with minimum 3/8-inch- high letters for emergency instructions at equipment used for power transfer.

K. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and Operation and Maintenance Manual. Apply labels on each power and system equipment/panel power equipment. Label shall include device identification and source.

1. Labeling instructions:

a. Indoor equipment: Engraved, laminated acrylic or melamine label. Unless otherwise indicated, provide a single line of text with 1/2-inch- high letters on 1-1/2-inch- high label; where 2 lines of text are required, use labels 2 inches high.
b. Outdoor equipment: Engraved, laminated acrylic or melamine label.
c. Elevated components: Increase sizes of labels and letters to those appropriate for viewing from the floor.

2. Equipment to be labeled:

a. Switchgear.
b. Switchboards.
c. Panelboards, electrical cabinets, and enclosures.
d. Access doors and panels for concealed electrical items.
e. Transformers.
f. Disconnect switches.
g. Enclosed circuit breakers.
h. Variable frequency controllers.
i. Motor starters.
j. Distribution panels.
k. Contactors.
l. Fire-alarm control panel and annunciators.
m. Transfer switches.

3. Equipment schedule:

a. Panelboards shall include correct, typewritten circuit directory cards identifying load served by branch circuit protective devices.
b. Panelboards shall include designation label, voltage, phase, wires, ampere, fed from, short circuit ratings, arc flash hazard level and feeder size on exterior cover of the panel door.

4. Distribution panels shall have labeling for each circuit breaker frame/trip size, including spare and spaces/provisions.
5. Motor controllers and disconnect switches: Label each with engraved plastic label with 1/2-inch high letters securely attached to the exterior of device as follows:

a. Equipment served, voltage, phase and wire.
b. Source of feed and circuit number. For example, “MS-AHU-1 fed from B-HEQDP-1 Circuit #4 located in Room B053”.
c. Feeder size.

6. Panelboards:

a. Provide approximately 5" X 8" frame inside the door with plastic protected typewritten directory card identifying all circuits with Owner's final room number.
b. Engraved plastic label with 1/2-inch high letters on panel cover identifying panel, voltage, phase, wire, ampere source of feed, short circuit rating, arc flash hazard level and feeder size.

7. Switchgear, switchboards and distribution panels:

a. Provide an engraved plastic label with 3/4-inch high letters, securely attached, identifying panel, voltage, phase, wire, ampere, source of feed, short circuit rating, arc flash hazard level and feeder size.
b. Branch devices shall be labeled with engraved plastic label with 3/16-inch high letter securely attached to exterior of device.

8. Transfer switches:

a. Label "Normal" and "Emergency" poles with engraved plastic tags.
b. Label with source designations for both sources.
c. Identify switch, voltage, phase, wire, ampere, short circuit rating, arch flash hazard level and feeder sizes.

L. Emergency Source Sign: Provide a sign complying with the requirements of NEC Article 700 identifying the presence of the on-site emergency power source. Locate in a conspicuous location on the utility source main switchboard near the main breaker. Sign shall read “Standby emergency power source. Diesel emergency generator. Located outdoor west of the facility”.

M. Painting:

1. Refer to Division 09 Section “Painting” for execution requirements related to painting of exposed Division 26 components.
2. Apply field labeling and other identification materials after painting has been completed.

3.2 INSTALLATION

A. Verify identity of each item before installing identification products.

B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.

C. Apply identification devices to surfaces that require finish after completing finish work.

D. Self-Adhesive Identification Products: Clean surfaces before application, using materials and methods recommended by manufacturer of identification device.

E. Attach non-adhesive signs and plastic labels with screws and auxiliary hardware appropriate to the location and substrate.

F. Accessible Raceway Labeling: Install at a conveniently viewable location. Locate bands at changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.

G. Color-Coding for Phase and Voltage Level Identification, 600 V and Less: Use the colors listed below for feeder and branch-circuit conductors. Colors shall be factory applied and continuous through the insulation from end to end. Field marking is not acceptable.

1. Colors for 208/120-V circuits:

a. Phase A: Black.
b. Phase B: Red.

c. Phase C: Blue.
d. Neutral:

1) Phase A: White with black strip.
2) Phase B: White with red strip.
3) Phase C: White with blue strip.

e. Ground: Green.

2. Colors for 480/277-V circuits:

a. Phase A: Brown.
b. Phase B: Orange.
c. Phase C: Yellow.
d. Neutral:

1) Phase A: Gray with brown strip.
2) Phase B: Gray with orange strip.
3) Phase C: Gray with yellow strip.

e. Ground: Green.

H. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 12 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench or concrete envelope exceeds 16 inches overall.

END OF SECTION 26 05 53

SECTION 26 05 73 – ELECTRICAL SYSTEM FAULT ANALYSIS, COORDINATION AND ARC FLASH STUDY

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This section includes requirements and provisions for providing a fault analysis study, arc flash analysis study, and overcurrent protection device coordination study for the entire electrical system including, but not limited to panels, switchgear, generator, transfer switches, mechanical equipment loads, etc.

B. This Section includes computer-based, fault-current, arc flash, and overcurrent protective device coordination studies. Protective devices shall be set based on results of the protective device coordination study.

C. Series rated protective devices are not permitted unless noted otherwise.

D. Protective devices and equipment requiring coordination will not be approved by Engineer until entire coordination study has been approved.

E. The coordination study shall include devices down to the branch circuit breakers in panelboards.

1.3 SUBMITTALS

A. Product Data: For computer software program to be used for studies.

B. Product Certificates: For coordination-study and fault-current-study computer software programs, certifying compliance with IEEE 399.

C. Qualification Data: For coordination-study specialist.

D. Submit one line schematic, fault-analysis coordinated study and arc flash analysis in both paper hard copy format and also in computer format (SKM files).

E. Other Action Submittals: The following submittals shall be made prior to the approval process for system protective devices has been completed. Submittals shall be in digital form.

1. Coordination-study input data, including completed computer program input data sheets.
2. Study and Equipment Evaluation Reports.

3. Coordination-Study Report (TCC Graphs):

a. Coordination-study report shall be submitted in color.

F. Obtain written correspondence from local utility denoting maximum and minimum available fault current at main service. Data shall be submitted.

G. Approved studies and utility correspondence shall be included in O & M Manual. Include color hard copies and computer software files on a CD.

H. Submit sample Arc Flash label (in color) prior to approval.

1.4 QUALITY ASSURANCE

A. Studies shall use computer programs that are distributed nationally and are in wide use. Software algorithms shall comply with requirements of standards and guides specified in this Section. Manual calculations are not acceptable.

B. Coordination-Study Specialist Qualifications: An entity experienced in the application of computer software used for studies, having performed successful studies of similar magnitude on electrical distribution systems using similar devices.

1. Professional Engineer, licensed in the state where Project is located, shall be responsible for the study. All elements of the study shall be performed under the direct supervision and control of engineer.

C. Comply with IEEE 242 for short-circuit currents and coordination time intervals.

D. Comply with IEEE 399 for general study procedures.

E. Comply with the latest Edition of NFPA 70E.

F. Comply with all applicable OSHA regulations.

PART 2 - PRODUCTS

2.1 COMPUTER SOFTWARE

A. Acceptable Products (The latest version of software shall be utilized):

1. SKM Systems Analysis, Inc.
2. ETAP.
3. EasyPower.

2.2 COMPUTER SOFTWARE PROGRAM REQUIREMENTS

A. Comply with IEEE 399.

B. Analytical features of fault-current-study computer software program shall include "mandatory," "very desirable," and "desirable" features as listed in IEEE 399.

C. Computer software program shall be capable of plotting and diagramming time-current-characteristic curves as part of its output. Computer software program shall report device settings and ratings of all overcurrent protective devices and shall demonstrate selective coordination by computer-generated, time-current coordination plots.

1. Additional features:

a. Arcing faults.
b. Simultaneous faults.
c. Explicit negative sequence.
d. Mutual coupling in zero sequence.

D. Arc Flash Analysis.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine Project overcurrent protective device submittals for compliance with electrical distribution system coordination requirements and other conditions affecting performance. Devices to be coordinated are indicated on Drawings.

1. Proceed with equipment submittals only after relevant coordination study has been provided and approved.

3.2 POWER SYSTEM DATA

A. Gather and tabulate the following input data to support coordination study:

1. Product data for overcurrent protective devices specified in other Division 26 Sections and involved in overcurrent protective device coordination studies. Use equipment designation tags that are consistent with electrical distribution system diagrams, overcurrent protective device submittals, input and output data, and recommended device settings.
2. Impedance of utility service entrance.
3. Electrical distribution system diagram: In hard-copy and electronic-copy formats, showing the following:

a. Circuit-breaker and fuse-current ratings and types.
b. Relays and associated power and current transformer ratings and ratios.
c. Transformer kilovolt amperes, primary and secondary voltages, connection type, impedance, and X/R ratios.
d. Generator kilovolt amperes, size, voltage, and source impedance.
e. Cables: Indicate conduit material, sizes of conductors, conductor material, insulation, and length.

f. Busway ampacity and impedance.
g. Motor horsepower and code letter designation according to NEMA MG 1.

4. Data sheets to supplement electrical distribution system diagram, cross-referenced with tag numbers on diagram, showing the following:

a. Special load considerations, including starting inrush currents and frequent starting and stopping.
b. Transformer characteristics, including primary protective device, magnetic inrush current, and overload capability.
c. Motor full-load current, locked rotor current, service factor, starting time, type of start, and thermal-damage curve.
d. Generator thermal-damage curve and decrement curves.
e. Ratings, types, and settings of utility company's overcurrent protective devices.
f. Special overcurrent protective device settings or types stipulated by utility company.
g. Time-current-characteristic curves to be coordinated for entire system.
h. Manufacturer, frame size, interrupting rating in amperes RMS symmetrical, ampere or current sensor rating, long-time adjustment range, short-time adjustment range, and instantaneous adjustment range for circuit breakers.
i. Manufacturer and type, ampere-tap adjustment range, time-delay adjustment range, instantaneous attachment adjustment range, and current transformer ratio for overcurrent relays.
j. Panelboards, switchboards, motor-control center ampacity, and interrupting rating in amperes RMS symmetrical.
k. TCC curve showing branch protective devices coordinated with upstream devices.

3.3 FAULT-CURRENT STUDY

A. Calculate the maximum available short-circuit current in amperes RMS symmetrical at circuit-breaker positions of the electrical power distribution system. The calculation shall be for a current immediately after initiation and for a three-phase bolted short circuit at each of the following:

1. Switchgear.
2. Switchboard.
3. Distribution panelboard.
4. Branch circuit panelboard.
5. Disconnect switch.
6. Motor controllers.
7. Automatic transfer switches.
8. Generator.

B. Study electrical distribution system from normal and alternate power sources throughout electrical distribution system for Project. Include studies of system-switching configurations and alternate operations that could result in maximum fault conditions. Scenarios shall evaluate utility maximum and minimum values, as well as various main and tie switching combinations along with the various generator combinations at the minimum and maximum utility values.

C. Calculate momentary and interrupting duties on the basis of maximum available fault current.

D. Calculations to verify interrupting ratings of overcurrent protective devices shall comply with IEEE 242.

1. Transformers:

a. ANSI C57.12.10.
b. ANSI C57.12.22.
c. ANSI C57.12.40.
d. IEEE C57.12.00.
e. IEEE C57.96.

2. Low-voltage circuit breakers: IEEE 1015 and IEEE C37.20.1.
3. Low-voltage fuses: IEEE C37.46.

E. Study Report:

1. Show calculated X/R ratios and equipment interrupting rating (1/2-cycle) fault currents on electrical distribution system diagram.
2. Show interrupting (5-cycle) and time-delayed currents (6 cycles and above) on medium- and high-voltage breakers as needed to set relays and assess the sensitivity of overcurrent relays.

F. Equipment Evaluation Report:

1. For 600-V overcurrent protective devices, ensure that interrupting ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.
2. For devices and equipment rated for asymmetrical fault current, apply multiplication factors listed in the standards to 1/2-cycle symmetrical fault current.
3. Verify adequacy of phase conductors at maximum three-phase bolted fault currents; verify adequacy of equipment grounding conductors and grounding electrode conductors at maximum ground-fault currents. Ensure that short-circuit withstand ratings are equal to or higher than calculated 1/2-cycle symmetrical fault current.

3.4 COORDINATION STUDY

A. Perform coordination study using approved computer software program. Prepare a written report using results of fault-current study. Comply with IEEE 399.

1. Calculate the maximum and minimum 1/2-cycle short-circuit currents.
2. Calculate the maximum and minimum interrupting duty (5 cycles to 2 seconds) short-circuit currents.
3. Calculate the maximum and minimum ground-fault currents.

B. Comply with IEEE 242 recommendations for fault currents and time intervals.

C. Transformer Primary Overcurrent Protective Devices:

1. Device shall not operate in response to the following:

a. Inrush current when first energized.

b. Self-cooled, full-load current or forced-air-cooled, full-load current, whichever is specified for that transformer.
c. Permissible transformer overloads according to IEEE C57.96 if required by unusual loading or emergency conditions.

2. Device settings shall protect transformers according to IEEE C57.12.00, for fault currents.

D. Conductor Protection: Protect cables against damage from fault currents according to ICEA P-32-382, ICEA P-45-482, and conductor melting curves in IEEE 242. Demonstrate that equipment withstands the maximum short-circuit current for a time equivalent to the tripping time of the primary relay protection or total clearing time of the fuse. To determine temperatures that damage insulation, use curves from cable manufacturers or from listed standards indicating conductor size and short-circuit current.

E. Coordination-Study Report: Prepare a written report indicating the following results of coordination study:

1. Tabular format of settings selected for overcurrent protective devices:

a. Device tag.
b. Relay-current transformer ratios; and tap, time-dial, and instantaneous-pickup values.
c. Circuit-breaker sensor rating; and long-time, short-time, and instantaneous settings.
d. Fuse-current rating and type.
e. Ground-fault relay-pickup and time-delay settings.

2. Coordination curves: Prepared to determine settings of overcurrent protective devices to achieve selective coordination. Graphically illustrate that adequate time separation exists between devices installed in series, including power utility company's upstream devices. Prepare separate sets of curves for the switching schemes and for emergency periods where the power source is local generation. Show the following information:

a. Device tag.
b. Voltage and current ratio for curves.
c. Three-phase and single-phase damage points for each transformer.
d. No damage, melting, and clearing curves for fuses.
e. Cable damage curves.
f. Transformer inrush points.
g. Maximum fault-current cutoff point.

3. Coordination curves:

a. Electronic breaker: Coordination curves shall be provided for all devices identifying time separation between subsequent devices.
b. Molded case breaker: Coordination curves shall be provided for the largest device of every different model of breaker within each different panelboard condition identifying time separation between subsequent devices.
c. Coordination of protection devices shall be demonstrated down to breakers in the panelboard.

F. Completed data sheets for setting of overcurrent protective devices.

G. Upon device installation, submit written correspondence noting all protective device adjustments have been performed.

3.5 ARC FLASH STUDY

A. Provide an Arc Flash Hazard Study for all electrical equipment in the electrical distribution system. The intent of the arc flash study is to provide arc flash analysis values for all equipment and subsequently provide arc flash hazard warning labels on all electrical equipment involved in the study.

B. Upon completion of coordination study and fault analysis study, arc flash study shall be performed based upon IEEE Std. 1584, "IEEE Guide for Performing Arc Flash Hazard Calculations."

C. The study shall be computer calculated with scenarios utilizing both minimum and maximum fault current values from the local utility. Scenarios shall also evaluate the various main and tie switching combinations along with the various generator combinations at the minimum and maximum utility values.

D. Calculations and practices shall be in accordance with applicable NFPA 70E, OSHA 29-CFR, Part 1910, and IEEE 1584 standards.

E. The following values shall be calculated and submitted to the Engineer in a summary sheet along with pertinent data and characteristics pertaining to the evaluated equipment.

1. Flash hazard protection boundary.
2. Limited approach boundary.
3. Restricted boundary.
4. Prohibited boundary.
5. Incident energy level.
6. Required Personal Protective Equipment (PPE) Class.
7. Type of fire rated clothing.

F. All equipment including, but not limited to, the following shall be included in the study.

1. Switchgear.
2. Switchboard.
3. Transformers.
4. Panelboards.
5. Variable frequency controllers.
6. All mechanical motor controllers $\geq$ 10 hp.
7. Disconnect switches and enclosed circuit breakers.
8. Automatic transfer switches.
9. Generator.

G. Produce and provide an arc flash warning label denoting items in Paragraph E.1 through E.7 above for all electrical pieces of equipment.

1. Label shall be printed in color and with an adhesive backing.

2. Label shall also include the following information on the label:

    a. Equipment Name.
    b. Bus Voltage.
    c. "WARNING."
    d. "ARC FLASH & SHOCK HAZARD."
    e. "Appropriate PPE Required."

H. Electrical Contractor shall be responsible to receive labels and install labels on all equipment.

1. Label shall be installed on front of unit in a conspicuous location below equipment nameplate(s).

END OF SECTION 26 05 73

SECTION 26 09 23 - LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Time Clock.
2. Photoelectric switches.
3. Indoor occupancy sensors.
4. Lighting contactors.
5. Digital room controllers.
6. Digital wall control stations.

PART 2 - PRODUCTS

2.1 TIME CLOCK

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Intermatic, Inc.
2. Paragon Time Controls
3. Emersion Network Power; ASCO Lighting Control
4. NSi Industries LLC; TORK Products.

B. Electronic Time Clock: Solid state, programmable, with alphanumeric display; complying with UL 917.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Contact Configuration: single pole, single throw (SPST) or as indicated on the drawings.
3. Contact Rating: 20-A ballast load, 120-/240-V ac. Provide inductive load rated contact where shown on drawings to control motor loads.
4. Programs: Minimum, two on-off set points on a 24-hour schedule, allowing different set points for each day of the week**.**
5. Automatic daylight savings time changeover.
6. Battery Backup: Not less than seven days reserve, to maintain schedules and time clock.

2.2 OUTDOOR PHOTOELECTRIC SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Intermatic, Inc.
2. NSi Industries LLC; TORK Products.
3. Leviton
4. Sunrise Technologies

B. Description: Solid state, with dry contact rated for 1800-VA, to operate connected relay, contactor coils, or microprocessor input; complying with UL 773A.

1. Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
2. Light-Level Monitoring Range: 1.5 to 10 fc, with an adjustment for turn-on and turn-off levels within that range**,** and a directional lens in front of the photocell to prevent fixed light sources from causing turn-off.
3. Time Delay: Fifteen second minimum, to prevent false operation.
4. Surge Protection: Metal-oxide varistor.
5. Mounting: Twist lock complies with NEMA C136.10, with base-and-stem mounting or stem-and-swivel mounting accessories as required to direct sensor to the north sky exposure.

2.3 INDOOR OCCUPANCY SENSORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Industries, Inc.; Greengate
2. Hubbell Building Automation, Inc.
3. Lutron Electronics Co., Inc.
4. Watt Stopper.
5. Acuity Controls.

B. Devices Types: Devices located in stairwells shall be ultrasonic type. All other locations shall be dual-technology (PIR and Ultrasonic) type, unless otherwise noted on drawings or in this specification.

C. General Description: Refer to drawings for type, mounting, integration, etc. and provide accordingly. Wall or ceiling mounting, part of a room controller, relay panel or standalone application. Provide all required relay packs, power packs, accessories, etc. as required to achieve control intent.
1. Operation:
    a. Occupancy senor (auto on/auto off): Turn lights on automatically when covered area is occupied and automatically off when space becomes unoccupied. Shall have a time delay for turning lights off that is adjustable for a range of 1 minute to 30 minutes.
    b. Vacancy sensors (manual on/auto off): Turn lights on when a low voltage wall switch is manually activated and automatically off when space becomes

unoccupied. Shall have a time delay for turning lights off that is adjustable for a range of 1 minute to 30 minutes.

2. Type: All sensors shall be digital, low voltage (Class 2) devices unless specifically noted otherwise.
3. Sensor:
   a. Shall have an internal additional isolated relay with normally open, normally closed and common outputs for use with HVAC control. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.
   b. Shall not have pop-off covers.
4. Provide with RJ-45 ports for interface with room controller or relay system where applicable.
5. Mounting:
   a. Sensor: Suitable for recessed mounting in any position on a standard outlet box. Surface mount is not acceptable.
   b. Relay: Mounted adjacent to sensor in a dedicated junction box.
6. Adjustments:
   a. Time delay: Adjustable range from 1 minute to 30 minutes, with a maximum of 8 incremental levels.
   b. Sensitivity: Adjustable from low to high sensitivity with a minimum of 3 incremental levels. The use of intelligent, adaptive technology is acceptable.
   c. Adjustment controls shall be concealed out of normal view.
   d. Independent control of PIR and UT technologies.
7. Coverage: The detection coverage of each sensor shall be selected by manufacturer to provide complete coverage of each space based on room type, size, shape and fixed obstructions present within the space. The placement and coverage shall be illustrated on the floor plan submittals as defined in Part 1 of this Section.
8. On/off buttons: Where applicable, provide with single or dual button control as indicated for independent, manual control of loads.
9. Relay/power pack units: Provide quantity of relays and/or power packs as required to meet design intent. Maintain separation of voltage classes and separation of different branches of power (normal, critical, and life-safety) as required by code.
10. Indicator: LED to show when motion is being detected during testing and normal operation of the sensor.
11. The mounting yokes and tabs for attaching wall mounted sensors to the back box shall be of metallic construction. The use of non-metallic or plastic materials will not be permitted.

D. PIR Type: Wall or ceiling mounting, detect occupancy by sensing a combination of heat and movement in area of coverage. Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of not less than 36 sq. in.

E. Ultrasonic Type: Wall or ceiling mounted, detect occupancy by sensing a change in pattern of reflected ultrasonic energy in area of coverage. Detect a person of average size and weight moving not less than 12 inches in either a horizontal or vertical manner at an appropriate speed of 12 inches/s.

F. Dual Technology Type: Wall or ceiling mounting, detect occupancy by using a combination of PIR and ultrasonic detection methods in area of coverage. Particular technology or combination of technologies that controls on-off functions shall be selectable in the field by operating controls on unit.
   1. Sensitivity adjustment: Separate for each sensing technology.

2. Detector sensitivity: Detect occurrences of 6-inch minimum movement of any portion of a human body that presents a target of not less than 36 sq. in and detect a person of average size and weight moving not less than 12 inches in either a horizontal or a vertical manner at an appropriate speed of 12 inches/s.

2.4 LIGHTING CONTACTORS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Allen-Bradley/Rockwell Automation.
2. ASCO Power Technologies, LP.
3. Eaton Corporation.
4. General Electric Company;
5. Square D.
6. Siemens

B. Description: Electrically operated and mechanically held, combination-type lighting contactors complying with NEMA ICS 2 and UL 508.

1. Current Rating for Switching: Listing or rating consistent with type of load served.
2. Fault Current Withstand Rating: Equal to or exceeding the available fault current at the point of installation.
3. Enclosure: Comply with NEMA 250, hinged enclosure with HOA switch installed in the door. All control wiring shall be wired through the automatic control position.

2.5 DIGITAL WALL SWITCHES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Lighting Systems; Cooper Control.
2. Hubbell Building Automation.
3. Lutron.
4. WattStopper.
5. *Acuity Controls.*

B. Low Voltage Momentary Pushbutton Switches in 1, 2, 3, 4, 5 and 8 Button Configuration: Wall switches shall include the following features:
1. Removable buttons for field replacement with engraved buttons and/or alternate color buttons. Button replacement may be completed without removing the switch from the wall. Provide custom labeling per direction from the Owner.
2. Configuration LED on each switch that blinks to indicate data transmission.
3. Load/scene status LED on each switch button with the following characteristics:
    a. Bi-level LED.
    b. Dim locator level indicates power to switch.
    c. Bright status level indicates that load or scene is active.
4. Programmable control functionality including:
    a. Button priority may be configured to any level corresponding to networked operation allowing local actions to utilize life safety priority.

b. Scene patterns may be saved to any button. Once set, button may be digitally locked to prevent overwriting of the preset levels.

5. All digital parameter data programmed into an individual wall switch shall be retained in non-volatile FLASH memory within the wall switch itself.

C. Two (2) RJ-45 ports for connection to the room controller local network.

D. Multiple digital wall switches may be installed in a room by simply connecting them to the free topology local network. No additional configuration shall be required to achieve multi-way switching.

E. The following switch attributes may be changed or selected using a wireless configuration tool:
1. Load and scene button function may be reconfigured for individual buttons (from load to scene and vice versa).
2. Individual button function may be configured to toggle, on only or off only.
3. Individual scenes may be locked to prevent unauthorized change.
4. Fade up and fade down times for individual scenes may be adjusted from 0 seconds to 18 hours.
5. Ramp rate may be adjusted for each dimmer switch.
6. Switch buttons may be bound to any load on a room controller and are not load type dependent. Each button may be bound to multiple loads.

2.6 DIGITAL ROOM CONTROLLERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
1. Eaton Lighting Systems; Cooper Control; Greengate Room Controller.
2. Hubbell Building Automation; NX Room Controller.
3. WattStopper; DLM Room Controller.
4. Acuity Controls.

B. Digital controllers for lighting automatically bind the room loads to the connected devices in the space without commissioning or the use of any tools. Room controllers shall be provided to match the room lighting control requirements. The controllers will be simple to install and will not have dip switches or potentiometers or require special configuration for standard plug n' go applications. The control units will include the following features:
1. Automatic room configuration to the most energy efficient sequence of operation based upon the devices in the room.
2. Simple replacement: Using the default automatic configuration capabilities, a room controller may be replaced with an off-the-shelf.
3. Multiple room controllers connected together in a local network must automatically prioritize each room controller, without requiring any configuration or setup so that loads are sequentially assigned using room controller devices ID's from highest to lowers.
4. Device status LEDs to indicate:
   a. Data transmission.
   b. Device has power.
   c. Status for each load.
   d. Configuration status.
5. Quick installation features including:
   a. Standard junction box mounting.

b. Quick low voltage connections using standard RJ-45 patch cable.

6. Based on individual configuration, each load shall be capable of the following behavior on power up following the loss of normal power:
   a. Turn on to 100%.
   b. Remain off.
   c. Turn on to last level.
7. Each load shall be configurable to operate in the following sequences based on occupancy:
   a. Auto-on/Auto-Off (follow on and off).
   b. Manual-on/Auto-off (follow off only).
8. UL 2043 plenum rated.
9. Dual voltage 120/277 VAC, 60 HZ, 20A total load.
10. All digital parameter data programmed into an individual room controller or plug load controller shall be retained in non-volatile FLASH memory within the controller itself.

C. On/Off/Dimming Enhanced Room Controllers shall include:
1. Four (4) RJ-45 local network ports with integral strain relief and dust cover.
2. One (1) dimming outlet per relay.
   a. 0-10 V dimming: 0-10 volt output for control of compatible LED drivers. The 0-10 volt output shall automatically open upon loss of power to the room controller to assure full light output from the controlled lighting.
   b. Each dimming output channel shall have an independently configurable minimum and maximum calibration trim level to set the dimming range to match the true dynamic range of the connected ballast or driver.
   c. The LED level indicators on bound dimming switches shall utilize this new maximum and minimum trim.
   d. Each dimming output channel shall have an independently configurable minimum and maximum trim level to set the dynamic range of the output within the new 0-100% dimming range defined by the minimum and maximum calibration trim.
   e. Calibration and trim levels must be set per output channel.
3. Each load shall have an independently configurable preset on level for normal hours and after hours' events to allow different dimmed levels to be established at the start of both normal hours and after hours' events.
4. Fade rates for dimming loads shall be specific to bound switch buttons and the load shall maintain a default value for any bound buttons that do not specify a unique value.

D. Local (Room) Network:
1. The local network is a free topology lighting control physical connection and communication protocol designed to control a small area of a building.
2. Features of the local network include:
   a. Plug n' Go automatic configuration and binding of occupancy sensors, switches and lighting loads to the most energy efficient sequence of operation based upon the device attached.
   b. Simple replacement of any device in the network with a standard off the shelf unit without requiring commissioning, configuration or setup.
   c. Push N Learn configuration to change the automatic configuration, including binding and load parameters without tools using only the button son the digital devices in the local network.
   d. Two-way infrared communications for control by handheld remotes and configuration by a handheld tool including adjusting load parameters, sensor

configuration and binding, within a line of sight of up to 30 feet from a sensor, wall switch or IR receiver.

3. Digital room devices connect to the local network using pre-terminated Category 5e cables with RJ-45 connectors which provide both data and power to room devices. Systems that utilize RJ-45 patch cords, but do not provide serial communication data from individual end devices are not acceptable.
4. If manufacturer's pre-terminated Category 5e cables are not used for the installation, the Contractor is responsible for testing each cable following installation and supplying manufacturer with test results.

E. Segment (Room-to-Room) Network: Linear topology to connect local rooms and relay panels.
1. Each connected local network shall include a single network bridge.
2. Network bridges, relay panels and segment managers shall include terminal blocks, with provisions for separate "in" and "out" terminations, for segment network connections.

F. Configuration Tools: A wireless configuration tool facilitates optional customization of local networks using two-way infrared communications, while PC software connects to each local network via a USB interface.

G. Network Bridge: The network bridge module connects a local network for communication between rooms, relay panels and a segment manager. Each local network shall include a network bridge component to provide a connection to the local network room devices. The network bridge shall use industry standard communications.

2.7 EMERGENCY POWER CONTROL

A. Comply with the requirements of Division 26 Section "Interior Lighting".

2.8 CONDUCTORS AND CABLES

A. Comply with the requirements of Division 26 Section "Low Voltage Electrical Power Conductors and Cables".

B. Coordinate cabling requirements with lighting control equipment manufacturer and provide as required for a complete installation.

C. Low Voltage Lighting Control Wiring:

1. Category 5 (minimum) quick connect cables: Cables shall be pre-terminated. The Electrical Contractor shall determine lengths required based on field conditions.
2. 0-10 volt dimming wiring: Wiring shall be minimum number 18 gauge, bundled/jacketed and shall be suitable for the installed environment. Coordinate exact wire type, quantity, color, etc. with lighting control equipment manufacturer.
3. Miscellaneous wiring: Wiring shall be suitable for the installed environment. Coordinate exact wire type, quantity, color, etc. with lighting control equipment supplier.
4. All cabling installed above an accessible ceiling shall be plenum rated.

2.9 WALL PLATES

A. Comply with the requirements of Division 26 Section "Wiring Devices."

2.10 FINISHES

A. Comply with the requirements of Division 26 Section "Wiring Devices."

PART 3 - EXECUTION

3.1 SENSOR INSTALLATION

A. Coordinate layout and installation of ceiling-mounted devices with other construction that penetrates ceilings or is supported by them, including light fixtures, HVAC equipment, smoke detectors, fire-suppression systems, and partition assemblies.

B. Install and aim sensors in locations to achieve not less than 90 percent coverage of areas indicated. Do not exceed coverage limits specified in manufacturer's written instructions.

3.2 WIRING INSTALLATION

A. Wiring within Enclosures: Comply with NECA 1. Separate power-limited and nonpower-limited conductors according to conductor manufacturer's written instructions.

B. Size conductors according to lighting control device manufacturer's written instructions unless otherwise indicated.

C. Splices, Taps, and Terminations: Make connections only on numbered terminal strips in junction, pull, and outlet boxes; terminal cabinets; and equipment enclosures.

3.3 IDENTIFICATION

A. Identify components and power and control wiring according to Section 260553 "Identification for Electrical Systems."

1. Identify controlled circuits in lighting contactors.
2. Identify circuits or luminaires controlled by photoelectric and occupancy sensors at each sensor.

B. Label time switches and contactors with a unique designation.

3.4 FIELD QUALITY CONTROL

A. Perform the following field tests and inspections and prepare test reports:

1. After installing lighting control devices and after electrical circuitry has been energized, adjust and test for compliance with requirements.
2. Operational test: Verify operation of each lighting control device and make additional adjustments as necessary.
3. Verify sensors operate upon entry and do not create false trips while occupied.
4. Verify time delay settings are consistent with manufacturer's recommendation based on room function.

B. Lighting control devices that fail tests and inspections are defective work. Replace device, make necessary adjustments and retest.

C. Verification: Upon completion of installation and testing, engage a manufacturer's field service technician to verify operation of a minimum of 50 percent of installed sensors or as recommended by manufacturer's standard whichever is higher. Technician shall verify sensor placement, quantity, settings, etc., to ensure proper operation, free of false trips.

D. Documentation: Provide documentation for each sensor including the following:

1. Room name.
2. Room number.
3. Device type, including sensor technology, mounting, voltage, and operation.
4. Circuit(s) controlled.
5. Time delay and sensitivity settings.

3.5 ADJUSTING

A. Occupancy Adjustments: When requested within 12 months of date of project Substantial Completion, provide on-site assistance in adjusting sensors to suit occupied conditions. Provide up to two (2) visits to project within this period. Shall include making adjustments to time delay and sensitivity settings to accommodate the functions within each space and to eliminate false trips. Shall also include relocating, adding, and/or repositioning sensors as required for each space. Include all travel, labor, material, etc., costs for no additional expense to the Owner.

3.6 DEMONSTRATION AND TRAINING

A. Training of the Owner's operation and maintenance personnel is required in cooperation with the Owner and/or Owner's Representative. Provide competent, factory authorized personnel to provide instruction to operation and maintenance personnel concerning the location, operation and troubleshooting of the installed systems. The instruction shall be scheduled in coordination with the Owner and/or Owner's Representative after submission and approval of formal training plans. Shall include a minimum of one (1) 4 hour, on-site training sessions.

END OF SECTION 26 09 23

SECTION 26 24 16 - PANELBOARDS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Distribution panelboards.
2. Lighting and appliance branch-circuit panelboards.

1.3 SUBMITTALS

A. Product Data: For each type of panelboard, overcurrent protective device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings and finishes.

B. Shop Drawings: For each panelboard and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
2. Details and confirmation that additional gutter space has been provided per the specification.
3. Detail bus configuration, current, and voltage ratings.
4. Short-circuit current rating of panelboards and overcurrent protective devices.

    a. Devices shall be fully rated for available fault current. Series rated devices will not be allowed.

5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
6. Include wiring diagrams for power, signal, and control wiring.
7. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submittal shall include a list for each overcurrent device provided indicating all upstream and downstream devices that will coordinate with the provided devices.

C. Field Quality-Control Reports:

1. Test procedures used.
2. Test results that comply with requirements.

3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.

B. Electrical Components, Devices, and Accessories: All equipment shall be UL listed and labeled as defined in NFPA 70 and marked for intended location and application.

C. Comply with NEMA PB 1.

D. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panelboards for installation according to NECA 407 and NEMA PB 1.

1.6 COORDINATION

A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 3.

1.7 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace equipment and associated components that fail in materials or workmanship within a minimum warranty period of 36 months from date of Project Substantial Completion.

PART 2 - PRODUCTS

2.1 GENERAL REQUIREMENTS FOR PANELBOARDS

A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Hangers and Supports for Electrical Systems."

B. Enclosures: Flush- and surface-mounted cabinets as per schedule in Contract Documents.

1. Rated for environmental conditions at installed location.

a. Indoor dry and clean locations: NEMA 250, Type 1.
b. Outdoor locations: NEMA 250, Type 3R.
c. Other wet or damp indoor locations: NEMA 250, Type 4X.

2. Hinged front cover: Panelboard fronts shall be hinged to box type. The locked door must be opened in order to access the screws to open the panelboard front. Panelboards shall require the use of two items to access energized parts, a key and a hand-held tool (screwdriver) to open the cover that exposes energized parts.

a. Panels with doors over 48 inches high shall have a minimum of two latches per door.

3. Finishes:

a. Panels and trim: Steel factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
b. Back boxes: Galvanized steel.

4. Directory card: Inside panelboard door with protective cover.

C. Incoming Mains Location: Top and bottom per schedule. The Contractor shall be responsible for coordinating feed locations.

D. Phase, Neutral, and Ground Buses:

1. Material: Tin-plated hard-drawn copper, 98 percent conductivity.
2. Equipment ground bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
3. Isolated ground bus: Adequate for branch-circuit isolated ground conductors; insulated from box.

E. Conductor Connectors: Suitable for use with conductor material and sizes.

1. Main and neutral lugs: Mechanical type.
2. Ground lugs and bus-configured terminations: Mechanical type.
3. Feed-through lugs: Mechanical type, suitable for use with conductor material. Locate at opposite end of bus from incoming lugs or main device.
4. Sub-feed (double) lugs: Mechanical type suitable for use with conductor material. Locate at same end of bus as incoming lugs or main device.

F. Temperature Rise Rating: Shall conform to industry standard temperature rise ratings as tested by an independent laboratory.

G. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.

H. Locks: Each panelboard shall have two self-latching locks.

I. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals. Series ratings will not be permitted.

2.2 DISTRIBUTION PANELBOARDS

A. Basis-of-Design Product: Subject to compliance with requirements, provide Schneider Electric (Square D), I-Line Style or comparable product by of the following:

1. Eaton.
2. General Electric Company.
3. Siemens Energy & Automation, Inc.

B. Main: Circuit breaker or lugs only per Panelboard Schedule.

C. Surge Protection Device: Comply with the requirements of Division 26 Section "Surge Protection Devices."

D. Electronic Trip Circuit Breakers: 80 percent rated, solid-state, electronic-trip circuit breaker with interrupting capacity to meet available fault currents:

1. Solid-state, electronic-trip circuit breakers having microprocessor-based trip units with interchangeable rating plug, trip indicators, and the following field adjustable settings:

    a. Functions: Long-time-pickup, long-time-delay, short-time-pickup, short-time-delay, instantaneous pickup, ground-fault-pickup, and ground-fault-delay functions, independent of each other in both action and adjustment.
    b. Current adjustability: Dial settings and rating plugs on trip units.
    c. Equip short-time trip function for switchable I^2t operation.
    d. Ground-fault protection shall have at least three short-time delay settings and three trip-time delay bands; adjustable current pickup for three-wire circuit or system and four-wire circuit or system.

2. Trip indication: Labeled, battery-powered lights or mechanical targets on trip device to indicate type of fault.

E. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-magnetic circuit breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable instantaneous trip setting for circuit-breaker trip sizes 150 amps and larger.
2. Molded-case circuit breaker (MCCB) features and accessories:

a. Bolt-on type.
b. Trip position shall be indicated by means other than the off position.
c. Standard frame sizes, trip ratings, and number of poles.
d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
e. Multi-pole units enclosed in a single housing or factory assembled to operate as a single unit.
f. Handle padlocking device: Fixed attachment for locking circuit-breaker handle in "on" or "off" position.
g. Handle clamp: Loose attachment for holding circuit breaker handle in "on" position.

2.3 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Eaton.
2. General Electric Company.
3. Siemens Energy & Automation, Inc.
4. Square D; a brand of Schneider Electric.

B. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.

C. Mains: Circuit breaker or lugs only per Panelboard Schedule.

D. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.

E. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.

1. Thermal-magnetic circuit breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable instantaneous trip setting for circuit-breaker trip sizes 150 amps and larger.
2. Ground-fault equipment protection (GFEP) circuit breakers: Class B ground-fault protection (30-mA trip).
3. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:

a. Bolt-on type.
b. Trip position shall be indicated by means other than the off position.
c. Standard frame sizes, trip ratings, and number of poles.
d. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
e. Ground-fault protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.
f. Multi-pole units enclosed in a single housing or factory assembled to operate as a single unit.
g. Handle padlocking device: Fixed attachment, for locking circuit-breaker handle in on or off position.

h. Handle clamp: Loose attachment, for holding circuit-breaker handle in on position.

4. Dual-Function, AFCI/GFCI type:

a. Bolt-on type.
b. Combination type, Class A, 5mA GFCI and AFCI protecting against both arc faults and ground faults.
c. Self-test feature.
d. LED trip indicator.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Receive, inspect, handle, and store panelboards according to NECA 407 and NEMA PB 1.1.

B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Install panelboards and accessories according to NECA 407 and NEMA PB 1.1.

B. Equipment Mounting: Install panelboards on concrete bases, 4-inch nominal thickness. Comply with requirements for concrete base specified in Division 3 Section "Miscellaneous Cast-in-Place Concrete."

1. Install dowel rods to connect concrete base to concrete floor. Unless otherwise indicated, install dowel rods on 18-inch centers around full perimeter of base.
2. For panelboards, install epoxy-coated anchor bolts that extend through concrete base and anchor into structural concrete floor.
3. Place and secure anchorage devices. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.
4. Install anchor bolts to elevations required for proper attachment to panelboards.
5. Attach panelboard to the vertical finished or structural surface behind the panelboard.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.

D. Comply with mounting and anchoring requirements specified in Division 26 Section "Hangers and Supports for Electrical Systems."

E. Mounting: Top most switch or circuit breaker in “on” position shall not be higher than 6’-7” above finished floor or working platform.

F. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.

G. Install overcurrent protective devices and controllers not already factory installed.

1. Set field-adjustable, circuit-breaker settings per arc flash and short circuit coordination study.

H. Install filler plates in unused spaces.

I. For recessed or semi-recessed panelboards, stub six (6) 1-inch empty conduits from panelboard into accessible ceiling space or space designated to be ceiling space in the future. Stub four (4) 1-inch empty conduits into raised floor space or below slab not on grade.

J. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.

K. Comply with NECA 1.

L. Bond panelboards to the equipment grounding conductor with the feeder conduit by a threaded grounding type insulated bushing at the conduit entrance into the tub. The equipment grounding conductor shall continue from the bushing to the panelboard ground bus and be bonded.

M. Bond the equipment grounding buses of normal and essential branch circuit panelboards serving the same patient care areas as required by NEC 517. Bond with a minimum #10 awg insulated continuous copper conductor routed in conduit.

N. Dual-Function AFCI/GFCI: All circuit breakers serving receptacles in patient accessible areas shall be dual-function AFCI/GFCI type.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."

B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.

C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

E. Arc Flash Labels: Comply with the requirements of Division 26 Section "Electrical System Fault Analysis Coordination and Arc Flash Study" for arc flash labeling.

F. Label each panelboard with the following information:

1. Panel designation.
2. Voltage, phase, wire.
3. Ampere.
4. Fed from, circuit number.
5. Short circuit rating.
6. Arc flash incident energy.
7. Feeder size (conduit, wire, ground).

3.4 FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

C. Tests and Inspections:

1. Perform each visual, mechanical inspection and electrical test as follows:

a. Certify compliance with test parameters.

2. Circuit breakers, insulated case/molded case:

a. Visual and mechanical inspection:

1) Compare equipment nameplate data with drawings and specifications.
2) Inspect physical and mechanical condition.
3) Inspect anchorage and alignment.
4) Verify the unit is clean.
5) Operate the circuit breaker to insure smooth operation.
6) Inspect bolted electrical connections for high resistance using bolted electrical connections by calibrated torque-wrench method in accordance with manufacturer’s published data or Table 100.12.
7) Inspect operating mechanism, contacts, and arc chutes in unsealed units.
8) Verify correct operation of any auxiliary features such as trip and pickup indicators, electrical close and trip operation, trip-free and anti-pump functions.

b. Electrical tests:

1) Perform adjustments for final setting in accordance with coordination study.

2) Verify correct operation of any auxiliary features such as trip and pickup indicators, electrical close and trip operation, trip-free and anti-pump function.
3) Verify operation of charging mechanism.
4) Test insulation resistance for each panelboard bus, component, connecting supply, feeder and control circuit.
5) Test continuity of each circuit.

3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.
4. Panelboards shall be considered defective if they do not pass test and inspections.

D. Prepare test and inspection reports, including a certified report that identifies panelboards included and that describes scanning results. Include notation of deficiencies detected, remedial action taken and observations after remedial action.

3.5 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Set field-adjustable circuit-breaker trip ranges per arc flash and short circuit coordination study.

C. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION 26 24 16

SECTION 26 27 26 - WIRING DEVICES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Receptacles: Straight blade, GFCI, USB.
2. Twist-locking receptacles.
3. Weather-resistant receptacles
4. Snap switches and wall-box dimmers
5. Floor boxes and poke-through assemblies.
6. Safety type receptacle (tamperproof).

B. Confinement/Institutional Areas: All devices and wall plates installed in an area defined as an inmate area shall be suitable for a Confinement/Institutional area.

1.3 DEFINITIONS

A. EMI: Electromagnetic interference.

B. GFCI: Ground-fault circuit interrupter.

C. Pigtail: Short lead used to connect a device to a branch-circuit conductor.

D. RFI: Radio-frequency interference.

E. IG: Isolated ground type.

F. TR: Tamper-resistant.

1.4 SUBMITTALS

A. Product Data: For each type of product indicated.

B. Shop Drawings: Provide for each multi-outlet assembly.

1. Provide 1/4" = 1'-0" scale floor plan drawings for each multi-outlet assembly. Provide an identification tag for each raceway with the room number plus identifier.

2. Provide details for each assembly identifying the exact length, mounting details, each device to be installed, cutout openings, covers, hardware, etc., required for the entire assembly.
3. Each receptacle shall be identified with NEMA configuration, panel, circuiting number, voltage, and conductor sizes/quantities.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For wiring devices to include in all manufacturers' packing label warnings and instruction manuals that include labeling conditions.

1.5 QUALITY ASSURANCE

A. Source Limitations: Obtain each type of wiring device and associated wall plate through one source from a single manufacturer. Insofar as they are available, obtain all wiring devices and associated wall plates from a single manufacturer and one source.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NFPA 70.

D. Comply with the latest edition of Facility Guidelines Institute (FGI) Design Guide for the Built Environment of Behavioral Health Facilities.

E. Comply with the latest edition of the New York State Office of Mental Health Patient Safety Standards, Materials and Systems Guidelines. Devices for installation in high or medium risk areas as illustrated on Drawing G110.2 must be shown as accepted in the latest edition of this Guideline.

1.6 COORDINATION

A. Receptacles for Owner-Furnished Equipment: Match plug configurations.

1. Cord and plug sets: Match equipment requirements.

1.7 CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For wiring devices to include in all manufactures’ packaging-label warnings and instruction manuals that include labeling conditions.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers' Names: Shortened versions (shown in parentheses) of the following manufacturers' names are used in other Part 2 articles:

1. Cooper Wiring Devices; a division of Cooper Industries, Inc. (Cooper).
2. Hubbell Incorporated; Wiring Device-Kellems (Hubbell).
3. Leviton Mfg. Company Inc. (Leviton).
4. Pass & Seymour/Legrand; Wiring Devices & Accessories (Pass & Seymour).

B. Source Limitations: Obtain each type of wiring device and associated wall plate from single source from a single manufacturer.

2.2 STRAIGHT BLADE RECEPTACLES

A. Convenience Receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement and FS W-C-596

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper 5351; (single), CR5362(duplex).
b. Hubbell HBL5351; (single), HBL5352 (duplex).
c. Leviton 5891; (single), 5352 (duplex).
d. Pass & Seymour 5361; (single), 5362 (duplex).

2.3 SAFETY TYPE (TAMPER-RESISTANT) RECEPTACLES

A. Tamper-Resistant Convenience receptacles, 125 V, 20 A: Comply with NEMA WD 1, NEMA WD 6 configuration 5-20R, and UL 498 Supplement sd, and FS W-C-596.

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper TR370 (duplex).
b. Hubbell BR20_TR (duplex).
c. Leviton T5850 (duplex).
d. Pass & Seymour TR20W (duplex).

2.4 GFCI RECEPTACLES

A. General Description: Straight blade, non-feed-through type. Comply with NEMA WD 1, NEMA WD 6, UL 498, and UL 943, Class A, and include indicator light that is lighted when device is tripped.

B. Hospital-Grade, Tamper Resistant, Duplex GFCI Convenience Receptacles, 125 V, 20 A: Comply with UL 498 Supplement SD.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper TRVGFH20.
    b. Hubbell GFR8300SG.
    c. Leviton 7590
    d. Pass & Seymour 2095HGTR.

2.5 STRAIGHT-BLADE USB RECEPTACLES

A. Convenience Duplex Receptacle, 125-volt, 20 amp, Tamper Resistant, Two (2) USB Type 2.0 ports, 3 amp, 5 volt DC. Comply with NEMA WD1, NEMA WD6 Configuration, 5-20R and UL 498 Supplement SD.

1. Products: Subject to compliance with requirements, provide one of the following:

    a. Cooper TR7756.
    b. Hubbell USB20X.
    c. Leviton T5832
    d. Pass & Seymour TR5362USB.

2.6 SPECIAL RECEPTACLES

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper.
2. Hubbell.
3. Leviton.
4. Pass and Seymour.

B. Heavy Duty, Specification Grade, Twist Lock, 250V, 30A, 3 Phase: Comply with NEMA WD1, NEMA WD6, Configuration L15-30. Shall be equal to Hubbell HBL2720.

C. Heavy Duty, Specification Grade, Twist Lock, 480V, 30A, 3 Phase: Comply with NEMA Configuration L16-30. Shall be equal to Hubbell HBL2730.

D. Refer to drawings for other NEMA configurations.

2.7 PENDANT CORD-CONNECTOR DEVICES

A. Description: Matching, locking-type plug and receptacle body connector; NEMA WD 6 configurations L5-20P and L5-20R, heavy-duty grade.

1. Body: Nylon with screw-open cable-gripping jaws and provision for attaching external cable grip.
2. External cable grip: Woven wire-mesh type made of high-strength galvanized-steel wire strand, matched to cable diameter, and with attachment provision designed for corresponding connector.

2.8 CORD AND PLUG SETS

A. Description: Match voltage and current ratings and number of conductors to requirements of equipment being connected.

1. Cord: Rubber-insulated, stranded-copper conductors, with Type SOW-A jacket; with green-insulated grounding conductor and equipment-rating ampacity plus a minimum of 30 percent.
2. Plug: Nylon body and integral cable-clamping jaws. Match cord and receptacle type for connection.

2.9 SNAP SWITCHES

A. Comply with NEMA WD 1 and UL 20.

B. Switches, 120/277 V, 20 A:

1. Products: Subject to compliance with requirements, provide one of the following:

a. Cooper AH1221 (single pole), AH1222 (two pole), AH1223 (three way), AH1224 (four way).
b. Hubbell; HBL1221 (single pole), HBL1222 (two pole), HBL1223 (three way), HBL1224 (four way).
c. Leviton; 1221-2 (single pole), 1222-2 (two pole), 1223-2 (three way), 1224-2 (four way).
d. Pass & Seymour; PS20AC1 (single pole), PS20AC2 (two pole), PS20AC3 (three way), 20AC4 (four way).

2.10 LIGHTING CONTROL DEVICES

A. Refer to Division 26 Section “Lighting Control Devices” for requirements related to occupancy sensors, daylight sensors and wall box dimmers.

2.11 WALL PLATES

A. Single and combination types to match corresponding wiring devices.
1. Plate-Securing Screws: Metal with head color to match plate finish.
2. Material for Finished Spaces (Non-Inmate Areas): Smooth, high-impact thermoplastic.
3. Material for Finished Spaces (Inmate Areas): 14-guage steel tamperproof cover. Kenall, Fail-Safe, New Star or equal.
4. Material for Damp Locations: Cast aluminum with spring-loaded lift cover, and listed and labeled for use in wet and damp locations.

B. Wet-Location, Weatherproof Cover Plate: NEMA 250, complying with Type 3R, Weather-resistant, die-cast aluminum with lockable cover.

1. Communications: One 1-1/4-inch conduit.

2.12 FINISHES

A. Color: Wiring device catalog numbers in Section Text do not designate device color.

1. Wiring devices connected to normal power system: White, unless otherwise indicated or required by NFPA 70 or device listing.
2. Wiring devices connected to emergency power system: Red.
3. TVSS Devices: Blue

B. Wall Plate Color: For plastic covers, match device color.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with NECA 1, including the mounting heights listed in that standard, unless otherwise noted.

1. Receptacles: 18 inches A.F.F. to center unless noted otherwise.
2. Switches/dimmer/wall occupancy sensor: 46 inches A.F.F. to center unless noted otherwise.

B. Coordination with Other Trades:

1. Take steps to insure that devices and their boxes are protected. Do not place wall finish materials over device boxes and do not cut holes for boxes with routers that are guided by riding against outside of the boxes.
2. Keep outlet boxes free of plaster, drywall joint compound, mortar, cement, concrete, dust, paint, and other material that may contaminate the raceway system, conductors, and cables.
3. Install device boxes in brick or block walls so that the cover plate does not cross a joint unless the joint is troweled flush with the face of the wall.
4. Install wiring devices after all wall preparation, including painting, is complete.

C. Conductors:

1. Do not strip insulation from conductors until just before they are spliced or terminated on devices.
2. Strip insulation evenly around the conductor using tools designed for the purpose. Avoid scoring or nicking of solid wire or cutting strands from stranded wire.
3. The length of free conductors at outlets for devices shall meet provisions of NFPA 70, Article 300, without pigtails.

D. Device Installation:

1. Replace all devices that have been in temporary use during construction or that show signs that they were installed before building finishing operations were complete.
2. Keep each wiring device in its package or otherwise protected until it is time to connect conductors.

3. Do not remove surface protection, such as plastic film and smudge covers, until the last possible moment.
4. Connect devices to branch circuits using pigtails that are not less than 6 inches (152 mm) in length.
5. When there is a choice, use side wiring with binding-head screw terminals. Wrap solid conductor tightly clockwise, 2/3 to 3/4 of the way around terminal screw.
6. Use a torque screwdriver when a torque is recommended or required by the manufacturer.
7. When conductors larger than No. 12 AWG are installed on 15- or 20-A circuits, splice No. 12 AWG pigtails for device connections.
8. Tighten unused terminal screws on the device.
9. When mounting into metal boxes, remove the fiber or plastic washers used to hold device mounting screws in yokes, allowing metal-to-metal contact.

E. Wall Plates: Do not use oversized or extra-deep plates. Repair wall finishes and remount outlet boxes when standard device plates do not fit flush or do not cover rough wall opening.

F. Arrangement of Devices: Unless otherwise indicated, mount flush, with long dimension vertical and with grounding terminal of receptacles on top. Group adjacent switches under single, multi-gang wall plates.

G. Adjust locations of floor boxes and poke through assemblies to suit arrangement of partitions and furnishings.

3.2 IDENTIFICATION

A. Comply with Division 26 Section "Identification for Electrical Systems."

1. Receptacle and switch cover plates: Identify panelboard and circuit number from which served with a clear label with black lettering.

3.3 FIELD QUALITY CONTROL

A. Perform tests and inspections and prepare test reports.

1. In healthcare facilities, prepare reports that comply with recommendations in NFPA 99.
2. Test instruments: Use instruments that comply with UL 1436.
3. Test instrument for convenience receptacles: Digital wiring analyzer with digital readout or illuminated LED indicators of measurement.

B. Tests for Convenience Receptacles:

1. Line voltage: Acceptable range is 105 to 132 V.
2. Percent voltage drop under 15 amp load: A value of 6 percent or higher is not acceptable.
3. Ground impedance: Values of up to 2 ohms are acceptable.
4. GFCI trip: Test for tripping values specified in UL 1436 and UL 943.
5. Using the test plug, verify that the device and its outlet box are securely mounted.
6. The tests shall be diagnostic, indicating damaged conductors, high resistance at the circuit breaker, poor connections, inadequate fault current path, defective devices, or similar

problems. Correct circuit conditions, remove malfunctioning units and replace with new ones, and retest as specified above.

C. Test straight blade hospital-grade convenience outlets for the retention force of the grounding blade according to NFPA 99. Retention force shall be not less than 4 oz. (115 g).

END OF SECTION 26 27 26

SECTION 26 28 13 - FUSES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Cartridge fuses rated 600 V and less for use in switches.

1.3 SUBMITTALS

A. Product Data: Include the following for each fuse type indicated:

1. Dimensions and manufacturer's technical data on features, performance, electrical characteristics and ratings.
2. Let-through current curves for fuses with current-limiting characteristics.
3. Time-current curves, coordination charts and tables, and related data.
4. Fuse size for elevator feeders and elevator disconnect switches.

B. Operation and Maintenance Data: For fuses to include in emergency, operation, and maintenance manuals.

1. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

a. Let-through current curves for fuses with current-limiting characteristics.
b. Time-current curves, coordination charts and tables, and related data.
c. Ambient temperature adjustment information.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain fuses from a single manufacturer.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with NEMA FU 1.

D. Comply with NFPA 70.

1.5 PROJECT CONDITIONS

A. Where ambient temperature to which fuses are directly exposed is less than 40 deg F (5 deg C) or more than 100 deg F (38 deg C), apply manufacturer's ambient temperature adjustment factors to fuse ratings.

1.6 COORDINATION

A. Coordinate fuse ratings with utilization equipment nameplate limitations of maximum fuse size.

1.7 EXTRA MATERIALS

A. Furnish extra materials described below that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Fuses: Quantity equal to three of each type and size.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Cooper Bussman, Inc.
2. Ferraz Shawmut, Inc.
3. Tracor, Inc.; Littelfuse, Inc. Subsidiary.

2.2 CARTRIDGE FUSES

A. Characteristics: NEMA FU 1, nonrenewable cartridge fuse; class and current rating indicated; voltage rating consistent with circuit voltage.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine utilization equipment nameplates and installation instructions. Install fuses of sizes and with characteristics appropriate for each piece of equipment.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 FUSE APPLICATIONS

A. Feeders: Class RK1, time delay.

B. Motor Branch Circuits: Class RK1, time delay.

3.3 INSTALLATION

A. Install fuses in fusible devices. Arrange fuses so rating information is readable without removing fuse.

3.4 IDENTIFICATION

A. Install labels indicating fuse replacement information on inside door of each fused switch.

END OF SECTION 26 28 13

SECTION 26 28 16 - ENCLOSED SWITCHES AND CIRCUIT BREAKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following individually mounted, enclosed switches.

1.3 DEFINITIONS

A. GFCI: Ground-fault circuit interrupter.

B. HD: Heavy duty.

C. RMS: Root mean square.

D. SPDT: Single pole, double throw.

1.4 SUBMITTALS

A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.

1. Enclosure types and details for types other than NEMA 250, Type 1.
2. Current and voltage ratings.
3. Short-circuit current rating.
4. Features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.

B. Shop Drawings: Diagram power, signal, and control wiring.

C. Field quality-control test reports including the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

D. Manufacturer's field service report.

E. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 1 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting enclosed switches.
2. Time-current curves.

1.5 QUALITY ASSURANCE

A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Comply with NFPA 70.

C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.

1.6 COORDINATION

A. Coordinate layout and installation of switches, circuit breakers, and components with other construction, including conduit, piping, equipment, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In other Part 2 articles where titles below introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 FUSIBLE AND NONFUSIBLE SWITCHES

A. Manufacturers:

1. Eaton.
2. General Electric Company.
3. Siemens Energy & Automation, Inc.
4. Square D/Group Schneider.

B. Fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, with clips or bolt pads to accommodate specified fuses, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

C. Non-fusible Switch, 600 A and Smaller: NEMA KS 1, Type HD, lockable handle with capability to accept two padlocks, and interlocked with cover in closed position.

D. Accessories:

1. Equipment ground kit: Internally mounted and labeled for copper and aluminum ground conductors.
2. Neutral kit: Internally mounted; insulated, capable of being grounded, and bonded; and labeled for copper and aluminum neutral conductors.
3. Auxiliary contact kit: Auxiliary set of contacts arranged to open before switch blades open.

2.3 ENCLOSURES

A. NEMA AB 1 and NEMA KS 1 to meet environmental conditions of installed location.

1. Outdoor locations: NEMA 250, Type 3R.
2. Other wet or dry indoor locations: NEMA 250, Type 4.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. Comply with applicable portions of NECA 1, NEMA PB 1.1, and NEMA PB 2.1 for installation of enclosed switches and circuit breakers.

B. Mount individual wall-mounting switches and circuit breakers with tops at uniform height, unless otherwise indicated. Anchor floor-mounting switches to concrete base.

C. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.

D. Variable Frequency Controller Interface: Where an enclosed switch is used in conjunction with a variable frequency controller, route VFC control wiring through auxiliary contact for stopping VFC prior to opening disconnect switch.

3.3 IDENTIFICATION

A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs as specified in Division 26 Section "Identification for Electrical Systems."

B. Enclosure Nameplates: Label each enclosure with engraved metal or laminated-plastic nameplate as specified in Division 26 Section "Identification for Electrical Systems." Shall include the following information:

1. Designation.
2. Equipment served.
3. Voltage, phase, wire.
4. Feeder size.
5. Fed from circuit number.

C. Arc Flash Labels: Comply with Division 26 Section "Electrical System Fault Analysis, Coordination and Arc Flash Study" for requirements related to arc flash labeling.

3.4 FIELD QUALITY CONTROL

A. Prepare for acceptance testing as follows:

1. Inspect mechanical and electrical connections.
2. Verify switch and relay type and labeling verification.
3. Verify rating of installed fuses.
4. Inspect proper installation of type, size, quantity, and arrangement of mounting or anchorage devices complying with manufacturer's certification.

B. Perform the following field tests and inspections and prepare test reports:

1. Test mounting and anchorage devices according to requirements in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
2. Perform each electrical test and visual and mechanical inspection. Certify compliance with test parameters.
3. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

3.5 CLEANING

A. On completion of installation, vacuum dirt and debris from interiors; do not use compressed air to assist in cleaning.

B. Inspect exposed surfaces and repair damaged finishes.

END OF SECTION 26 28 16

SECTION 26 51 00 - INTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Interior lighting fixtures, LED modules and drivers.
2. Exit signs.
3. Emergency power control devices.
4. Lighting fixture supports.

B. Related Sections include the following:

1. Division 26 Sections "Lighting Control Devices" for the automatic control of lighting.

1.3 DEFINITIONS

A. CRI: Color-rendering index.

B. LER: Luminaire efficacy rating.

C. Luminaire: Complete lighting fixture, including ballast housing if provided.

D. EPC: Emergency Power Control device.

E. Tunable White: Technology enabling the control of white light between CCT of 2700 Kelvin to 6500 Kelvin intended to mimic natural daylight.

1.4 SUBMITTALS

A. Product Data: For each type of lighting fixture arranged in order of fixture designation. Include data on features, accessories, finishes, and the following:

1. Physical description of all products listed above including dimensions.
2. LED information.
3. Driver information, including catalog numbers, power consumption, etc.
4. Life, output, and energy-efficiency data.
5. Photometric data, in .IES format, based on laboratory tests of each lighting fixture type, outfitted with LED modules, drivers and accessories identical to those indicated for the

lighting fixture as applied in this Project. The IES files shall be for the exact fixture and configuration for this project.

B. Shop Drawings: Show wiring diagrams for generator transfer devices.

C. Field quality-control test reports.

D. Operation and Maintenance Data: For lighting equipment and fixtures to include in emergency, operation, and maintenance manuals.

E. Warranties: Special warranties specified in this Section.

1.5 QUALITY ASSURANCE

A. Defined by OSHA in 29 CFR 1910.7.

B. Electrical Components, Devices, and Accessories: All equipment shall be UL listed and labeled as defined in NFPA 70, Article 100 and marked for intended use.

C. Comply with NFPA 70.

D. LED Lighting: Shall comply with the requirements of IESNA LM-79 and LM-80.

E. Emergency Power Control devices and exit lights shall be UL 924.

1.6 COORDINATION

A. Coordinate layout and installation of lighting fixtures and suspension system with other construction that penetrates ceilings or is supported by them, including HVAC equipment, fire-suppression system, and partition assemblies.

B. Coordinate ceiling type with reflected ceiling plan and provide appropriate mounting frame for specified light fixture. Light fixture model/series on fixture schedule on drawing does not specify type of trim.

1.7 WARRANTY

A. Warranty for Drivers: Manufacturer's standard form in which driver manufacturer agrees to repair or replace drivers that fail in materials or workmanship within specified warranty period.

1. Warranty period for Led drivers: Five years from date of Project Substantial Completion.

B. Warranty for LED Products: Manufacturer’s standard form in which manufacturer agrees to repair or replace LED products that fail in materials or workmanship within specified warranty period.

1. LED products: Shall apply to the entire LED product including, but not limited to, LED, LED modules, drivers, housing, lens, paint, etc. Replace items that fail and/or the light

output has decreased below the L70 values within five years from date of Project Substantial Completion.

C. Warranty for Emergency Power Control Devices: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship within specified warranty period.

1. Five (5) years from date of project Substantial Completion.

1.8 EXTRA MATERIALS

A. Exit Signs: The Electrical Contractor shall include as part of their scope of work to furnish and install additional exit signs above and beyond the number of devices shown on the plans at locations yet to be determined. This shall include the complete installation (conduit, boxes, wiring, labor, etc.). The locations shall be dictated during construction by the A/E, Owner and/or authority having jurisdiction. The quantity of additional exit signs shall be five (5) and the estimated length of conduit and wire required per location to connect to an adjacent exit sign circuit shall be fifty feet.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Interior Lighting Fixture Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

B. LED Chips:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Cree
b. Nichia.
c. Samsung.
d. Sylvania.

C. Drivers:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Eldo LED.
b. Lutron.
c. Osram.
d. Phillips.
e. Sylvania.

f. Universal.

D. Emergency Power Control Device:

1. Eaton Lighting
2. Hubbell Lighting.
3. LVS, Inc.

2.2 LIGHTING FIXTURES AND COMPONENTS, GENERAL REQUIREMENTS

A. All fixtures shall be “Paint after Fabrication” (PAF).

B. Recessed Fixtures: Comply with NEMA LE 4 for ceiling compatibility for recessed fixtures.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Fabricate lay-in fixtures of not less than #22 USG steel with 20 gage end plates, assembled with spot welds or concealed screw fasteners. All fixtures shall have no visible light leaks between the diffuser and the fixture housing.

E. Diffuser door frames shall be .050" extruded aluminum with mitered corners. Door frames shall be hinged by means of zinc plated "Tee" type hinges. The latching mechanism shall be visible and positive cam type. The door shall be gasketed to prevent dust accumulation. Door shall be the 1/2" deep regressed style.

F. Final Painted Enamel Finish: Similar and equal to Dupont "white" have a minimum reflection factor of 85 percent. Final finish shall cover all metal portions and be uniform in color, coverage, and gloss. Flat test samples shall withstand 300 hours of salt spray in accordance with ASTM B117-491.

G. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position.

H. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White surfaces: 85 percent.
2. Specular surfaces: 83 percent.
3. Diffusing specular surfaces: 75 percent.
4. Laminated silver metallized film: 90 percent.

I. Plastic Diffusers, Covers, and Globes:

1. Acrylic lighting diffusers: 100 percent virgin acrylic plastic. High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

a. Lens thickness: At least 0.125 inch minimum unless different thickness is indicated.
b. UV stabilized.

2.3 EXIT SIGNS

A. Description: Comply with UL 924; for sign colors, visibility, luminance, and lettering size, comply with authorities having jurisdiction.

B. Internally Lighted Signs:

1. Lamps for AC operation: LEDs, 70,000 hours minimum rated lamp life.

2.4 LED ASSEMBLY

A. LED luminaire manufacturer shall perform and provide documentation of a certified photometric report per IESNA LM-79. Shall be performed by an approved DOE Lab.

B. Provide IESNA LM-80 test data for each LED luminaire.

C. Minimum allowable CRI shall be 82.

D. Color temperature shall be as per light fixture schedule on drawings.
1. A sample of each color temperature shall be provided to the owner for owner's decision on interior lighting color temperature.

E. Tunable white temperature range: 2700K – 6500K.

F. Rated life shall be minimum 60,000 hours at L70. Provide documentation.

G. Drivers: 0-10V dimming compatible with LED chip/module. Provide full range dimming down to 5 percent. Five percent shall be measured foot candle readings from full output readings.

2.5 EMERGENCY POWER CONTROL DEVICES

A. Operation: The EPC allows emergency lights to be switched or dimmed using the same controls as the normal (general) lighting in the same area. Upon loss of power, the EPC's will switch the emergency lights on at full brightness, regardless of switch or dimmer position, until normal power is restored.

B. The EPC shall be listed as a UL924 device.

C. Ratings:

1. Voltage: 120 or 277V Sensing Input, 60 Hz.
2. Temperature: 32 deg. F to 140 deg. F.
3. Load/capacity: 20Amps

D. The EPC shall include emergency power and regular power indicator LED's and a manual test switch which are visible to room occupants when installed flush.

2.6 LIGHTING FIXTURE SUPPORT COMPONENTS

A. Comply with Division 26 Section "Hangers and Supports for Electrical Systems" for channel- and angle-iron supports and nonmetallic channel and angle supports.

B. Single-Stem Hangers: 1/2-inch steel tubing with swivel ball fittings and ceiling canopy. Finish same as fixture.

C. Twin-Stem Hangers: Two, 1/2-inch steel tubes with single canopy designed to mount a single fixture. Finish same as fixture.

D. Wires: ASTM A 641/A 641M, Class 3, soft temper, zinc-coated steel, 12 gage.

E. Wires for Humid Spaces: ASTM A 580/A 580M, Composition 302 or 304, annealed stainless steel, 12 gage.

F. Rod Hangers: 3/16-inch minimum diameter, cadmium-plated, threaded steel rod.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting Fixtures: Set level, plumb, and square with ceilings and walls. Install light fixtures flush with substrate.

B. Support for Lighting Fixtures in or on Grid-Type Suspended Ceilings: Use grid as a support element.

1. Install a minimum of two ceiling support system rods or wires for each fixture. Locate not more than 6 inches from lighting fixture corners.
2. Support clips: Fasten to lighting fixtures and to ceiling grid members at or near each fixture corner with clips that are UL listed for the application. The use of a bend out tab on the fixtures is not an acceptable clip. Clip shall be mechanically fastened to the fixture.
3. Fixtures of sizes less than ceiling grid: Install as indicated on reflected ceiling plans or center in acoustical panel, and support fixtures independently with at least two 3/4-inch metal channels spanning and secured to ceiling tees. Install at least one independent support rod or wire from structure to a tab on lighting fixture. Wire or rod shall have breaking strength of the weight of fixture at a safety factor of 3.

C. Suspended Lighting Fixture Support:

1. Pendants and rods: Where longer than 48 inches, brace to limit swinging.
2. Stem-mounted, single unit fixtures: Suspend with twin-stem hangers.
3. Continuous rows: Use tubing or stem for wiring at one point and tubing or rod for suspension for each unit length of fixture chassis, including one at each end.

D. Adjust aimable lighting fixtures to provide required light intensities.

E. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

F. Generator Transfer Devices:

1. GTD serving individual fixture: Factory installed and mounted within the fixture. Shall be accessible from below the ceiling. If this is not possible, field install in an appropriately sized enclosure and mount above ceiling immediately adjacent to the fixture. Maintain clearance as required for maintenance.
2. GTD serving multiple fixtures: Field install in an appropriately sized enclosure and locate as per drawings on each floor. Maintain clearance as required for maintenance.
3. Clearly and accurately mark locations of all GTD's on as-built drawings.
4. Provide normal, emergency and sensing circuit wiring per manufacturer's wiring diagrams.

G. Emergency Power Control:

1. EPC shall be mounted in a double gang box with an extension and a single gang plaster ring.
2. (1) EPC is required per switchleg/zone with emergency lighting and shall be located in the electrical room above the door.

3.2 FIELD QUALITY CONTROL

A. Test for Emergency Lighting: Interrupt power supply to demonstrate proper operation. Verify transfer from normal power to generator power and retransfer to normal.

B. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 51 00

SECTION 26 56 00 - EXTERIOR LIGHTING

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes the following:

1. Exterior luminaires with lamps and ballasts.
2. Poles and accessories.

1.3 DEFINITIONS

A. CRI: Color-rendering index.

B. Luminaire: Complete lighting fixture, including ballast housing if provided.

C. Pole: Luminaire support structure, including tower used for large area illumination.

D. Standard: Same definition as "Pole" above.

1.4 STRUCTURAL ANALYSIS CRITERIA FOR POLE SELECTION

A. Dead Load: Weight of luminaire and its horizontal and vertical supports and supporting structure, applied as stated in AASHTO LTS-4.

B. Wind Load: Pressure of wind on pole and luminaire, calculated and applied as stated in AASHTO LTS-4.

1. Wind speed for calculating wind load for poles is 100 mph.

1.5 SUBMITTALS

A. Product Data: For each luminaire, pole, and support component, arranged in order of lighting unit designation. Include data on features, accessories, finishes, and the following:

1. Physical description of luminaire, including materials, dimensions, effective projected area, and verification of indicated parameters.
2. Details of attaching luminaires and accessories.
3. Details of installation and construction.

4. Luminaire materials.
5. Energy efficiency data for luminate.
6. Lamps, including life, output, and energy-efficiency data.
7. Materials, dimensions, and finishes of poles.
8. Means of attaching luminaires to supports, and indication that attachment is suitable for components involved.
9. Anchor bolts for poles.

B. Shop Drawings:

1. Anchor-bolt templates keyed to specific poles and certified by manufacturer.
2. Wiring diagrams: Power and control wiring.

C. Pole and Support Component Certificates: Signed by manufacturers of poles, certifying that products are designed for indicated load requirements in AASHTO LTS-4 and that load imposed by luminaire has been included in design.

D. Qualification Data: For agencies providing photometric data for lighting fixtures.

E. Field quality-control test reports.

F. Operation and Maintenance Data: For luminaires and poles to include in emergency, operation, and maintenance manuals.

G. Warranty: Special warranty specified in this Section.

1.6 QUALITY ASSURANCE

A. Luminaire Photometric Data Testing Laboratory Qualifications: Provided by manufacturers' laboratories that are accredited under the National Volunteer Laboratory Accreditation Program for Energy Efficient Lighting Products.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

C. Comply with IEEE C2, "National Electrical Safety Code."

D. Comply with NFPA 70.

E. LED Lighting: Shall comply with or meet the requirements of IESNA LM-79 and LM-80.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Package aluminum poles for shipping according to ASTM B 660.

B. Store poles on decay-resistant-treated skids at least 12 inches (300 mm) above grade and vegetation. Support poles to prevent distortion and arrange to provide free air circulation.

C. Retain factory-applied pole wrappings on metal poles until right before pole installation. For poles with nonmetallic finishes, handle with web fabric straps.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace products that fail in materials or workmanship; that corrode; or that fade, stain, perforate, erode, or chalk due to effects of weather or solar radiation within specified warranty period. Manufacturer may exclude lightning damage, hail damage, vandalism, abuse, or unauthorized repairs or alterations from special warranty coverage.

1. Warranty period for luminaires: Five (5) years from date of Substantial Completion.
2. Warranty period for metal corrosion: Five (5) years from date of Substantial Completion.
3. Warranty period for color retention: Five (5) years from date of Substantial Completion.
4. Warranty period for poles: Repair or replace lighting poles and standards that fail in finish, materials, and workmanship within five years from date of Substantial Completion.

B. Warranty for LED Products: Manufacturer’s standard form in which manufacturer agrees to repair or replace LED products that fail in materials or workmanship within specified period.

1. LED products: This shall apply to the entire LED product including, but not limited to, LED, LED modules, drivers, housing, lens, paint, etc. Replace items that fail and/or light output has decreased below the L70 values within five years from date of Substantial Completion.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. In Exterior Lighting Device Schedule where titles below are column or row headings that introduce lists, the following requirements apply to product selection:

1. Manufacturers: Subject to compliance with requirements, provide products by one of the manufacturers specified.

2.2 LUMINAIRES, GENERAL REQUIREMENTS

A. Luminaires shall comply with UL 1598 and be listed and labeled for installation in wet locations by an NRTL acceptable to authorities having jurisdiction.

B. Comply with IESNA RP-8 for parameters of lateral light distribution patterns indicated for luminaires.

C. Metal Parts: Free of burrs and sharp corners and edges.

D. Sheet Metal Components: Corrosion-resistant aluminum, unless otherwise indicated. Form and support to prevent warping and sagging.

E. Housings: Rigidly formed, weather- and light-tight enclosures that will not warp, sag, or deform in use. Provide filter/breather for enclosed luminaires.

F. Doors, Frames, and Other Internal Access: Smooth operating, free of light leakage under operating conditions, and designed to permit re-lamping without use of tools. Designed to prevent doors, frames, lenses, diffusers, and other components from falling accidentally during re-lamping and when secured in operating position. Doors shall be removable for cleaning or replacing lenses. Designed to disconnect ballast when door opens.

G. Exposed Hardware Material: Stainless steel.

H. Plastic Parts: High resistance to yellowing and other changes due to aging, exposure to heat, and UV radiation.

I. Light Shields: Metal baffles, factory installed and field adjustable, arranged to block light distribution to indicated portion of normally illuminated area or field.

J. Reflecting surfaces shall have minimum reflectance as follows, unless otherwise indicated:

1. White surfaces: 85 percent.
2. Specular surfaces: 83 percent.
3. Diffusing specular surfaces: 75 percent.

K. Lenses and Refractors Gaskets: Use heat- and aging-resistant resilient gaskets to seal and cushion lenses and refractors in luminaire doors.

L. Luminaire Finish: Manufacturer's standard paint applied to factory-assembled and -tested luminaire before shipping. Where indicated, match finish process and color of pole or support materials.

1. Surface preparation: Clean surfaces to comply with SSPC-SP 1, "Solvent Cleaning," to remove dirt, oil, grease, and other contaminants that could impair paint bond. Grind welds and polish surfaces to a smooth, even finish. Remove mill scale and rust, if present, from uncoated steel, complying with SSPC-SP 5/NACE No. 1, "White Metal Blast Cleaning" or SSPC-SP 8, "Pickling."
2. Exterior surfaces: Manufacturer's standard finish consisting of one or more coats of primer and two finish coats of high-gloss, high-build polyurethane enamel.

2.3 LED ASSEMBLY

A. LED luminaire manufacturer shall perform and provide documentation of a certified photometric report per IESNA LM-79. Shall be performed by an approved DOE Lab.

B. Provide IESNA LM-80 test data for each LED luminaire.

C. Minimum allowable CRI shall be 80.

D. Color temperature shall be as per fixture schedule on drawings.

E. Rated life shall be minimum 60,000 hours at L70. Provide documentation.

2.4 POLES AND SUPPORT COMPONENTS, GENERAL REQUIREMENTS

A. Wind-Load Strength of Poles: Adequate at indicated heights above grade without failure, permanent deflection, or whipping in steady winds of speed indicated in Part 1 "Structural Analysis Criteria for Pole Selection" Article, with a gust factor of 1.3.

B. Strength Analysis: For each pole, multiply the actual equivalent projected area of luminaires and brackets by a factor of 1.1 to obtain the equivalent projected area to be used in pole selection strength analysis.

C. Luminaire Attachment Provisions: Comply with luminaire manufacturers' mounting requirements. Use stainless-steel fasteners and mounting bolts, unless otherwise indicated.

D. Mountings, Fasteners, and Appurtenances: Corrosion-resistant items compatible with support components.

1. Materials: Shall not cause galvanic action at contact points.
2. Anchor bolts, leveling nuts, bolt caps and washers: Hot-dip galvanized after fabrication, unless stainless-steel items are indicated.
3. Anchor-bolt template: Plywood or steel.

E. Concrete Pole Foundations: Cast in place, with anchor bolts to match pole-base flange. Concrete, reinforcement, and formwork are specified in Division 3 Section "Cast-in-Place Concrete."

F. Breakaway Supports: Frangible breakaway supports, tested by an independent testing agency acceptable to authorities having jurisdiction, according to AASHTO LTS-4.

2.5 ALUMINUM POLES

A. Poles: Seamless, extruded structural tube complying with ASTM B 429, Alloy 6063-T6 with access handhole in pole wall.

B. Poles: ASTM B 209 (ASTM B 209M), 5052-H34 marine sheet alloy with access handhole in pole wall.

1. Mounting provisions: Butt flange for bolted mounting on foundation or breakaway support.

C. Pole-Top Tenons: Fabricated to support luminaire or luminaires and brackets indicated, and securely fastened to pole top.

D. Grounding and Bonding Lugs: Welded 1/2-inch (13-mm) threaded lug, complying with requirements in Division 26 Section "Grounding and Bonding for Electrical Systems," listed for attaching grounding and bonding conductors of type and size listed in that Section, and accessible through handhole.

E. Brackets for Luminaires: Detachable, with pole and adapter fittings of cast aluminum. Adapter fitting welded to pole and bracket, then bolted together with stainless-steel bolts.

1. Tapered oval cross section, with straight tubular end section to accommodate luminaire.

2. Finish: Same as luminaire.

F. Prime-Coat Finish: Manufacturer's standard prime-coat finish ready for field painting.

2.6 POLE ACCESSORIES

A. Duplex Receptacle: 120 V, 20 A in a weatherproof assembly complying with Division 26 Section "Wiring Devices" for ground-fault circuit-interrupter type.

1. Recessed, 12 inches above finished grade.
2. Nonmetallic polycarbonate plastic or reinforced fiberglass cover, that when mounted results in NEMA 250, Type 3R enclosure.
3. With cord opening.
4. With lockable hasp and latch that complies with OSHA lockout and tag-out requirements.

B. Base Covers: Manufacturers' standard metal units, arranged to cover pole's mounting bolts and nuts. Finish same as pole.

PART 3 - EXECUTION

3.1 LUMINAIRE INSTALLATION

A. Install lamps in each luminaire.

B. Fasten luminaire to indicated structural supports.

1. Use fastening methods and materials selected to resist seismic forces defined for the application and approved by manufacturer.

C. Adjust luminaires that require field adjustment or aiming. Include adjustment of photoelectric device to prevent false operation of relay by artificial light sources.

3.2 POLE INSTALLATION

A. Align pole foundations and poles for optimum directional alignment of luminaires and their mounting provisions on the pole.

B. Clearances: Maintain the following horizontal distances of poles from surface and underground features unless otherwise indicated on drawings.

1. Fire hydrants and storm drainage piping: 60 inches (1520 m).
2. Water, gas, electric, communication and sewer lines: 10 feet (3m).

C. Concrete Pole Foundations: Set anchor bolts according to anchor-bolt templates furnished by pole manufacturer. Concrete materials, installation, and finishing requirements are specified in Division 3 Section "Cast-in-Place Concrete."

D. Foundation-Mounted Poles: Mount pole with leveling nuts, and tighten top nuts to torque level recommended by pole manufacturer.

1. Use anchor bolts and nuts selected to resist seismic forces defined for the application and approved by manufacturer.
2. Grout void between pole base and foundation. Use non-shrink or expanding concrete grout firmly packed to fill space.
3. Install base covers, unless otherwise indicated.
4. Use a short piece of 1/2-inch- (13-mm-) diameter pipe to make a drain hole through grout. Arrange to drain condensation from interior of pole.

E. Poles and Pole Foundations Set in Concrete Paved Areas: Install poles with minimum of 6-inch- (150-mm-) wide, unpaved gap between the pole or pole foundation and the edge of adjacent concrete slab. Fill unpaved ring with pea gravel to a level 1 inch (25 mm) below top of concrete slab.

F. Raise and set poles using web fabric slings (not chain or cable).

G. Install vibration damper per manufacturer’s recommendation.

3.3 CORROSION PREVENTION

A. Aluminum: Do not use in contact with earth or concrete. When in direct contact with a dissimilar metal, protect aluminum by insulating fittings or treatment.

B. Steel Conduits: Comply with Division 26 Section "Raceway and Boxes for Electrical Systems." In concrete foundations, wrap conduit with 0.010-inch- (0.254-mm-) thick, pipe-wrapping plastic tape applied with a 50 percent overlap.

3.4 GROUNDING

A. Ground metal poles and support structures according to Division 26 Section "Grounding and Bonding for Electrical Systems."

1. Install grounding electrode for each pole, unless otherwise indicated.
2. Install grounding conductor pigtail in the base for connecting luminaire to grounding system.

3.5 FIELD QUALITY CONTROL

A. Inspect each installed fixture for damage. Replace damaged fixtures and components.

B. Illumination Observations: Verify normal operation of lighting units after installing luminaires and energizing circuits with normal power source.

1. Verify operation of photoelectric controls.

C. Prepare a written report of tests, inspections, observations, and verifications indicating and interpreting results. If adjustments are made to lighting system, retest to demonstrate compliance with standards.

END OF SECTION 26 56 00

SECTION 27 05 00 - COMMON WORK RESULTS FOR COMMUNICATIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Communications equipment coordination and installation.
2. Sleeves for pathways and cables.
3. Sleeve seals.
4. Grout.
5. Common communications installation requirements.

1.3 DEFINITIONS

A. EPDM: Ethylene-propylene-diene terpolymer rubber.

B. NBR: Acrylonitrile-butadiene rubber.

1.4 SUBMITTALS

A. Product Data: For sleeve seals.

1.5 COORDINATION

A. Coordinate arrangement, mounting, and support of communications equipment:

1. To allow maximum possible headroom unless specific mounting heights that reduce headroom are indicated.
2. To provide for ease of disconnecting the equipment with minimum interference to other installations.
3. To allow right of way for piping and conduit installed at required slope.
4. So connecting pathways, cables, wire-ways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.

B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

C. Coordinate location of access panels and doors for communications items that are behind finished surfaces or otherwise concealed. Access doors and panels are specified in Division 8 Section "Access Doors and Frames."

D. Coordinate sleeve selection and application with selection and application of firestopping specified in Division 7 Section "Firestopping."

PART 2 - PRODUCTS

2.1 SLEEVES FOR PATHWAYS AND CABLES

A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

B. Sleeves for Rectangular Openings: Galvanized sheet steel.

1. Minimum metal thickness:

a. For sleeve cross-section rectangle perimeter less than 50 inches (1270 mm) and no side more than 16 inches (400 mm), thickness shall be 0.052 inch (1.3 mm).
b. For sleeve cross-section rectangle perimeter equal to, or more than, 50 inches (1270 mm) and 1 or more sides equal to, or more than, 16 inches (400 mm), thickness shall be 0.138 inch (3.5 mm).

2.2 SLEEVE SEALS

A. Description: Modular sealing device, designed for field assembly, to fill annular space between sleeve and pathway or cable.

1. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

a. Advance Products & Systems, Inc.
b. Calpico, Inc.
c. Hilti.
d. Metraflex Co.
e. Pipeline Seal and Insulator, Inc.
f. Specified Technologies, Inc.

2. Sealing elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of pathway or cable.
3. Pressure plates: Carbon steel. Include two for each sealing element.
4. Connecting bolts and nuts: Carbon steel with corrosion-resistant coating of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.3 GROUT

A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, non-staining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.1 COMMON REQUIREMENTS FOR COMMUNICATIONS INSTALLATION

A. Comply with NECA 1.

B. Measure indicated mounting heights to bottom of unit for suspended items and to center of unit for wall-mounting items.

C. Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide maximum possible headroom consistent with these requirements.

D. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both communications equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.

E. Right of Way: Give to piping systems installed at a required slope.

3.2 SLEEVE INSTALLATION FOR COMMUNICATIONS PENETRATIONS

A. Communications penetrations occur when pathways, cables, wire-ways, or cable trays penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.

B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.

C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.

D. Fire-Rated Assemblies: Install sleeves for penetrations of fire-rated floor and wall assemblies unless openings compatible with firestop system used are fabricated during construction of floor or wall.

E. Cut sleeves to length for mounting flush with both surfaces of walls.

F. Extend sleeves installed in floors 3 inches above finished floor level.

G. Size pipe sleeves to provide 1/4-inch (6.4-mm) annular clear space between sleeve and pathway or cable, unless indicated otherwise.

H. Seal space outside of sleeves with grout for penetrations of concrete and masonry

1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.

I. Interior Penetrations of Non-Fire-Rated Walls and Floors: Seal annular space between sleeve and pathway or cable, using joint sealant appropriate for size, depth, and location of joint. Comply with requirements in Division 7 Section "Joint Sealants".

J. Fire-Rated-Assembly Penetrations: Maintain indicated fire rating of walls, partitions, ceilings, and floors at pathway and cable penetrations. Install sleeves and seal pathway and cable penetration sleeves with firestop materials. Comply with requirements in Division 7 Section "Firestopping."

K. Roof-Penetration Sleeves: Seal penetration of individual pathways and cables with flexible boot-type flashing units applied in coordination with roofing work.

L. Aboveground, Exterior-Wall Penetrations: Seal penetrations using steel pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch (25-mm) annular clear space between pipe and sleeve for installing mechanical sleeve seals.

M. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch (25-mm) annular clear space between pathway or cable and sleeve for installing mechanical sleeve seals.

3.3 SLEEVE-SEAL INSTALLATION

A. Install to seal exterior wall penetrations.

B. Use type and number of sealing elements recommended by manufacturer for pathway or cable material and size. Position pathway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between pathway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

3.4 FIRESTOPPING

A. Apply firestopping to penetrations of fire-rated floor and wall assemblies for communications installations to restore original fire-resistance rating of assembly. Firestopping materials and installation requirements are specified in Division 07 Section "Firestopping."

END OF SECTION 27 05 00

SECTION 27 05 26 GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide the labor, tools, equipment, and materials necessary to furnish and install telecommunications grounding system in accordance with the plans and as specified herein. Provide all accessories as necessary for a complete system.

B. Provide communications system-grounding conductor at point of service entrance and connect to Telecommunications Main Grounding Busbar (TMGB). Bond together the communications system grounding.

C. This section includes the following:
   1. Telecommunications Main Grounding Busbar (TMGB)
   2. Telecommunications Bonding Conductor (TBC)

1.2 SUBMITTALS

A. Refer to and follow Submittals Sections 26 00 15

B. Product data for TMBG.

C. Ground resistance testing results certified by the testing organization.

D. Schematic diagram of the telecommunications grounding system.

1.3 QUALITY ASSURANCE

A. All equipment shall be UL listed and labeled for their intended usage.

B. All equipment shall comply with the latest National Electric Code.

C. All equipment shall comply with the latest TIA/EIA-607, and BICSI standards.

PART 2 - PRODUCTS

2.1 TELECOMMUNICATIONS MAIN GROUNDING BUSBAR (TMGB)

A. Provide Telecommunications Main Grounding Busbars (TMGB) as indicated on the drawings.

B. The TMGB shall have minimum dimensions of ¼-inch thick x 4-inch wide and 12-inch in length with 18 attachment points (two rows of 9 each). The length may need to be adjusted longer to meet the application requirements with consideration of future growth. The busbar shall be UL Listed as grounding and bonding equipment.

C. The TMGB shall be a predrilled solid copper busbar provided with standard NEMA bolt hole sizing and spacing for the type of connectors to be used. The hole pattern for attaching grounding lugs shall meet the requirements of ANSI-J-STD – 607-A and shall accept 15 two-hole grounding lugs with 5/8" hole centers and 3 two-hole lugs with 1" hole centers. The busbar shall include wall-mount stand-off brackets, assembly screws and insulators creating a 4" standoff from the wall.

2.2 TELECOMMUNICATIONS BONDING CONDUCTOR (TBC)

A. Provide conductors used to bond components to the TMGB and the TGBs as follows:

1. Avoid unnecessary connections or splices in TBCs. When necessary, use an approved connection and position it in an accessible location.
2. Typical connections are made by using: bolts or crimps (connectors, clamps, or lugs). Where possible, use irreversible compression-type connections and two-hole lugs. Always use listed hardware that has been laboratory tested.

PART 3 - EXECUTION

3.1 INSTALLATION

A. As a minimum, Bond TMGB to following:

1. Building Steel (minimum #1/0 AWG insulated copper bonding conductor). Attach Bonding Conductors to Building Steel using listed exothermic welding process.
2. Main Electrical Service Ground (minimum #1/0 AWG insulated copper bonding conductor).
3. Local Service Panel Ground.
4. Telecommunications Bonding Backbone (TBB) that connects TMGB (minimum #1/0 AWG insulated copper bonding conductor).
5. Associated Telecommunications Cable Tray(s).
6. Telecommunications Conduit(s) Entering TR.

B. As a minimum, the Technology Contractor shall bond the following devices to the associated TMGB and TGBs using a minimum #6 AWG insulated copper bonding conductor using 2-hole compression style lugs:

1. PABX Equipment
2. Equipment Racks and Cabinets
3. TR Cable Ladder and Tray
4. CATV Equipment
5. Lightning and Surge Protectors
6. Telecommunications Devices

7. Coupled Bonding Conductors (CBCs)
8. Backbone Cable Shields
9. Telecommunication and Fiber Cable Shields
10. Antenna Cable Shields
11. Raised Floors

C. General:
1. Route ground conductors to provide the shortest, most direct path from point to point. Telecommunications ground must be bonded to the lightning protection system ground.
2. Bonding conductors should not be placed in ferrous metallic conduit. If it is necessary to place bonding conductors in ferrous metallic conduit that exceeds 3 feet in length, the conductors shall be bonded to each end of the conduit with a conductor sized as a #6 AWG, minimum (this makes the conduit a parallel path with the cable).
3. A continuous ground path shall be provided in all telecommunications raceways. Grounded cable trays shall be considered continuous ground path.
4. At each Telecommunication Room (TR) all equipment and raceways shall be bonded to the TGB.
5. Any grounding or bonding conductor that is run through a metallic conduit shall be bonded to the conduit.
6. Provide dedicated Telecommunications Bonding Backbone (TBB) to interconnect the TRs and related equipment.

D. Telecommunications Entrance Facility (TEF) Telecommunications Main Grounding Busbar (TMGB):
1. The Telecommunications Main Grounding Busbar (TMGB) serves as the dedicated extension of the building grounding electrode system for the telecommunications infrastructure. The TMGB also serves as the central attachment point for telecommunications bonding backbones (TBB) and equipment, and is located such that it is accessible to telecommunications personnel.
2. The TEF is the desirable location for the TMGB. This TMGB may serve as the TGB for collocated equipment in the TEF. The TMGB shall be bonded to electrical service equipment ground. This bond at the TMGB shall use a double bolted, compression style grounding lug. The bond at the electrical service equipment ground shall use an exothermically welded connection.
3. Where an electrical panelboard is located in the same room or space as the TMGB, the ground or enclosure of that electrical panelboard shall be bonded to the TMGB. Locate the TMGB as close to the electrical panelboard as practical to maintain clearances required by applicable electrical codes.
4. Locate the TMGB near the TBB cabling and associated terminations. The connections of the bonding conductors for telecommunications, and the TBBs to the TMGB shall utilize listed two-hole compression lugs.
5. Telecommunications primary protector grounding conductor shall be bonded to the TMGB. A minimum of 1 foot separation shall be maintained between this insulated conductor and any DC power cables, switchboard cables, or high frequency cables, even when placed in metal raceway.
6. All metallic raceways for telecommunications cabling located within Equipment Room (ER) shall be bonded to the TMGB. However for metallic raceways containing grounding conductors where the raceway is bonded to the ground conductor, no additional bonding to the TMGB is required.

7. In buildings where the backbone telecommunications cabling incorporates a shield or metallic member, this shield or metallic member shall be bonded to the TMGB where the cables are terminated or where pairs are broken out.

E. Telecommunications Room (TR) Telecommunications Grounding Busbar (TGB):
1. The TGB is the grounding connection point for telecommunications systems and equipment in the location served by that TR or ER. Each TR and ER shall contain a TGB. Multiple TGBs may be installed within the same TR or ER to aid in minimizing bonding conductor lengths and terminating space. In all cases, multiple TGBs within the same ER shall be bonded together with a conductor the same size as the TBB.
2. The TGB shall be located near the TBB cabling and associated terminations.
3. The bonding conductor between a TBB and TGB shall be continuous and routed in the shortest possible straight-line path. The bonding conductor shall be the same size as the TBB.
4. All metallic raceways for telecommunications cabling located within TR shall be bonded to the TGB. However for metallic raceways containing grounding conductors where the raceway is bonded to the ground conductor, no additional bonding to the TGB is required.
5. In buildings where the backbone telecommunications cabling incorporates a shield or metallic member, this shield or metallic member shall be bonded to the TGB where the cables are terminated or where pairs are broken out.

F. Telecommunications Bonding Backbone (TBB):
1. A TBB is a conductor that interconnects all TGBs with the TMGB. A TBB's basic function is to reduce or equalize potential differences between telecommunications systems bonded to it. A TBB is not intended to serve as the only conductor providing a ground fault current return path.
2. A TBB shall be designed with consideration given to the type of building construction, the telecommunications requirements, and the configuration of the telecommunications pathways and spaces. Specifically, the design of a TBB shall:
   a. Be consistent with the design of the telecommunications backbone cabling system.
   b. Address routing to minimize the lengths of the TBB.
3. All TBB Connections to be made with double-bolted, Compression style, Grounding Lugs.
4. TBB conductors shall be installed without splices. Where splices are required, they shall be kept to the minimum quantity necessary, shall be accessible and located in telecommunications spaces. Joined segments of a TBB shall be connected using irreversible compression-type connectors or exothermic welding. All joints shall be adequately supported and protected from damage.

G. Telecommunications Bonding Conductors (TBC):

1. Bonding conductor sizing. The following applies to the Telecommunications Bonding Conductor (TBC):
   a. Bonding Conductor Length (ft) / Bonding Conductor Size (AWG)
      1) <13 / #6
      2) 14-20 / #4
      3) 21-26 / #3
      4) 27-33 / #2
      5) 34-41 / #1

6) 42-52 / #1/0

SECTION 27 05 28 PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish and install all conduits, cable trays, outlet boxes, raceways, risers, service lateral conduits and backboards for a complete pathway for communications systems as specified herein and as shown on the drawings.

B. Rooms with lay-in ceiling shall have conduit stubbed-up above accessible ceiling. In all other rooms, provide conduit continuously routed to nearest cable tray or support structure in corridor with lay-in ceiling or directly to telecommunications equipment.

C. Unless noted otherwise, refer to Division 26 Specifications for requirements for conduits, outlet boxes and raceways.

D. Furnish and install cable tray system as specified herein and as shown on the drawings.

1.2 SUBMITTALS

A. Manufacturer’s product data sheets including dimensions, materials and finishes.

B. Coordination drawings with scaled floor plans including cable tray system layout relative to adjacent elements of other trades as coordinated in the field.

1.3 QUALITY ASSURANCE

A. All communications pathway equipment shall be UL classified and labeled and comply with latest NEMA, ASTM and ANSI Standards.

B. In addition, cable tray systems shall comply with the latest NEC Article 392, NEMA VE-1 and VE-2, and TIA 569-B.

C. Cable tray system of any type shall be from the same manufacturer.

1.4 COORDINATION

A. Coordinate layout and installation of cable tray with other trades installations.
   1. Any revision of locations and elevations from those indicated as required to suit field conditions will require A/E approval in writing.

1.5 DELIVERY, HANDLING AND STORAGE

A. Storage and Handling: Avoid breakage, denting and scoring finishes. Damaged products will not be installed. Store cable trays and accessories in original cartons and in clean dry space; protect from weather and construction traffic. Wet materials will be unpacked and dried before storage.

B. Equipment or materials damaged during storage or installations shall be replaced as directed by the A/E at Contractor's cost.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Wire Mesh and Ladder Cable Tray
   1. Cablofil
   2. B-Line
   3. Thomas & Betts
   4. Chalfant
   5. Chatsworth
   6. Snake Tray

2.2 WIRE MESH CABLE TRAY

A. Wire mesh tray system includes (but not limited to) straight sections, horizontal and vertical bends, tees, dropouts, supports and accessories.

B. Mesh tray shall be electro-plated zinc galvanized steel, continuous, rigid, 2" x 4" grid and spot welded wire at all intersections.

C. Tray width shall be as shown on drawings. Tray height shall be such that usable cable loading height is 4".

D. Straight sections of tray shall have continuous top wire safety edge and welded to all tray sides. Provided in 10' sections.

E. Mesh tray shall be support at a maximum of 5' intervals.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Cable tray and J-hook systems shall be installed level and plumb according to manufacturer's `written instructions, coordination drawings and applicable standards.

B. Cable trays are strictly for telecommunications cabling only. Other cables such as power, fire alarm, security, low voltage controls, etc. are not permitted in cable trays.

C. Cable trays shall be assembled with bolted splice plates. Splice hardware shall be zinc plated.

D. Install necessary expansion splice hardware at locations as recommended by manufacturer and as shown on the drawings.

E. Ground and bond metallic cable trays in accordance with NEC Article 392.7:
   1. Provide bonding to maintain continuity between all cable tray components.
   2. Bond cable tray sections at maximum 100' intervals with minimum #6 AWG bare copper conductors to building steel or telecommunications grounding bars.
   3. Make connections to cable tray with compression connectors.
   4. Cable tray shall not be used for equipment grounding means.
   5. Refer to Section "Grounding and Bonding for Telecommunications Systems" for additional requirements.

F. Secure conduits attached to cable trays with approved clamps. Install grounding bushing on conduit end and extend #12 AWG bonding jumper to cable tray.

G. Cable tray shall penetrate walls through wall sleeves. Wall sleeves shall be galvanized steel, have height and width matching cable tray. Install wall sleeves with approved firestopping when penetrating fire-rated walls, matching fire rating of wall being penetrated.

H. Conduits extensions to cable trays shall be within 6" of tray.

I. Hung cable tray shall be supported from building structure with trapeze type hanger, threaded rods and accessories as recommended by the manufacturer.

J. Cable trays installed adjacent to walls shall be supported with wall brackets and accessories as recommended by the manufacturer.

K. Unless noted otherwise, cable tray located above lay-in ceiling shall be installed below HVAC and piping system.

L. Cable trays shall be located no less than 12" from power cabling or luminaire ballasts.

3.2 FIELD QUALITY CONTROL

A. Test electrical continuity cable tray systems grounding and bonding connections for compliance with maximum grounding resistance specified.

END OF SECTION 27 05 28

SECTION 28 46 00
FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

1.2 RELATED REQUIREMENTS

A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables.

B. Section 26 05 33.13 - Conduit for Electrical Systems.

C. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems: Requirements for the seismic qualification of equipment specified in this section.

D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

C. IEEE C62.41.2 - IEEE Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Corrigendum 2012).

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. NFPA 72 - National Fire Alarm and Signaling Code; Most Recent Edition Cited by Referring Code or Reference Standard.

1.4 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

B. Evidence of designer qualifications.

C. Design Documents: Submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, riser diagrams, and description of operation:
   1. Copy (if any) of list of data required by authority having jurisdiction.
   2. NFPA 72 "Record of Completion", filled out to the extent known at the time.

3. Clear and concise description of operation, with input/output matrix similar to that shown in NFPA 72 Appendix A-7-5-2.2(9), and complete listing of software required.
4. System zone boundaries and interfaces to fire safety systems.
5. Location of all components, circuits, and raceways; mark components with identifiers used in control unit programming.
6. Circuit layouts; number, size, and type of raceways and conductors; conduit fill calculations; spare capacity calculations; notification appliance circuit voltage drop calculations.
7. List of all devices on each signaling line circuit, with spare capacity indicated.
8. Manufacturer's detailed data sheet for each component, including wiring diagrams, installation instructions, and circuit length limitations.
9. Description of power supplies; if secondary power is by battery include calculations demonstrating adequate battery power.
10. Certification by either the manufacturer of the control unit or by the manufacturer of each other component that the components are compatible with the control unit.
11. Certification by the manufacturer of the control unit that the system design complies with Contract Documents.
12. Certification by Contractor that the system design complies with Contract Documents.

D. Manufacturer's equipment seismic qualification certification.

E. Evidence of installer qualifications.

F. Evidence of instructor qualifications; training lesson plan outline.

G. Evidence of maintenance contractor qualifications, if different from installer.

H. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test Form," filled out.

I. Operating and Maintenance Data: See Section 01 78 00 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Complete set of specified design documents, as approved by authority having jurisdiction.
2. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
3. Contact information for firm that will be providing contract maintenance and trouble call-back service.
4. List of recommended spare parts, tools, and instruments for testing.
5. Replacement parts list with current prices, and source of supply.
6. Detailed troubleshooting guide and large scale input/output matrix.
7. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
8. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

J. Project Record Documents: See Section 01 78 00 for additional requirements; have one set available during closeout demonstration:

1. Complete set of floor plans showing actual installed locations of components, conduit, and zones.
2. "As installed" wiring and schematic diagrams, with final terminal identifications.
3. "As programmed" operating sequences, including control events by device, updated input/output chart, and voice messages by event.

K. Closeout Documents:
1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.

L. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.
1. Furnish spare parts of same manufacturer and model as those installed; deliver in original packaging, labeled in same manner as in operating and maintenance data.

1.5 QUALITY ASSURANCE

A. Designer Qualifications: NICET Level III or IV (3 or 4) certified fire alarm technician or registered fire protection engineer, employed by fire alarm control panel manufacturer, Contractor, or installer , with experience designing fire alarm systems in the jurisdictional area of the authorities having jurisdiction.

B. Installer Qualifications: Firm with minimum 3 years documented experience installing fire alarm systems of the specified type and providing contract maintenance service as a regular part of their business.
1. Authorized representative of control unit manufacturer; submit manufacturer's certification that installer is authorized; include name and title of manufacturer's representative making certification.
2. Installer Personnel: At least 2 years of experience installing fire alarm systems.
3. Supervisor: NICET level III or IV (3 or 4) certified fire alarm technician; furnish name and address.

C. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

D. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6 WARRANTY

A. Provide control panel manufacturer's warranty that system components other than wire and conduit are free from defects and will remain so for 5 years after date of Substantial Completion.

B. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Fire Alarm Control Units and Accessories:
1. Honeywell Security & Fire Solutions/Fire-Lite: www.firelite.com/#sle.
2. Honeywell Security & Fire Solutions/Notifier: www.notifier.com/#sle.
3. Potter Electric Signal Company: www.pottersignal.com/#sle.
4. Siemens Building Technologies, Inc: www.usa.siemens.com/#sle.
5. Simplex, a brand of Johnson Controls: www.simplex-fire.com/#sle.
6. Provide control units made by the same manufacturer.

B. Initiating Devices and Notification Appliances:
1. Same manufacturer as control units.

C. Fire Alarm Cable:
1. West Penn Cable.
2. Genesis Cable.
3. Belden Cable.

D. Substitutions: See Section 01 60 00 - Product Requirements.
1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with Contract Documents.
2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with Contract Documents.

2.2 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:
1. Provide all components necessary, regardless of whether shown in Contract Documents or not.
2. Protected Premises: Entire building shown on drawings.
3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:
   a. ADA Standards.
   b. The requirements of the local authority having jurisdiction .
   c. Applicable local codes.
   d. Contract Documents (drawings and specifications).
   e. NFPA 72; where the word "should" is used consider that provision mandatory; where conflicts between requirements require deviation from NFPA 72, identify deviations clearly on design documents.
4. Evacuation Alarm: Multiple smoke zones; allow for evacuation notification of any individual zone or combination of zones, in addition to general evacuation of entire premises.

5. General Evacuation Zones: Each smoke zone is considered a general evacuation zone unless otherwise indicated, with alarm notification in all zones on the same floor, on the floor above, and the floor below.
6. Fire Command Center: Location indicated on drawings.
7. Fire Alarm Control Unit: New, located at fire command center.

B. Supervising Stations and Fire Department Connections:
1. Public Fire Department Notification: By remote supervising station.
2. On-Premises Supervising Station: None.
3. Remote Supervising Station: UL-listed central station under contract to facility.
4. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.

C. Circuits:
1. Initiating Device Circuits (IDC): Class B, Style A.
2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
3. Notification Appliance Circuits (NAC): Class B, Style W.
4. Minimum Pathway Survivability Level (All Circuits): 0.

D. Spare Capacity:
1. Initiating Device Circuits: Minimum 25 percent spare capacity.
2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
3. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

E. Power Sources:
1. Primary: Dedicated branch circuits of the facility power distribution system.
2. Secondary: Storage batteries.
3. Capacity: Sufficient to operate entire system for period specified by NFPA 72.
4. Each Computer System: Provide uninterruptible power supply (UPS).

F. Seismic Qualification: Provide fire alarm system and associated components suitable for application under the seismic design criteria specified in Section 26 05 48 where required. Include certification of compliance with submittals.

2.3 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:

2.4 COMPONENTS

A. General:
1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Addressable Modules:
   1. Provide addressable modules suitable for connection to fire alarm control unit signaling line circuits.
   2. Unless otherwise indicated, use addressable modules only in clean, dry, indoor, nonhazardous locations.
   3. Monitor Modules: Unless devices are explicitly permitted to be connected together as zone, provide separate addressable monitor module for each conventional dry-contact input device in order to be individually identifiable by addressable fire alarm control unit.
   4. Relay Modules: Provide as indicated or as required to perform necessary functions via dry-contact interface. Where load exceeds module contact rating, provide accessory power isolation relays suitable for load as required.
   5. Signaling Line Circuit (SLC) Isolating Modules: Provide as indicated or as required to automatically isolate short circuits on connected sections of SLC loops and allow other sections to continue to function normally. Provide automatic reset upon correction of short circuit.

D. Initiating Devices:
   1. Addressable Systems:
      a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
      b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.

E. Notification Appliances:

F. Circuit Conductors: Copper; provide 200 feet (60 m) extra; color code and label.

G. Pathways and Boxes: Red, per Section 26 05 53 - Identification for Electrical Systems.

H. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
   1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
   2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
   3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.

I. Locks and Keys: Deliver keys to Owner.

J. Instruction Charts: Printed instruction chart for operators, showing steps to be taken when a signal is received (normal, alarm, supervisory, and trouble); easily readable from normal operator's station.
   1. Frame: Stainless steel or aluminum with polycarbonate or glass cover.
   2. Provide one for each control unit where operations are to be performed.
   3. Obtain approval of Owner prior to mounting; mount in location acceptable to Owner.
   4. Provide extra copy with operation and maintenance data submittal.

K. System Records Documents Box: Space Age Electronics SSU00689, or equivalent.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Install all wiring in accordance with Section 26 05 33.13 - Conduit for Electrical Systems.

C. Install all exposed cables and conductors in conduit.

D. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

E. Cables may not be spliced except where necessary, using terminal blocks.

F. Obtain Owner's approval of locations of devices, before installation.

G. Install instruction cards and labels.

3.2 INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

H. Diagnostic Period: After successful completion of inspections and tests, Operate system in normal mode for at least 14 days without any system or equipment malfunctions.
   1. Record all system operations and malfunctions.
   2. If a malfunction occurs, start diagnostic period over after correction of malfunction.
   3. Owner will provide attendant operator personnel during diagnostic period; schedule training to allow Owner personnel to perform normal duties.
   4. At end of successful diagnostic period, fill out and submit NFPA 72 "Inspection and Testing Form."

3.3 Owner PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:
   1. Hands-On Instruction: On-site, using operational system.
   2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:
   1. Initial Training: 1 session pre-closeout.

C. Basic Operation: One-hour sessions for attendant personnel, security officers, and engineering staff; combination of classroom and hands-on:
   1. Initial Training: 1 session pre-closeout.

D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.4 CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.
   1. Be prepared to conduct any of the required tests.
   2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.
   3. Have authorized technical representative of control unit manufacturer present during demonstration.
   4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
   5. Repeat demonstration until successful.

3.5 MAINTENANCE

A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, a proposal as an alternate to the base bid, for a maintenance contract for entire warranty period, to include the work described below; include the total cost of contract, proposal to be valid at least until 30 days after date of Substantial Completion.

C. Perform routine inspection, testing, and preventive maintenance required by NFPA 72, including:
   1. Maintenance of fire safety interface and supervisory devices connected to fire alarm system.
   2. Repairs required, unless due to improper use, accidents, or negligence beyond the control of the maintenance contractor.
   3. Record keeping required by NFPA 72 and authorities having jurisdiction.

D. Provide trouble call-back service upon notification by Owner:
   1. Provide on-site response within 2 hours of notification.
   2. Include allowance for call-back service during normal working hours at no extra cost to Owner.
   3. Owner will pay for call-back service outside of normal working hours on an hourly basis, based on actual time spent at site and not including travel time; include hourly rate and definition of normal working hours in maintenance contract.

E. Provide a complete description of preventive maintenance, systematic examination, adjustment, cleaning, inspection, and testing, with a detailed schedule.

F. Maintain a log at each fire alarm control unit, listing the date and time of each inspection and call-back visit, the condition of the system, nature of the trouble, correction performed, and parts replaced. Submit duplicate of each log entry to Owner's representative upon completion of site visit.

G. Comply with Owner's requirements for access to facility and security.

SECTION 31 11 00
SITE CLEARING

PART I - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Clearing and grubbing.
2. Topsoil stripping and stockpiling.
3. Protection of existing vegetation to remain.

B. Related Sections:
1. Division 31 Section "Earthwork".
2. Division 31 Section "Erosion Control".

1.2 SUBMITTALS

A. Product Data: For each type of product indicated.

1.3 PROTECTION

A. Description:

1. Protect existing trees, vegetation and site improvements to remain.
2. Damage or destruction of items intended to remain shall be repaired or replaced to the satisfaction of the Owner, without additional cost to the Owner.
3. Mark and protect trees and other existing landscaping to remain by barricades and by wrapping. Place barricades generally outside the dripline.
4. Protect trees and other vegetation to remain from sprayed herbicides or soil poison.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Wrapping: Burlap AASHTO-M182-60 Class 2.

B. Barricades: Minimum shall be U.V. resistant orange plastic snow fence, 4’-0” high with posts as required to comply with protection requirements.

C. Tree Wound Paint: Standard bituminous product.

D. Marking: Bright surveyor’s tape.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordination and Verification:

1. Contact Owner prior to clearing and grubbing to verify items of salvage.
2. Also verify all existing trees, landscaping and other items or areas which are to remain, and which are to be cleared.

B. Dust Prevention: Use water sprinkling and other necessary means to prevent dust from becoming a nuisance to the Owner, public or concurrent performance of the work.

C. Limits:

1. Limits of clearing and grubbing shall be the construction limits as shown on the Drawings or indicated and implied by the Contract Documents.
2. If any clarification of limits is necessary, contact Owner and Architect/Engineer.
3. If any work is necessary outside the contract limits, contact Owner and Architect/Engineer for approval prior to work.

D. Clearing:

1. Clean the site of all boulders, trash and debris as indicated and necessary.
2. Remove items and materials indicated on Drawings to be removed.
3. At areas to be covered by paving, walks, curbs, mechanical and electrical items, and where existing surfaces will be graded to new elevations, remove all trees, shrubs and other vegetation as required for installation of Work.
4. Refer to Drawings for additional trees, shrubs and other vegetation to be removed.
5. Saw damaged tree limbs clean and apply tree wound paint.

E. Grubbing:

1. Unless partial removal is indicated, remove all items to their full depth.
2. Where partial removal is indicated or is practical, make straight and neat cuts in existing materials.
3. Remove all stumps, roots over 2” in diameter, and matted roots within the limits of grubbing to the following depth from finish grading:

    a. Footings: 18” or as required to provide construction clearance.
    b. Walks: 12”.
    c. Roads: 18”.
    d. Parking areas: 12”.
    e. Lawn areas: 8”.

4. Apply tree wound paint to all cut ends of remaining stumps or roots to prevent regrowth.

F. Removal and Disposal:

1. Remove all logs, stumps, roots, cuttings, and other material as a result of clearing and grubbing daily as it accumulates and legally dispose of off-site.
2. Burning of these materials on the site is not permitted.

G. Completion of Work: Remove barricades at completion of work and ensure site is clean and free from debris.

3.2 PREPARATION

A. Install temporary fencing located as indicated or outside the drip line of trees to protect remaining vegetation from construction damage.

B. Protect tree root systems from damage due to noxious materials caused by runoff or spillage while mixing, placing, or storing construction materials.

C. Protect root systems from flooding, eroding, or excessive wetting caused by dewatering operations.

D. Do not store construction materials, debris, or excavated material within the drip line of remaining trees.

E. Do not permit vehicles or foot traffic within the dripline; prevent soil compaction over root systems.

F. Do not allow fires under or adjacent to remaining trees or other plants.

3.3 EXCAVATION

A. Install shoring or other protective support systems to minimize sloping or benching of excavations.

B. Do not excavate within drip line of trees, unless otherwise indicated.

C. Where excavation for new construction is required within drip line of trees:

1. Hand clear and excavate to minimize damage to root systems.
2. Use narrow-tine spading forks and comb soil to expose roots.
3. Relocate roots in backfill areas where possible.
4. If encountering large, main lateral roots, expose roots beyond excavation limits as required to bend and relocate them without breaking.
5. If encountered immediately adjacent to location of new construction and relocation is not practical, cut roots approximately 3 inches back from new construction.
6. Do not allow exposed roots to dry out before placing permanent backfill.
7. Provide temporary earth cover or pack with peat moss and wrap with burlap.
8. Water and maintain in a moist condition.
9. Temporarily support and protect roots from damage until they are permanently relocated and covered with soil.

D. Where utility trenches are required within drip line of trees:

1. Tunnel under or around roots by drilling, auger boring, pipe jacking, or digging by hand.
2. Do not cut main lateral roots or taproots; cut only smaller roots that interfere with installation of utilities.
3. Cut roots with sharp pruning instruments; do not break or chop.

3.4 REGRADING

A. Grade Lowering:

1. Where new finish grade is indicated below existing grade around trees, slope grade beyond drip line of trees.
2. Maintain existing grades within drip line of trees.
3. Where new finish grade is indicated below existing grade new trees, slope grade away from trees unless otherwise indicated.
4. Root Pruning: Prune tree roots exposed during grade lowering. Do not cut main lateral roots or taproots; cut only smaller roots. Cut roots with sharp pruning instruments; do not break or chop.

B. Minor Fill: Where existing grade is 6 inches or less below elevation of finish grade, fill with topsoil. Place topsoil in a single un-compacted layer and hand grade to required finish elevations.

C. Moderate Fill: Where existing grade is more than 6 inches, but less than 12 inches, below elevation of finish grade, place drainage fill, filter fabric, and topsoil on existing grade as follows:

1. Carefully place drainage fill against tree trunk approximately 2 inches above elevation of finish grade and extend not less than 18 inches from tree trunk on all sides. For balance of area within drip-line perimeter, place drainage fill up to 6 inches below elevation of grade.
2. Place filter fabric with edges overlapping 6 inches minimum.
3. Place fill layer of topsoil to finish grade. Do not compact drainage fill or topsoil. Hand grade to required finish elevations.

3.5 TREE PRUNING

A. Prune remaining trees affected by temporary and new construction.

B. Prune remaining trees to compensate for root loss caused by damaging or cutting root system. Provide subsequent maintenance during Contract period as recommended by qualified arborist.

C. Pruning standards: Prune trees according to ANSI A300:

D. Cut branches with sharp pruning instruments, do not break or chop.

E. Chip branches removed from trees. Spread chips where indicated or as directed by Architect/Engineer.

3.6 TREE REPAIR AND REPLACEMENT

A. Promptly repair trees damaged by construction operations within 24 hours. Treat damaged trunks, limbs, and roots according to written instructions of the qualified arborist.

B. Aerate surface soil, compacted during construction, 10 feet beyond drip line and no closer than 36 inches to tree trunk. Drill 2-inch diameter holes a minimum of 12 inches deep at 24 inches o.c. Backfill holes with an equal mix of augured soil and sand.

SECTION 31 20 00
EARTHWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Excavation, filling, backfilling and compacting.
2. Trenching and trench backfilling.
3. Mass earthwork and rough grading.
4. Finish grading, including spreading of topsoil.
5. Dewatering.
6. Soil stabilization.
7. Testing and inspection.

B. Related Sections:

1. Division 00 Section “Geotechnical Data”.
2. Division 02 Section “Selective Site Demolition”.
3. Division 31 Section “Site Clearing”.
4. Division 31 Section “Erosion Control”.

1.2 QUALITY ASSURANCE

A. Testing and Inspection:

1. All testing and inspection shall be performed by an independent Geotechnical Engineering Consultant ("Geotechnical Engineer").
2. The Geotechnical Engineer is responsible for all testing, sampling and inspection.
3. The Geotechnical Engineer is responsible for approving materials, installation and procedures.
4. The Contractor is responsible for providing these services.
5. The Contractor is responsible for all coordination and scheduling with the Geotechnical Engineer.

B. Topsoil:

1. All topsoil shall be tested and approved by the Soil Scientist.
2. Refer to 1.3 Submittals for more information.

C. Any work in public right-of-way or other areas subject to the jurisdiction of anybody shall be performed either to the requirements of that jurisdiction or to the requirements of this Specification, whichever is more stringent.

1.3 SUBMITTALS

A. All submittals shall be reviewed and approved by Architect/Engineer and Geotechnical Engineer.

B. Product Data and Test Reports:

1. Field and laboratory tests and inspections.
2. Drainage file: Include material specifications and sieve analysis. Include signed material certificate from manufacturer/supplier.
3. Chemical modification: Include material specifications and signed material certificate from manufacturer/supplier.
4. Geo-synthetic materials: Include material specifications and signed material certificate from manufacturer/supplier.

C. Topsoil:

1. Furnish topsoil analysis performed by a soil scientist.

   Approved Vendors:
   a. A&L Greatlakes Laboratories at 3505 Conestoga Dr. Fort Wayne, IN 46808.
   b. Lawn & Garden Soil Analysis at 682 North Pleasant Street, University of Massachusetts, Amherst, MA 01003.

2. Analysis shall state the following: (Refer to Part 2 for minimum requirements)

   a. Percentage of organic matter.
   b. Gradation of sand, silt and clay, Include USDA textural classification.
   c. Cation exchange capacity.
   d. Deleterious material.
   e. ph.
   f. Mineral and plant nutrient content (phosphorus, potassium, magnesium, calcium).
   g. Any requirements or recommendations necessary to make it suitable.
   h. Annual nutrient requirements and recommendations for evergreens shrubs, trees, and flowers. Soil test results without recommendations will be rejected.

3. This analysis is required for both on site and off-site topsoil.
4. Samples of the topsoil shall be taken under the following conditions:

   a. Within four (4) weeks prior to placing topsoil, take three representative samples of proposed topsoil.
   b. Within one week after placing topsoil, take three representative samples of in-place topsoil.
   c. All samples shall be taken at the witness of the Owner, in areas approved by the Owner. Contractor to coordinate with Owner as required.

5. Provide copies of all topsoil analysis and recommendations to Owner and Architect/Engineer.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. All soil materials shall be approved by the Geotechnical Engineer.
2. All soil materials shall be suitable for each application.
3. Suitable soils are defined as soils which provide proper strength, compaction and drainage requirements and which are approved by the Geotechnical Engineer.
4. Fill material which is unsuitable due to excess moisture will not be classified as unsuitable if it can be dried to optimum moisture specified herein by manipulation, aeration or blending with other materials satisfactorily as approved by the Geotechnical Engineer.

B. Fill Materials:

1. Note: The following describes fill materials and their application for use. The materials shall be used for the listed applications, unless designated otherwise on the Drawings. If the Contractor has any questions or concerns regarding the materials or intended application, contact the Architect/Engineer for directions. Compaction requirements are the percentage of maximum dry density per ASTM D698 Standard Proctor Test, unless noted otherwise in the Geotechnical Report.
2. General fill:

    a. Suitable on-site or off-site fill material free of debris, roots, organic and frozen materials, and stones having a maximum dimension of 2”.
    b. Minimum compaction: 95%.
    c. Application: General filling and backfilling of excavations and trenches outside of the building.

3. Structural fill:

    a. Suitable on-site or off-site fill material free of debris, roots, organic and frozen materials, and stones having a maximum dimension of 2”.
    b. Minimum compaction: 100%.
    c. Application: Compacted subgrade under buildings, foundations and areas subject to structural loads.

4. Granular fill:

    a. Clean, natural or manufactured sand per requirements of INDOTSS Type “B” borrow, 4.75mm (No. 4) gradation. Pea gravel is not acceptable.
    b. Minimum compaction: 95%.
    c. Application: Backfilling of excavations and trenches which are under or within 5’ of pavement, and underneath exterior concrete pavement, walks, curbs and slabs on grade.

5. Drainage Fill:

a. General: Clean, washed fill sand with 100% passing the 4.75mm (No.4) sieve and no more than 5% passing the 0.075 mm (No. 200) sieve. Pea gravel or #53 stone are not acceptable.
b. Minimum compaction: 95%.
c. Application: Free draining material required for applications such as the outside of basement walls, the back side (earth side) of retaining walls and building slabs on grade.

6. Aggregate fill: Unless otherwise indicated, shall meet the following:

a. Naturally or artificially graded mixture of natural or crushed gravel, crushed stone and natural or crushed sand.
b. ASTM D2940, with 100 percent passing a 1 ½ inch sieve and not more than 8 percent passing a No. 200 sieve.
c. Application: base course under concrete and other items per plans.

C. Topsoil:

1. Topsoil shall be fertile, friable, natural surface soil obtained from well-drained areas and possessing characteristics of representative soils in the project vicinity that produce heavy growths of crops, grass or other vegetation.
2. Topsoil shall consist of friable loam, reasonably free of subsoil, clay lumps, brush, roots, weeds or other objectionable vegetation, stones or similar objects larger than 1-1/2" in any dimension, litter or other materials unsuitable or harmful to plant growth.
3. Supplement on-site topsoil with off-site topsoil as necessary.
4. Unless otherwise indicated, minimum compacted thickness in lawn areas is 4".
5. The mechanical analysis of topsoil shall be as follows:

a. 1" mesh sieve size; 99%-100% passing.
b. 1/4" mesh sieve size: 97%-99% passing.
c. No. 100 mesh sieve size: 40%-60% passing.
d. No. 200 mesh sieve size: 20%-40% passing.

6. The following minimum requirements shall also be met:

a. Organic matter: 3-5%.
b. pH: 6.5 to 7.3.
c. Sand, silt, clay content: per USDA loam textural classification.
d. Minerals and nutrients: Per Geotechnical Engineer or Soil Scientist recommendations and amendments suitable for use in local area.

D. Soil Separator Fabric:

1. Nonwoven, needle-punched geotextile fabric manufactured from polyolefins or polyesters per ASTM M288, suitable for subsurface drainage and other specified applications.
2. Application: subsurface drains and as specified in Contract Documents.
3. Specifications (values based on Mirafi 140N):

a. Apparent opening size: 70 (U.S. Standard Sieve Size); ASTM D-4751-99A.
b. Flow rate: 135 gpm/sf; ASTM D-4491-99A.
c. Puncture strength: 65 lbs; ASTM D-4833-00.

d. Mullen Burst: 225 lb/sq. in.
e. Grab tensile/elongation: 155 lbs/50%.
f. UV Resistance: 70% at 500 hours.

E. Geo-synthetic Reinforcement:

1. General: H-Series HX165 Geogrid as manufactured by Tensar International Corp., Atlanta Georgia.
2. Application: Soil stabilization as required and as recommended by the Geotechnical Engineer.

F. Chemical Modification:

1. General: INDOTSS 215.
2. Materials: Hydrated lime per INDOTSS 913.04(b) and Type I Portland cement per INDOTSS 901-01(b).
3. Quantity: 4.0 +/- 0.5% by dry unit mass of the soils.
4. Application: If Geotechnical report indicates that chemical modification may be needed for soil stabilization, then the Contractor shall include provisions for chemical modification in their bid.

G. Other Materials:

1. All other materials not specifically described but not required for proper completion of the Work of this Section, shall be selected by the Contractor subject to the approval of the Architect/Engineer and Geotechnical Engineer.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. General:

1. Weather: Do not perform earthwork activities during inclement weather.
2. Dust: Use all necessary and appropriate means, such as water sprinkling, as required to prevent dust from being a nuisance to the Owner, public and concurrent performance of other work on the site.
3. Conflicts: Should the preceding job conditions or other items specified herein because of actual or possible conflicts, notify the Architect/Engineer immediately and do not proceed until such conflict has been resolved.
4. Refer to Division 31 Section “Termite Control” for termite protection requirements.

B. Preparation: Verify that the following has been completed prior to beginning earthwork:

1. Protective fencing has been installed for trees and vegetation to remain.
2 Site clearing (clearing and grubbing).
3. Selective site demolition.
4. Erosion and sediment control measures are in place.

C. Protection:

1. For items indicated to remain, provide protection to prevent damage from construction activities. Any damage or destruction to items intended to remain intact shall be repaired or replaced to the satisfaction of the Owner at the Contractor's expense.
2. Topsoil: Protect placed topsoil from heavy machinery traffic. Remove and replace topsoil that is compacted by heavy machinery traffic.
3. Subgrade: Ditches and drains along the subgrade shall be maintained to always drain effectively. Repair subgrade of any ruts that may occur by reshaping and recompacting as required.
4. Utilities: Determine locations of existing utilities and the extent to which they may affect earthwork operations. Where service and utility lines are to remain, provide protection to prevent damage or disruption of services.
5. Damaged utilities shall be repaired immediately at the Contractor's expense.
6. Open excavation:

    a. The Contractor is responsible for ensuring all open excavations are properly barricaded and always protected. This includes work such as mass excavation and trenching and includes other potentially dangerous conditions such as retention ponds.
    b. Provide and install all necessary and appropriate means such as, but not limited to, signage, fencing, traffic barricades, and lighting to warn, discourage, and prevent danger to adjacent workers and the public.
    c. Unless otherwise indicated, install a minimum 6' 10-guage chain link fence around all open excavations, retention ponds, and other areas of potential danger, and maintain them while such conditions exist. Increase measures as required by site conditions.

3.2 LAYOUT

A. Surveyor: Secure the services of a licensed land surveyor, acceptable to the Architect/Engineer and Owner, to layout locations of building, parking areas, drive, walks, curbs, finish elevations and other work, including mechanical and electrical items that are to be installed on the project site.

B. References: Establish and maintain lines, corners, elevations and general reference points. Verify dimensions indicated on Drawings. If conflicts exist, immediately notify the Architect/Engineer before continuing work.

3.3 EXCESS WATER CONTROL

A. Excess moisture: If excess moisture is present in soil, do not resume operations until moisture content and density are reported to be satisfactory by the Geotechnical Engineer.

B. Flooding: Provide berms or channels to prevent flooding of subgrade. Promptly remove all water collecting in depressions.

C. Softened subgrade: Where soil has been softened or eroded by flooding or placement during inclement weather, remove all damaged areas and recompact as specified for fill and compaction.

D. Dewatering:

1. Provide and maintain ample means and devices with which to promptly remove and dispose of all water from every source always entering the excavations or other parts of the work during construction.
2. Dewater by means which will ensure dry excavations and the preservation of the final lines and grades at bottom of excavations, such as sump pumps, trenching, etc.
3. Do not use extreme measures or durations to cause adverse effects to Project Site or adjoining properties.

3.4 CHEMICAL MODIFICATION

A. General:

1. Scarify and/or disc area to a depth of 12" prior to distributing modifiers.
2. Utilize screw type, cyclone, or pressure manifold type distributors to apply modifier.
3. Do not apply when wind conditions create potential hazards or transference of material to adjacent areas.
4. Mix modifiers with rotary speed mixers or disc harrow and continue until a homogenous layer of the required thickness is obtained.
5. Compaction:

    a. Lime modified soils shall be compacted within 3 days.
    b. Cement modified soils shall be compacted within 30 minutes.

6. Observation and testing: Quantities of materials, placing, mixing, and compacting shall be, as recommended, observed and tested by the Geotechnical Engineer.

3.5 STOCKPILING

A. General:

1. See drawings for designated stockpiling areas. If Drawings do not designate specific areas, or areas shown are insufficient, contact Architect/Engineer for direction.
2. Stockpile earth materials in manners that will prevent intermixing of different materials and intrusion of trash, debris and organic materials.
3. Slope stockpiled materials to provide adequate surface drainage.
4. Install and maintain erosion control measures. Refer to drawings and Division 31 Section "Erosion Control". At a minimum, silt fences shall be installed around all stockpiled areas. Seed areas which are to remain stockpiled for extended periods of time.
5. Storage or stockpiling of materials on the subgrade is prohibited.

3.6 EXCAVATION

A. General:

1. Excavation shall conform to OSHA and all other applicable safety regulations.

2. Excavation shall conform to the dimensions and elevations indicated on the Drawings, except as specified herein.
3. Excavation shall extend sufficient distance from walls and footings to allow for placing and removal of forms, installation of services and inspection.
4. Remove unsuitable material below indicated depths and replace it with suitable, compacted material or lean concrete, at the Architect/Engineer discretion.
5. Topsoil stripping: Strip topsoil to its depth from areas to be covered by building, by walks and by other work and where existing surface areas required grading to establish new elevations.
6. Subgrade: Unless otherwise indicated, excavate to following subgrades:

    a. Slab-on-grade: Sub-grade at bottom of drainage fill or at bottom of existing topsoil, whichever is lower.
    b. Drives and paving: Sub-grade at bottom of aggregate base.
    c. Footing: Sub-grade at indicated bottom of footing.
    d. Lawn area: Sub-grade 4” below indicated surface elevation.

3.7 TRENCHING

A. General:

1. All trenching shall conform to OSHA and all other applicable safety standards.
2. Verification:

    a. Contractor shall verify all existing grades, inverts, utilities, obstacles and topographical conditions prior to any trenching, excavation or underground installations.
    b. In the event existing conditions are such as to prevent installations in accordance with the Contract Documents, immediately notify the Architect/Engineer and await decision before continuing work.
    c. Architect/Engineer decision will be final and binding upon the Contractor, and installations shall be in accordance with same.

3. Saw cut existing pavements to proper width for trenching.
4. Legally dispose materials unsuitable for trench backfilling off-site.

B. Width:

1. Trenches for piping shall be not less than 12” wide or more than 16” wider than the outside diameter of the pipe to be laid therein, and shall be excavated true-to-line, so that a clear space not less than 6” or more than 8” in width is provided on each side of the pipe.
2. For sewers, the maximum width of the trench specified shall apply to the width at and below the level at the top of the pipe. The width of the trench above that level may be made as wide as necessary for sheeting and bracing, and proper installation of the Work.
3. Trenches shall be open vertical construction.

C. Depth:

1. Trench as required to provide the elevations shown on the drawings.

2. Where elevations are not shown on the drawings, trench to sufficient depth to give a minimum of 36” of fill above the top of the pipes measured from the adjacent finish grade.
3. Where trench excavation is inadvertently carried below proper elevation, backfill with approved material and then compact to provide a firm and unyielding subgrade and/or foundation at no additional cost to the Owner.

D. Trench Bracing:

1. Properly support all trenches in strict accordance with all pertinent rules and regulations.
2. Brace, sheet, and support trench walls in such a manner that they will be safe and that the ground alongside the excavation will not slide or settle, and that all existing improvements of every kind, whether on public or private property, will be fully protected from damage.
3. In the event of damage to such improvements, immediately make all repairs and replacements necessary at no additional cost to the Owner.
4. Arrange all bracing, sheeting, and shoring so as to not place stress on any portion of the completed Work until the general construction thereof has proceeded far enough to provide sufficient strength.
5. All shoring and sheeting required to perform and protect the excavation and as required for the safety of employees and abutting structures shall be performed. All workmen performing work in 48” or deeper trench or excavation shall be protected by use of a welded sheet steel “safety box.”
6. Removal: Exercise care in the drawing and removal of sheeting, shoring, bracing, and timbering to prevent collapse or caving of the excavation faces being supported.

E. Bedding:

1. Where pipes or conduits are to be installed, excavate below the proposed alignment of the pipe and backfill with clean sand to provide uniform support unless otherwise noted on the drawings.
2. Unless shown otherwise on Drawings, minimum bedding to be 4” below pipe.
3. Storm sewer pipes are to be bedded with stone.
4. Refer to drawings and details for further information and requirements.

F. Grading and Handling of Trenched Material:

1. During excavation, material shall be stacked in an orderly manner a sufficient distance back from edges of trenches to avoid overloading and prevent slides or cave-ins.
2. Control the temporary stockpiling of trenched material in a manner to prevent water from running into the excavations.
3. Do not obstruct the surface drainage but provide means whereby stormwater is diverted into existing gutters, surface drains or other temporary drains.
4. Any water accumulated in the trenches shall be removed by pumping or by other approved methods.

3.8 FILLING, BACKFILLING AND COMPACTING

A. Prior to filling, backfilling and compacting, proof-roll and remediate subgrade per Part 3 Quality Assurance.

B. Unless otherwise indicated, maximum lift thickness is 8” of un-compacted material.

C. Moisture:

1. Thoroughly mix each layer to assure uniformity of material.
2. Supplement mixing with wetting or drying as required to obtain the moisture content required for the indicated percentages of compaction.
3. All fill shall be placed so that the moisture content is within +/- 2% of the optimum moisture content according to ASTM D698.
4. Do not use frozen materials in the fill or allow the fill to be placed upon frozen materials.

D. Compaction:

1. Compaction shall be accomplished by approved means and shall meet the following densities for various parts of the Work. See Part 2 for density requirements of individual soil materials.
2. Compaction by flooding is not acceptable.
3. In cut areas where pavement is planned, scarify the upper 12” of subgrade prior to compaction.

E. Equipment:

1. Tracked equipment shall not be used as compaction equipment.
2. The static weight of compaction equipment utilized for the compaction of backfill materials near walls as defined in No.3 below shall not exceed 2,000 lbs. for non-vibratory equipment and 1,000 lbs. for vibratory equipment.
3. All heavy equipment, including compaction equipment heavier than noted herein, shall not be allowed closer to walls than 3 feet plus the vertical distance from backfill surface to the bottom of the wall.

3.9 GRADING

A. General:

1. After filling and backfilling operations are complete, neatly and evenly grade areas to be seeded or sodded.
2. Scarify subgrade to a depth of 6” and place minimum 4” topsoil (6” maximum).
3. Grade to obtain the elevations indicated within a tolerance of plus or minus 0.1 foot.
4. Slope finished subgrade surface to provide drainage away from building walls.

B. Treatment After Completion of Grading:

1. After grading is completed and inspected, permit no further excavation, filling, or grading except with the review of and the inspection by the Owner.
2. Use all necessary means to prevent the erosion of freshly graded areas during construction and until such time as permanent drainage and erosion control measures have been installed.

3.10 QUALITY ASSURANCE

A. Coordination:

1. A representative from the Geotechnical Engineer shall be present to always observe and perform tests earthwork is in progress.
2. Contractor shall provide minimum 72 hour notice to Geotechnical Engineer before each operation requiring testing or inspection.

B. Testing:

1. To verify the adequacy of compaction, the Geotechnical Engineer shall perform field density tests.
2. A grid pattern shall be established with a maximum area of 1,000 square feet.
3. For each grid, provide a minimum of one test per each lift of compacted material.

C. Proof rolling:

1. Proof rolling shall be supervised by the Geotechnical Engineer.
2. Since standard test procedures are not available for proof rolling, the necessary scope and method of testing shall be determined by the Geotechnical Engineer, subject to review by the Architect/Engineer.
3. In areas covered by buildings and other site improvements, and other areas deemed necessary by the Geotechnical Engineer or Architect/Engineer, prepare and test subgrade as follows:

    a. Using a loaded tri-axle dump truck or other approved method, the Contractor shall proof-roll the exposed subgrade under the observation of the Geotechnical Engineer.
    b. Based on this observation, plus supplemental testing as required, the Geotechnical Engineer shall determine when and where soft, loose or other undesirable materials are to be removed and replaced.

D. Approval and Remediation:

1. When testing and proof rolling indicate proper compaction has been obtained, and after approval from Geotechnical Engineer has been given, continue fill and backfill work until the indicated elevation is achieved.
2. If required density has not obtained, the Contractor shall remove the defective material and repeat operations until the required density is obtained, and approval is given by the Geotechnical Engineer.
3. Cost of material removal, replacement, compaction and re-testing shall be the responsibility of the Contractor.

3.11 SURPLUS SOIL MATERIALS

A. Unless otherwise indicated or directed by Owner, remove excess soil materials and legally dispose of off-site.

3.12 JOB COMPLETION

A. Upon completion of the Work of this Section:

1. Remove all trash and debris from earthwork operations.

2. Remove surplus equipment and tools.
3. Leave the site in a neat and orderly condition.
4. Restore all adjacent areas disrupted by earthwork activities to their original condition.

SECTION 31 25 00
EROSION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Prevention of soil or sediment leaving project site.
2. Prevention of soil or sediment impacting on-site or off-site activities or conditions.
3. Dust control.

B. Related Sections:

1. Division 02 Section “Selective Site Demolition”.
2. Division 31 Section “Site Clearing”.
3. Division 31 Section “Earthwork”.

1.2 SUBMITTALS

A. Product data for the following:

1. Silt fence.
2. Inlet filters.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:

1. The standard for erosion/sediment control for this project is the Indiana Handbook for Erosion Control in Developing Areas, latest edition (Indiana Department of Natural Resources, Division of Soil Conservation). All erosion control work shall conform to this manual.

B. General Requirements:

1. Erosion/sediment control measures are to be installed prior to beginning any earth disturbing activities and maintained throughout construction.
2. The Contractor is responsible for ensuring all specified and necessary erosion/sediment control measures are installed, functioning and properly maintained.
3. Any fines or other costs incurred due to inadequate or improper installation, maintenance or performance of erosion/sediment control measures as identified by the self-monitoring process and/or other agency having jurisdiction over erosion control shall be the sole responsibility of the Contractor.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Silt Fence:

1. Woven or non-woven produced from 100% polypropylene, designed specifically to retain sediment and remain highly permeable to water.
2. Geotextile shall be attached to wood stakes with wood leathers and staples or nails.
3. Bottom 12 inches of fabric shall be left unsecured to allow for entrenchment.
4. Stakes: 2” x 2” x 36” hardwood sharpened to a point on one end, maximum 5’ spacing.
5. Lath: ½” x 1 ½” x 24” for attaching the fabric to the stakes.

B. Inlet Filters: Stream guard catch basin insert by Bowhead Environmental & Safety (800-909-3677), or Architect/Engineer approved equal.

C. Refer to Division 32 Sections "Seeding" and "Planting" for temporary and permanent ground cover requirements.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. General:

1. Prevent mud and dirt accumulation on all streets surrounding the project. Utilize stone tracking strips/construction entrances, street sweepers, spray trucks, power washers and other necessary and appropriate means as required. Roadways should be kept clear of accumulated sediment that is a result of runoff or tracking.
2. Dust control: Use all necessary and appropriate means, such as water sprinkling, calcium chloride (AASHTO M 144), vegetative cover, spray-on adhesives, as required to prevent dust from being a nuisance to the Owner, public or concurrent performance of work on the site.
3. Always keep the amount of disturbed area to a minimum.
4. Seed immediately after grading soil and install erosion control blanket where applicable.
5. Sequence installation of measures to ensure proper erosion control. See Drawings for basic sequencing requirements.
6. Temporarily seed all areas that cannot be final seeded within a period that will prevent soil erosion. For temporary seeding, utilize a fast-growing seed of oats, annual rye grass, wheat or rye depending on the time of year.
7. See Division 32 Section “Seeding” for seeding requirements.
8. The Contractor shall inform all Subcontractors of the requirements of the Construction Stormwater Pollution Prevention Plan (SWP3) and its maintenance provisions, so that erosion/sediment disruption may be prevented by all those working on site.
9. Un-vegetated areas that are likely to be left inactive for more than 15 days must be stabilized.
10. Proper storage and handling of materials, such as fuels or hazardous waste, and spill prevention and cleanup measures shall be implemented to minimize the potential for

pollutants to contaminate surface or ground water or degrade soil quality. Notify Indiana Department of Environmental Management (IDEM) of any release.

11. Final stabilization shall be achieved when all land disturbing activities have been completed, and a perennial vegetative cover exists with at least a 70% density. Once this has been achieved, the Contractor shall notify the Owner and Architect/Engineer. The Contractor must still complete all maintenance and quality requirements as specified in Division 32 Sections "Seeding" and "Planting".

3.2 INSTALLATION

A. Silt Fence:

1. Install silt fences where indicated on Drawings and on other areas as required.
2. Follow all manufacturer guidelines for installation.
3. Dig a minimum 8” deep trench along proposed fence line to allow toe-in.
4. Install a fence with stakes on the downstream/slope side.
5. Backfill and compact both sides of trench and ensure fence is anchored sufficiently.

B. Stone Tracking Area/Construction Entrance:

1. Install at all temporary entrances/exits for construction traffic and in other areas as needed to prevent soil materials from being deposited on streets, parking areas, etc.
2. Minimum thickness is 6” of #2 stone. Increase as necessary for field conditions. Install geotextile fabric underneath stone to improve stability if needed.
3. Minimum dimensions are shown on the plans. Increase as necessary for field conditions.

3.3 INSPECTION AND MAINTENANCE

A. General:

1. Inspect all erosion control measures periodically and after each storm event.
2. Repair and replace all measures as necessary to ensure proper soil erosion prevention.
3. Maintain temporary measures until vegetation has been adequately established and construction activities have been completed to a point where the potential for soil erosion has been sufficiently eliminated. The Contractor is responsible for maintaining temporary measures until such a point and then removing the measures, even if all other construction work is complete.
4. Implement erosion/sediment control modifications as directed by the Architect/Engineer.

B. Silt Fence:

1. Inspect periodically and after each storm event.
2. If fabric tears start to decompose, or in any way becomes ineffective, replace the affected portion immediately.
3. Remove deposited sediment when it reaches 1/3 of the height of the fence at its lowest point or when it is causing the fabric to bulge. Do not undermine the fence during cleanout.
4. After the contributing drainage area has been stabilized, remove the fence and sediment deposits, bring the disturbed area to grade and stabilize.

C. Stone Tracking Area/Construction Entrance:

1. Inspect weekly and after storm events or heavy use.
2. Re-shape as needed for drainage and runoff control.
3. Top dress with clean stone as needed.
4. Immediately remove mud and sediment tracked or washed onto roads, parking lots, etc. by brushing or sweeping. Flushing is only to be used if the water is conveyed to a sediment trap or basin.

D. Inlet Filters:

1. Inspect each inlet periodically and after each storm event.
2. If fabric tears start to decompose, or in any way become ineffective, replace the affected portion immediately.
3. Remove deposited sediment often and do not allow it to build up and cause damage to the fabric or reduce the flow capacity of the inlet.
4. Remove inlet fabric after the contributing drainage area has been stabilized.

E. Seeding:

1. Inspect temporary and permanent seeding periodically and after each storm event.
2. Repair damaged, bare or sparse areas by filling any gullies, re-fertilizing, over-seeding, re-seeding and re-mulching.
3. Install erosion control blanket over areas that do not hold.

F. Final Inspection and Acceptance:

1. Contractor shall notify the Owner in writing, 24 hours in advance that the project is ready for final inspection and acceptance. The following conditions must be met:

    a. All land disturbing activities have been completed, and the entire site has been stabilized.
    b. All temporary erosion and sediment control measures have been removed.

SECTION 32 12 16
ASPHALT PAVING

PART I - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Asphalt paving as shown or implied by Contract Documents.
2. Asphalt paving is required because of trenching through or demolition of existing asphalt.

1.2 QUALITY ASSURANCE

A. All materials and work shall comply with the Indiana Department of Transportation Standard Specifications (INDOTSS), current edition.

B. Any work in public right-of-way, or other areas subject to the jurisdiction of anybody, shall be performed either to the requirements of that jurisdiction or to the requirements of this Specification, whichever is more stringent.

C. Testing and Inspection:

1. All testing and inspection shall be performed by an independent Geotechnical Engineering Consultant ("Geotechnical Engineer").
2. The Geotechnical Engineer is responsible for all testing, sampling and inspection.
3. The Geotechnical Engineer is responsible for approving all materials, installation and procedures.
4. The Contractor is responsible for providing these services.
5. The Contractor is responsible for all coordination and scheduling with the Geotechnical Engineer.

1.3 SUBMITTALS

A. Materials Certificates:

1. Materials certificates must be signed by material supplier and Contractor.
2. Certificates must be submitted for all asphalt paving items.
3. Certificates must state that each material item meets or exceeds specified requirements.

B. Job Mix Formulas:

1. Submit a job mix formula (JMF) for all asphalt paving work.
2. The JMF must state that the mix meets the requirements of INDOTSS Section 402 as specified herein.
3. The JMF must include the following, at a minimum:

a. Aggregate type, source and gradation.
b. Type and percent of binder (actual and extracted).
c. Voids in mineral aggregate (VMA).
d. Voids filled with asphalt (VFA).
e. Percent of air voids.
f. Density.
g. Amount of recycled materials in intermediate course, if applicable.

C. Other:

1. Testing and inspection reports.

PART 2 - PRODUCTS

2.1 PAVING

A. Aggregates:

1. Fine aggregates: INDOTSS Section 904.02
2. Coarse aggregates: INDOTSS Section 904.03
3. All crushed stones for the aggregate base shall be per the INDOTSS gradations and CAPP specifications.
4. Commercial grade aggregates are not acceptable.

B. Asphalt Materials:

1. General: INDOTSS Section 402.
2. Binder: Performance Graded Asphalt Binder, INDOTSS 902.01 (a).
3. Prime coat: Asphalt Emulsion, AE-PMP, INDOTSS 902.01 (b).
4. Tack coat: Asphalt Emulsion, AE-PMT, INDOTSS 902.01 (b).
5. Recycled asphalt materials:

a. Do not exceed the maximum allowable amount per INDOTSS 401.06.

C. Mixtures:

1. Percent of aggregates passing sieves.

Sieve Size	**Surface**	**Intermediate**
19.0 mm (3/4 in.)	100	100
12.5 mm (1/2 in.)	100	70-92
9.5 mm (3/8 in.)	96-100	50-75
4.75 mm (No. 4)	75±5	40±5
2.36 mm (No. 8)	36-66	18-45
1.18 mm (No. 16)	19-50	10-36
600 mm (No. 30)	10-38	6-26
300 µm (No. 50)	5-26	2-18
150 µm (No. 100)	2-17	0-11
75 µm (No. 200)	0-5	0-4
Percent of Bitumen	5.7 – 7.2	4.1 – 5.2

Percent Air Voids	4.0	4.0

2. The contractor is responsible for adjusting the mix, if required for proper placement and performance. Any such modifications shall be approved by the Architect/Engineer.

D. Unless otherwise indicated or required by jurisdictions having authority, a prime coat is to be used at the discretion of the Contractor, as necessary and appropriate to ensure proper protection and placement of paving.

PART 3 - EXECUTION

3.1 GENERAL

A. Protection:

1. Provide all necessary barricades and markers to keep vehicular traffic off freshly placed paving until the pavement has cooled and hardened for at least twelve hours.
2. During paving operations, exercise care not to chip, spall, scar or otherwise damage curbs, walks, buildings and other work. Any such damage shall be repaired to the Owner's satisfaction by the Contractor at the Contractor's expense.

B. Job Conditions:

1. Weather limitations:

a. Apply prime and tack coats when ambient temperature is above 50 degrees F, (10 degrees C), and when temperature has not been below 35 degrees F, (1 degree C), for 12 hours immediately prior to application. Do not apply when the base is wet or contains an excess of moisture.
b. Place intermediate course when air temperature is above 30 degrees F, (-1 degree C), and rising.
c. Place surface course when air temperature is above 40 degrees F, (4 degrees C), and when intermediate course is dry.

2. Asphalt temperature: The paving mixture shall be placed and compacted at a temperature between 250˚F (121˚C) and 300˚F (149˚C).

3.2 PAVING

A. Grading and Drainage:

1. Ensure positive and adequate grading for all work. Notify Architect/Engineer of any concerns or conflicts prior to installation.

B. Preparation:

1. Immediately prior to placing the base course, proof-roll the sub-base with a pneumatic tire roller.
2. Remove and replace all areas of failures, irregularities and roller marks in the sub-base so that it meets the compaction requirements of Division 31 Section “Earthwork”.

C. Placement:

1. Aggregate base course:

   a. Place base course only on solid, dry and unfrozen subsurface.
   b. Unless specified otherwise on the Drawings, the aggregate base shall consist of the following minimum requirements: a 4” layer of compacted No. 53 crushed stone on top of a 4” layer of compacted No. 2 crushed stone, for a minimum overall compacted thickness of 8”.

2. Intermediate course:

   a. Immediately prior to the placing of the intermediate course, proof roll the aggregate base course by making a minimum of two passes over the entire areas with a pneumatic tire roller. Remove and replace all areas of failures, irregularities and roller marks in the base course.
   b. Place intermediate courses only on clean, solid, dry and unfrozen sub-course.
   c. Spread each course concurrently, within practical limits, using mechanical spreaders.
   d. Intermediate course shall have minimum 3” compacted thickness, unless specified otherwise on the Drawings.

3. Surface course:

   a. Place surface course only on clean, solid, dry and unfrozen sub-course.
   b. Apply tack coat to the underlying surface as necessary to ensure proper placement.
   c. Spread each course concurrently, within practical limits, using mechanical spreaders.
   d. Surface course shall have minimum 1 1/2” compacted thickness, unless specified otherwise on the Drawings.

4. Abutting existing asphalt pavement:

   a. Saw cut the existing pavement straight and true.
   b. Ensure new pavement elevation matches existing.
   c. Ensure joints are clean and tight, with no gap or traveling.
   d. Refer to Drawings for abutment detail.

D. Compaction:

1. Aggregate base course:

   a. Prior to compacting, remove any foreign materials that have become incorporated into the base course.
   b. Thoroughly compact base course to the proper elevations and density.

2. Intermediate and surface courses:

    a. Prior compacting, remove any foreign materials that have become incorporated into the paving courses.
    b. Follow the spreading processes immediately with rollers of sufficient size to compact the paving courses to their proper densities and elevations.
    c. Ensure no low spots exist which might retain water.
    d. Perform additional rolling as required to produce a well compacted, crack-free, fissure-free surface of uniform texture, without evidence of tool or machine marks.
    e. Do not roll over the unprotected edge of a spread.

3.3 PATCHING

A. Saw cut around areas to be patched or repaired.

B. Remove existing pavement down to sound base, excavating with vertical faces.

C. Replace with a full-deep patch, making neat, even and crisp joint with adjacent areas.

D. Patched areas shall match adjacent areas in texture and grade.

3.4 FIELD QUALITY CONTROL

A. Coordination:

1. The Geotechnical Engineer shall be present to always observe and perform tests paving work is in progress.
2. Contractor shall provide a minimum of 72-hour notice to the Geotechnical Engineer before each operation requiring testing or inspection.

B. Testing:

1. Geotechnical Engineer shall take one sample per lift of asphalt concrete for each 5,000 square feet of pavement area, with a minimum of two samples per lift of asphalt concrete each day before paving operation. The following laboratory tests shall be performed:

    a. Aggregate gradation.
    b. Binder content.
    c. Density.
    d. Percent air voids.

2. Geotechnical Engineer shall test in-place compacted asphalt for density with nuclear penetrometer (backscatter, no drilling of pavement). Geotechnical Engineer shall take one reading per lift of asphalt concrete for each 1,000 square feet of pavement area, with a minimum of two readings per lift of asphalt concrete each day. The in-place density shall be a minimum of 94% of the maximum theoretical density per the Job Mix Formula.

C. Thickness:

1. The in-place compacted thickness will not be acceptable if it exceeds the following allowable variation from the required thickness:

    a. Base course: ½".
    b. Intermediate course: ¼".
    c. Surface course: ¼".

D. Surface Smoothness:

1. The finished surface will not be acceptable if it exceeds the following tolerances, using 10' straightedge applied parallel with and at right angles to centerline of paved area:

    a. Base course: 1/4".
    b. Intermediate course: 1/8".
    c. Surface course: 1/8".
    d. Finished grade shall be within ½" of grade specified on the drawings.

E. Unsatisfactory Pavement:

1. The contractor is responsible for removing and replacing pavements that do not meet the Specifications herein, as well as any pavement deemed unacceptable by Architect/Engineer, Geotechnical Engineer or Owner.
2. The Contractor is responsible for the cost of any re-testing due to unsatisfactory pavement replacement.

3.5 COMPLETION OF WORK

A. At the completion of paving operations, the Contractor shall perform the following:

1. Remove all protective barricades and markers.
2. Clean paving materials from all structures, curbs, walks, mechanical and electrical items, and other surfaces to which the paving is incidental and not intended.

SECTION 32 13 00
SITE CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Cast-in-place concrete outside of the building for site improvements including, but not limited to, the following:

   a. Curbing, gutters, walks and pavement.
   b. Equipment pads, light pole bases, utility trench protection and bollard anchorage.
   c. Retaining walls, vaults, utility structures.

2. Precast concrete wheel stops.

1.2 QUALITY ASSURANCE

A. Any work in public right-of-way or other areas subject to the jurisdiction of anybody shall be performed either to the requirements of that jurisdiction or to the requirements of this Specification, whichever is more stringent.

B. Qualifications of Workers:

1. Provide at least one person who shall always be present during the execution of this portion of the work.
2. This person should be thoroughly familiar with the type of materials being installed and the best methods for their installation.
3. This person shall direct all work performed under this Section.

C. Manufacturer: manufacturer of ready-mixed concrete products complying with ASTM C94 requirements for production facilities and equipment.

D. Codes and Standards:

1. In addition to complying with all pertinent codes and regulations, comply with all pertinent requirements of the following American Concrete Institute Publications:

   a. “Building Code Requirements for Reinforced Concrete” ACI 318-99.
   b. “Recommended Practice for Cold Weather Concreting” ACI 306 R-88.
   c. “Recommended Practice for Hot Weather Concreting” ACI 305 R-91.
   d. “Recommended Practice for Evaluation of Strength Test Result for Concrete” ACI 214-77.
   e. “Standard Practice for Selecting Proportions for Normal, Heavy Weight, and Mass Concrete” ACI 211.1-98.

2. Where provisions of pertinent codes and standards conflict with this Section, the more stringent provisions shall govern.

E. Testing and Inspection:

1. All testing and inspection shall be performed by an independent Geotechnical Engineering Consultant ("Geotechnical Engineer").
2. The Geotechnical Engineer is responsible for all testing, sampling and inspection.
3. The Geotechnical Engineer is responsible for approving all materials, installation and procedures.
4. The Contractor is responsible for providing these services.
5. The Contractor is responsible for all coordination and scheduling with the Geotechnical Engineer.

1.3 SUBMITTALS

A. Mix Designs.

B. Testing and inspection reports.

C. Chloride ion tests or total chloride tests (with generally accepted method to relate total chloride to chloride ion) to show compliance with maximum ion concentrations.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Concrete:

1. Cement: ASTM C150, Type I or III.
2. Fine aggregate: ASTM C33.
3. Coarse aggregate: ASTM C33.
    a. Crushed stone shall be used for exterior concrete, unless otherwise noted.
    b. Maximum aggregate size is 3/4 of the minimum clear spacing (per code) between reinforcing bars or between bars and forms.
4. Water: Clean, fresh, potable.
5. Air-entraining admixture: ASTM C260.
6. Fly ash: ASTM C618.
7. Fiber mesh:
    a. Fiber mesh shall be polypropylene fibrillated, and mix shall contain a minimum of 1.5 lbs. of fiber per cubic yard of concrete, unless otherwise prescribed by manufacturer and approved by Architect/Engineer.
    b. Fiber shall be mixed at batch plant; field mixing is not acceptable.
8. Sealer/curing compound:

a. ASTM C309, Type I, clear.
b. Compatible with texture of surfaces.

B. Mix Design:

1. Strength: 4000 psi, ready mixed in accordance with ASTM C94.
2. Slump: 4" +/- 1".
3. Minimum cement content: 517 pounds per cubic yard (adjust for air entrainment)
4. Fly ash shall not replace more than 20% of the cement.
5. Maximum water/cement ratio: 0.40.
6. Air entrainment: 6%. The percentage of air content shall be determined in accordance with the admixture manufacturer's recommendations based on aggregate size and moderate level of exposure.
7. White concrete must have a 3-year aged minimum SR value of 0.28, or initial SR value of at least 33.

C. Other Requirements:

1. Proportions of materials for concrete shall be established in accordance with Section 5.2 of ACI 318 (Latest edition).
2. Follow ACI 211 and ACI 301 to determine the water-cement ratios.
3. Concrete shall not exceed maximum chloride ion content for corrosion protection as defined in ACI 318 Table 4.4.1.
4. Do not use calcium chloride or admixtures containing soluble chlorides.
5. Do not use re-tempered concrete or concrete that has been contaminated by foreign materials.
6. All exterior concrete shall be air entrained.
7. Unless otherwise indicated, all reinforcing for concrete pavement shall be epoxy coated.

D. Isolation Joints: Unless specified otherwise on Drawings, use the following:

1. Cork isolation joints with sealant:

a. Joint material: AASHTO M213; 1/2 inch thick.
b. Joint sealer: AASHTO M173; polyurethane with color matching adjacent concrete
c. Application: Use cork isolation joints with sealant for isolation joints for sidewalks, drop-offs, decorative concrete pavement areas, areas adjacent to buildings, structures, and columns.

2. Asphalt saturated cellulosic fiber:

a. Joint material: AASHTO M213; 1/2 inch thick.
b. Do not place sealant on asphalt saturated cellulosic fiber isolation joints.
c. Application: Use this type of isolation joint for items such as curbs and walks, which are in areas not adjacent to buildings, structures and columns, etc. Do not use in areas of colored concrete.

3. Contact Architect/Engineer if further direction is needed for proper application in specific areas.

STEEL REINFORCING

E. Reinforcing Bars:

1. Reinforcing bars and dowels: ASTM A615, Grade 60.
2. Reinforcing to be welded: ASTM A615, Grade 40.
3. Epoxy coated bars and dowels: ASTM A884, Grade 60.

F. Welded Wire Fabric:

1. ASTM A185 6”x6” xW1.4xW1.4, unless otherwise indicated.
2. Provide in flat sheets, not rolled form.

G. Other Embedded Items: Provide standard manufactured products as approved by the Architect/Engineer.

H. Bar Supports:

1. Conform to the requirements of the “Manual of Standard Practice”, published by the Concrete Reinforcing Steel Institute.
2. Accessories shall be plastic protected Class “C” for all concrete exposed in the finished structure, except as specified below.
3. Accessories shall be Class “A”, bright basic, for unexposed concrete.
4. Utilize Call “E,” stainless steel bar supports, for exterior concrete to be finished by sand blasting.
5. Do not use continuous highchairs. Use individual highchairs laced with bottom cross bars plus #5 support bars. (Minimum of 2 rows of support for all reinforcing).
6. Supports must be capable of supporting construction loads without failing. Contractor to furnish additional supports at no cost to the Owner if in the Architect/Engineer estimation the supports are not adequate.

2.2 FORMWORK

A. Form Lumber:

1. All form lumber in contact with exposed concrete shall be new or of sufficient quality to ensure an unblemished texture.
2. All form lumber shall be plywood, board lumber, hardwood or other material of grade or quality to best suit each particular usage.

B. Fiber Forms:

1. Fiber forms may be utilized to construct round columns/piers.
2. Seamless forms must be used for concrete exposed in the finished structure.
3. Standard seamed tubes are permissible for non-exposed concrete.

C. Form Release Agent:

1. Standards:

a. The release agent shall be similar to Symons Manufacturing Company Magic Kote.

b. Grace Construction Products Formshield Chemical Release Agent.

D. Bracing/Shoring/Studs:

1. Such supports should be selected for the economy consistent with safety requirements and the quality required in the finished work. The Contractor is responsible for the design, illustration, safety and serviceability of all formworks.

E. Other Materials: All other materials, not specifically described, but required for proper completion of concrete formwork, shall be selected by the Contractor subject to advance acceptance by the Architect/Engineer.

2.3 OTHER

A. Precast Concrete Wheel Stops:

1. Reinforced, precast concrete units 6” high x 9” wide x 7’ long.
2. Provide minimum 2-#4 deformed bars 80” in length.
3. Provide chamfers on the top edges and drainage slots on the underside.
4. Anchor pins shall be 5/8” diameter deformed bars minimum 18” long.

PART 3 - EXECUTION

3.1 GENERAL

A. Job Conditions:

1. Extreme temperature conditions:

a. When extreme hot or cold weather conditions occur, or are expected to occur, which might detrimentally affect concrete, employ handling and placing techniques to guard against such effects.
b. Comply with the recommendations of American Concrete Institute for hot and cold weather concreting. ACI Publications ACI 306 and ACI 305.

2. Inclement weather: Unless adequate protection is provided, do not place exterior concrete during rain, sleet or snow.

B. Preparation and Verification:

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly begin.
2. Verify all items to be embedded in concrete are in place.
3. Verify concrete may be placed on the lines and elevations indicated on the Drawings, with all required clearances for reinforcement.
4. Verify forms may be constructed in accordance with all pertinent codes and regulations, the referenced standards and the original design.
5. Remove all dirt, oil, paint, loose rust and other foreign materials from the concrete reinforcement prior to placement.

6. In the event of discrepancy, contact Architect/Engineer immediately and do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.
7. Verify approval of mock-ups by Owner and Architect/Engineer before beginning work.

C. Other: Unless otherwise indicated, all exterior concrete shall be placed on a compacted aggregate fill per the following:

1. Minimum depth equal to the concrete thickness for pavement, walks and other slabs on grade.
2. Minimum 6” depth of fill for curbing and other support bases.

3.2 FORMWORK

A. Protection:

1. Use all necessary and appropriate means to protect formwork materials before, during and after installation.
2. Protect the installed work and materials of all other trades.
3. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to Owner or other trades.

B. General:

1. Forms shall have sufficient strength and be sufficiently tight to prevent leakage of mortar.
2. The design and engineering of the formwork shall be the responsibility of the Contractor.
3. Refer to this Section for construction joint requirements.
4. Tolerances: Construct all forms straight, true, plumb and square within the tolerances recommended by ACI 347.
5. Embedded items: Set all required steel frames, angles, grilles, bolts, reglets, inserts, pipe, conduit and other such items required to be anchored in the concrete before the concrete is placed.
6. Wetting: Keep forms sufficiently wetted to prevent joints opening before concrete is placed, except as recommended in ACI 306 R-78, “Recommended Practice for Cold Weather Concreting.”

C. Layout:

1. Form all required cast-in-place concrete to the shapes, sizes, lines and dimensions indicated on the Drawings.
2. Exercise particular care in the layout of forms to ensure the proper finish structure, size and shape.
3. Make proper provisions for all openings, offsets, recesses, anchorage, blocking and other features of the Work as shown or required.
4. Carefully examine the Contract Documents and consult with other trades as required to ensure proper provisions for openings, reglets, chases, and other items in the forms.

D. Bracing and Shoring:

1. Properly brace and tie the forms together to maintain position and shape and to ensure safety to personnel.
2. Construct all bracing, supporting members, and centering of ample size and strength to safely carry, without excessive deflection, all dead and live loads to which they may be subjected.
3. Properly space the forms apart and securely tie them together, using metal spreader ties that give positive tying and accurate spreading.
4. All shoring shall extend to adequate foundations.
5. The Contractor is responsible for both the proper design and installation of all bracing and shoring, to properly ensure the safety and serviceability of the structure.

E. Plywood Forms:

1. Assembly: Nail the plywood panels directly to studs and apply in a manner to minimize the number of joints.
2. Joints: Make all panel joints tight but joints with all edges true and square.

F. Reuse of forms:

1. Reuse of forms shall in no way delay or change the schedule for placement of concrete from the schedule obtainable if all forms were new.
2. Reuse of forms shall in no way impart less structural stability to the forms, nor less acceptable appearance to finished concrete.

G. Cleaning:

1. Before concrete is placed the forms shall be cleaned of all debris, ice, snow, frost, and standing water.
2. Remove all loose earth materials from the surfaces of earth forms.

H. Removal of Forms:

1. Forms should be removed in such a manner to ensure complete safety of the structure.
2. Formwork for columns, walls, and other parts not supporting the weight of the concrete may be removed as soon as the concrete has hardened sufficiently to resist damage from removal operations with the following minimums:

    a. Formwork for walls and columns shall remain in place a minimum of two (2) days during which the temperature of the air surrounding the concrete must be above 50˚ F.
    b. This minimum time period represents a cumulative number of days or fractions thereof.
    c. Such formwork for concrete placed during cold weather with surrounding air temperatures 50˚ F shall remain in place one day after the artificial heating and/or freeze protection is discontinued/removed.

3. Forms and false work:

    a. Any supporting vertical loads shall remain in place until the members have acquired sufficient strength to safely support their weight and any superimposed loads.

b. Such forming shall remain in place until the concrete has attained its specified 28-day strength as indicated by the test cylinders unless re-shores are installed in sufficient quantities to transmit the loads to adequate foundations without stressing the particularly cured structure.
c. The requirements of ACI 305 and 306 must also be met before forms may be removed.
d. Removal of forms and false work is the responsibility of the Contractor, and the Contractor shall bear full responsibility for this operation.
e. Concrete damaged by too early removal of forms or false work shall be repaired or replaced as directed by the Architect/Engineer.

4. Concrete exposed by form removal during the curing period shall be cured by one of the methods specified in this Section.
5. Curing compounds are not permitted in certain locations. In these cases, curing is to be by an alternate method. Refer alternate methods in this Section.
6. In no case shall the superimposed load or relatively new concrete exceed 50 pounds per square foot unless proper shoring to suitable foundations is installed as required by the Architect/Engineer.
7. Use all necessary and appropriate means to protect workman, public, the installed work and materials of other trades, and the complete safety of the structure.
8. Cut nails and similar fasteners off flush and leave all surfaces smooth and clean.

3.3 REINFORCEMENT

A. Protection:

1. Use all necessary and appropriate means necessary to protect concrete reinforcement before, during and after installation and to protect the installed work and materials of all other trades.
2. Store in a manner to prevent excessive rusting and fouling with dirt, grease, and other bond-breaking coatings.
3. In the event of damage, immediately make all repairs and replacements necessary at no additional cost to the Owner.

B. Placing:

1. Reinforcing bars:

a. Positively secure reinforcing bar supports and tie or otherwise anchor bars to prevent displacement by construction loads or by the placing of concrete.
b. Splice bars with a minimum lap of 40 bar diameters, unless otherwise indicated.
c. Use mechanical splicers/couplers where quantity of reinforcement restricts placement of concrete if lapped splices are utilized.
d. Splice bars only at locations indicated on the Contract Documents and shop drawings.
e. Both shop and field bending shall be accomplished without heating the bars.
f. Minor placing adjustments can be made to avoid interference with other reinforcement and/or embedded devices. The final arrangement, however, is subject to review and acceptance of the Architect/Engineer.

g. Immediately notify the Architect/Engineer if reinforcing cannot be installed as shown on drawings. No cutting of reinforcing shall occur unless the Architect/Engineer has reviewed and approved such cuts.

2. Embedded devices:

a. Set hangers, anchor bolts, inserts, and other embedded devices accurately in place.
b. Make sure all such devices are installed so that the work to be attached thereto will be properly received.
c. Keep devices straight and true-to-line.

3. Welded wire fabric:

a. Splice by lapping each section at least two meshes wide plus one wire with the adjacent section, but not less than 8".
b. Extend fabric into all openings, doorways, and the like, unless otherwise indicated.

C. Final Cleaning:

1. Prior to placing concrete, remove all loose mill and rust scale, oil, mud, ice, and other foreign coatings which destroy and/or reduce bond between the reinforcement and concrete.
2. Use wire brushing and/or other suitable methods to complete cleaning operations.

3.4 CONCRETE PLACEMENT

A. Preparation:

1. Remove all wood scraps, ice, snow, frost, standing water and debris from the area in which concrete will be placed.
2. Thoroughly wet the surface of excavations (except in freezing weather), coat forms with release agent and remove all standing water.

B. Method:

1. Convey concrete from mixer to place of final deposit by methods that will prevent separation and loss of materials.
2. For chuting, pumping and pneumatically conveying concrete, use only equipment of such size and design as to ensure a practically continuous flow of concrete at the delivery end without loss or separation of materials.
3. Deposit concrete as nearly as possible in its final position to avoid segregation due to re-handling and flowing.
4. Use screed poles or similar devices to ensure that all slabs are cast at the proper elevations and that specified tolerances are maintained.

C. Rate of Placement:

1. Place concrete at such a rate that concrete is always plastic and flows readily between reinforcement.

2. Once placing is started, carry it on as a continuous operation until the placement of the panel or section is complete.
3. Do not pour a greater area at one time than can be properly finished. This is particularly important during hot or dry weather.

D. Consolidation:

1. Thoroughly consolidate all concrete by mechanical vibration, hand, and other suitable means during placement, working it around all embedded fixtures and into corners of forms.
2. Do not over-consolidate when using mechanical vibration to cause separation of the aggregate.

3.5 JOINTS

A. Unless otherwise shown on Drawings, joints shall meet the following minimum requirements. If questions or concerns exist, contact Architect/Engineer for direction.

B. Isolation Joints:

1. General:

a. Tool concrete on both sides of joint (1/4" radius).
b. Install joint material to full depth of concrete.
c. See Part 2 Products for type of joint material to be used.
d. Install sufficient smooth doweling reinforcing to prevent differential movement in curbing, walks and pavement.
e. Do not dowel into such items as columns and exterior building walls/foundations, unless specified on drawings. Refer to structural drawings also.
f. Unless otherwise indicated, install isolation joints per the following minimum requirements.

2. Curbing:

a. Provide each side of inlet castings.
b. Provide at all tangent points and changes in direction.

3. Walks:

a. For walks 6 feet in width and less, provide at intervals not exceeding 25 feet.
b. For larger walks and plaza areas, provide at intervals not exceeding 20 feet in any direction.

4. Pavement: Provide at intervals not exceeding 20 feet in any direction.
5. Retaining walls: Provide at intervals not exceeding 40 feet per linear length of wall.

6. Other:

a. Provide accessible ramps, buildings, columns, bollards, castings, drains and other locations as necessary to prevent excess cracking or displacement.

b. Contact Architect/Engineer if any areas of question or concern are encountered.

C. Control Joints:

1. General:

a. Control joint depth shall be minimum ¼ of the slab thickness.
b. Continue one half of reinforcing through joint.
c. Install joints by tooling or saw cutting as described below, unless otherwise indicated.
d. Construction joints may be used where appropriate.

2. Curbing: Saw cut at intervals not exceeding 10 feet.
3. Walks: Tool joints at intervals not-to-exceed 5 feet in any direction.
4. Pavement: Saw cut at intervals not exceeding 18x pavement thickness feet in any direction.
5. Retaining walls: Provide at intervals not exceeding 20 feet per linear length of wall.
6. Other:

a. Provide accessible ramps, columns, bollards, castings, drains and other locations as necessary to prevent excess cracking.
b. Contact Architect/Engineer if any areas of question or concern are encountered.

D. Construction Joints:

1. Joints shall be made with properly constructed bulkheads and formed keyways.
2. Extend reinforcing through construction joints, unless otherwise indicated.
3. The Contractor shall consult with the Architect/Engineer before starting concrete work to establish a satisfactory placing schedule and to confirm joint locations.
4. Retaining walls: Provide at intervals not exceeding 80 feet per linear length of wall.

E. Tooled Joints and Scoring:

1. Make straight, clean and non-ragged.
2. Tool or score concrete on both sides of joint (1/4” radius).
3. Provide windowpane joint finishes unless otherwise indicated.

F. Bond Break: 15 per 100 square foot building paper.

3.6 FINISHING

A. Unless otherwise indicated, provide a light-broom finish on all exterior slabs, walks and stairs.

B. Provide a dry-rub finish for all exposed concrete walls, curbs or edge surfaces.

3.7 CURING

A. Formed Surfaces:

1. Cure formed surfaces by either of the following methods:

a. Leave forms in place until the cumulative number of days or fractions thereof, not necessarily consecutive, has totaled seven days during which the temperature of the air in contact with the concrete is 50˚F or above.
b. Remove forms at an earlier time but apply curing compound to concrete surfaces.
c. Apply compound in accordance with manufacturer's recommendations.

2. If curing compound is not used and the forms are stripped prior to 7 days curing, the following methods are approved:

a. Ponding or continuous sprinkling.
b. Continuously wet mats.
c. Sand kept continuously wet.

3.8 PATCHING

A. Patch existing concrete to receive new finish in a manner so that existing and patched surfaces are smooth and continuous and have a uniform appearance.

3.9 QUALITY ASSURANCE

A. Coordination:

1. A representative from the Geotechnical Engineer shall be present to always observe and perform tests. The site concrete work is in progress.
2. The contractor shall provide a minimum of 72 hours' notice to the Geotechnical Engineer before each operation requiring testing or inspection.

B. Inspection:

1. Immediately after forms and curing membranes have been removed, inspect all concrete surfaces and patch all pour joints, voids, rock pockets, form tie holds and other imperfections before the concrete is thoroughly dry.
2. If the defects are serious or affect the strength of the structure, or if patching does not satisfactorily restore the quality and appearance of the surface, the concrete shall be removed and replaced complete, at no additional cost to the Owner.

C. Testing: The Geotechnical Engineer shall perform the following:

1. Compression tests:

a. Secure three standard cylinders from each pour of concrete, in accordance with ASTM C31, and cure under standard moisture and temperature conditions.
b. Test in accordance with ASTM C39.
c. Test one cylinder at 7 days and two cylinders at 28 days.
d. Submit duplicate test reports of results from testing to Architect/Engineer.
e. Take steps immediately to evaluate unsatisfactory test results.
f. In the event of unsatisfactory test results, an investigation as outlined in Section 5.6.5 of ACI 318-99 shall be employed.

2. Slump and air entrainment:

   a. Perform slump tests in accordance with ASTM C143.
   b. Determine the air content of concrete in accordance with ASTM standards.
   c. Submit results of slump tests and air content on each compression test report.

3. Should additional testing be required because of unsatisfactory test results, the Contractor is responsible for the costs incurred for correcting any deficiencies and the cost of additional testing.

3.10 DETECTABLE WARNING SURFACE

A. Shall be installed per manufacturer requirements.

B. The contractor shall install the warranty system for a period of three years from the date of substantial completion.

C. Contractor shall provide the owner with detectable warning surface units equal to 10% of the total units installed for future repairs.

SECTION 32 31 13
CHAINLINK FENCES & GATES

PART I - GENERAL

1.1 SUMMARY

A. Section Includes:

1. All permanent chain link fencing as shown as indicated or implied by Contract Documents.

B. Related Sections:

1. Division 31 Section “Earthwork”.
2. Division 32 Section “Site Concrete”.
3. Division 01 for temporary construction fencing.

1.2 QUALITY ASSURANCE

A. Standard:

1. Anchor Fence Division, Anchor Post Products, Inc.
2. Cyclone Fence Division, United States Steel.

B. All fencing shall conform to CLFM (Chain Link Fence Manufacturers Institute) recommendations to ASTM F567 and ASTM F900.

1.3 SUBMITTALS

A. Shop drawings and product information for the following:

1. Installation details.
2. Dimensional data, including plan review layout.
3. Gate details.
4. Foundation details.
5. Grounding details and locations.

B. Certificates:

1. Manufacturer’s certification that materials meet specification requirements, including concrete.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. Fence components shall be galvanically compatible.
2. Minimum zinc weight shall be 1.8 ounces per square foot for all fence components.

B. Chain Link Fabric:

1. FS RR-F-00191/1, Type I, zinc coated steel.
2. One piece fabric, full height. See plans for height of fence.
3. Mesh size: 2” diamond mesh.
4. Wire diameter: 9 gauge.
5. Selvages: Knuckled at both selvages.

C. Framework:

1. Posts: FS RR-F-00191/3, Type I, Class 1, steel pipe.
2. Rails and braces: FS RR-F-00191/3, Type II, Class 1, steel pipe.
3. Provide continuous top and bottom rails.
4. Equip each gate post, end post, pull post, and both sides of corner posts with brace rails and adjustable 3/8” diameter truss rods.
5. Accessories: FS RR-F-00191/4, Type 1 caps, rail ends, rail sleeves, wire ties and clips, brace bands, tension bands, tension bars, tension wire, barbed wire, barbed wire support arms, miscellaneous bolts, nuts, and washers.

D. Grounding Accessories:

1. Grounding rods shall be ¾” diameter copper clad steel rods, 10’ long.
2. Connection wire shall be stranded copper wire not less than No. 4 AWG.
3. Provide approved clamp type fittings for rods and fence posts.
4. Provide flexible bond straps for gates and gate posts.

E. Miscellaneous:

1. Provide a lockable latch for each gate, unless otherwise indicated or directed by Owner.
2. For each double swing gate, install a center stay post anchored in the ground with gate rod to secure the center of the gates.

PART 3 - EXECUTION

3.1 PREPARATION

A. Inspection:

1. Prior to all work of this Section, carefully inspect the installed work of all other trades and verify that all such work is complete to the point where this installation may properly commence.
2. Verify that all fences may be installed in accordance with all pertinent codes and regulations, the original design, and the referenced standards.

B. Discrepancies:

1. Do not proceed with installations in areas of discrepancy until all such discrepancies have been fully resolved.

3.2 INSTALLATION

A. Posts:

1. All posts shall be set in minimum 12” diameter x 36” deep hole. After the posts have been plumbed vertically, the hole shall be filled with poured concrete. Exposed surface of concrete shall be crowned to shed water.
2. Post braces shall be provided for each gate corner, pull and end post.
3. Post spacing shall be maximum 10’-0” on centers unless otherwise shown on the Drawings.

B. Fence Fabric:

1. Fabric shall be stretched tight and uniform.
2. Fabric shall be positioned approximately 1” above ground level or pavement surface at post.
3. Join ends of fabric by weaving with single strand of fabric wire to form continuous mesh pattern.
4. Attach fabrics to terminal posts using tension bars and tension bands.
5. Thread tension bars through fabric.
6. Tension band spacing shall not exceed 15” O.C.
7. Attach fabric to line posts using clips at spacing not to exceed 15” O.C.
8. Attach fabric to rails at 24” O.C.

3.3 GROUNDING

A. Location:

1. Each fence post to be grounded shall be connected to a grounding rod driven not less than 11’ into the ground with rod located at the fence line, or as near the fence line as possible.
2. Unless shown otherwise on Drawings, ground one out of every eight posts, with a minimum of one grounded post for fence with less than eight posts.
3. Disperse ground rods in even pattern throughout length of fence.

3.4 ADJUSTMENT

A. Installation:

1. Adjust brace rails and tension rods for rigid installation.

2. Tighten all hardware, fasteners, and accessories.
3. Remove excess material from the site.

SECTION 33 05 00
COMMON WORK RESULTS FOR UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. All utility systems 5 feet outside the building line, as shown or implied in the Contract Documents and as required for the Work, including but not limited to:

   a. Water distribution.
   b. Sanitary sewage.
   c. Storm drainage.

2. The contractor is responsible for all utility work as shown on contract documents or as required, unless specifically indicated otherwise.

B. Related Sections:

1. Division 02 Section “Maintenance of Existing Conditions”.
2. Division 33 Section “Site Water Distribution”.
3. Division 33 Section “Sanitary Sewers”.
4. Division 33 Section “Storm Drainage”.

1.2 SUBMITTALS

A. Warning Tape System.

1.3 DEFINITIONS

A. Utilities include all underground and above ground piping, conduits, cables and related structures and appurtenances. Utilities also include sewers.

B. “Utility Companies” as referenced herein includes all public, private and other companies and agencies supplying utility services or having jurisdiction over such services.

1.4 QUALITY ASSURANCE

A. All materials and installation shall meet the requirements of utility companies.

B. All installations shall meet the requirements and recommendations of the material manufacturers and suppliers.

C. All installations shall meet the requirements and recommendations of the material manufacturers and suppliers.

1.5 COORDINATION

A. All installations shall meet the requirements and recommendations of the material manufacturers and suppliers.

B. Verify all proposed utility work with utility companies prior to beginning work.

C. Provide sufficient notice to utility companies for all work affecting the services of utility companies.

D. The contractor shall always maintain complete and operable utility services.

E. Coordinate timing of utility work and temporary measures with Owner and Utility Companies.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Warning Tape:

1. Verify warning tape requirements with Utility Companies, Owner and Architect/Engineer prior to installation. Unless otherwise indicated or required, provide per the following.
2. Color:

a. Blue: Water, fire and chilled water lines.
b. Red: Electric.
c. Orange: Telecommunications.
d. Yellow: Gas, oil, steam, dangerous materials.
e. Green: Sanitary laterals

3. Use one of the following systems:

a. Non-detectable warning tape with toning wire below:
1) Acid- and alkali-resistant polyethylene warning tape manufactured for marking and identifying underground utilities, 6” inches wide and 4 mils thick.
2) Label: continuous “CAUTION—BURIED (name of utility) BELOW”. Toning wire: 12-gauge copper wire with protective jacket for corrosion protection.
3) Unless otherwise indicated, install warning tape 18” below finished grade with toning wire 12” below warning tape.
4) Turn up and tie toning wire as indicated or as required by Utility Companies and Owner.

b. Detectable warning tape:

1) Acid- and alkali-resistant polyethylene warning tape manufactured for marking and identifying underground utilities, 6” inches wide and 4 mils thick with metallic core with protective jacket for corrosion protection.

2) Label: continuous “CAUTION—BURIED (name of utility) BELOW”.
3) Unless otherwise indicated, install warning tape 18” below finished grade.

B. Unless otherwise indicated or required, warning tape does not apply to sewers or subsurface drains.

C. Refer to individual Sections for further utility product specifications.

PART 3 - EXECUTION

3.1 REQUIREMENTS

A. General:

1. New utilities shall be installed and operational prior to displacing existing utilities. Service must be always maintained.
2. All work shall be always made readily accessible for inspection by Utility Companies and Owner during working hours.
3. Refer to Division 31 Section “Earthwork” for excavation, trenching and backfilling.

B. Preparation:

1. Verify existing utilities and topographic conditions prior to trenching, excavation or installation.
2. If existing field conditions prevent installation per the contract documents, notify the Architect/Engineer immediately.
3. Review proposed utility work prior to installation and notify Architect/Engineer immediately of any conflicts or concerns.
4. Mark underground utilities prior to beginning any excavation or other underground work around proposed activity.

C. Installation:

1. Provide and maintain all necessary stakes, benchmarks and batter boards for installing utilities to alignment and grades.
2. During backfilling, install continuous warning tape over all utilities. Install tape full length of the utility and terminate properly to allow for charging of tape or toning wire. If utility is installed by Utility Companies, provide warning tape and coordinate installation.

SECTION 33 10 00
SITE WATER DISTRIBUTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Water and fire services outside of the building.

B. Related Sections:

1. Division 33 Section “Common Work Results for Utilities”.
2. Division 28 Section “Fire Alarm” for fire protection supervision devices.

1.2 SUBMITTALS

A. Product Data for the following:

1. Pipe, fittings and joining materials.
2. Transition fittings.
3. Valves, hydrants and tapping sleeves.
4. Other water specialties and accessories required for Work.

B. Water line cleaning and test reports.

C. Operation and Maintenance Data: In addition to items specified in Division 01 Section “Closeout Procedures”, include the following:

1. Valves.
2. Fire hydrants.

1.3 QUALITY ASSURANCE

A. Product Options: Drawings indicate size, profiles and dimensional requirements of piping and specialties and are based on the specific system indicated. Refer to Division 01 Section “Quality Requirements.”

B. Regulatory Requirements:

1. Comply with requirements of utility company supplying the water (“Water Company”).
2. Comply with requirements of local fire department (“Fire Department”).
3. Comply with the standards of authorities having jurisdiction for potable water services, including materials, installation, testing and disinfections.
4. Comply with standards of authorities having jurisdiction for fire suppression systems, including materials, hose threads, installation and testing.

C. Other:

1. Piping material shall bear labels, stamps, or other markings of specified testing agencies.
2. Comply with ASTM F 645 for selection, design, and installation of thermoplastic water piping.
3. Comply with FMG's "Approval Guide" or UL's "Fire Protection Equipment Directory" for fire-service-main products.
4. NFPA Compliance: Comply with NFPA 24 for materials, installations, tests, flushing, and valve and hydrant supervision for fire-service-main piping for fire suppression.
5. NSF Compliance:

    a. NSF 14 for plastic potable water-service piping.
    b. NSF 61 for material for water-service piping and specialties for domestic water.

1.4 DELIVERY, STORAGE, AND HANDLING

A. Preparation for Transport:

1. Ensure all materials are dry and internally protected against rust and corrosion.
2. Protect valves against damage to threaded ends and flanged faces.
3. Set valves in best position for handling. Set valves closed to prevent rattling.

B. Delivery:

1. Deliver piping with factory-applied end caps.
2. Maintain end caps through shipping, storage and handling to prevent pipe-end damage and to prevent entrance of dirt, debris and moisture.

C. Storage:

1. Do not remove valve or hydrant protectors unless necessary for inspection, then reinstall for storage.
2. Protect valves and hydrants from weather. Store indoors and maintain temperature higher than ambient dewpoint temperature.
3. Support valves and hydrants off the ground or pavement in watertight enclosures when outdoor storage is necessary.
4. Protect stored piping from moisture and dirt. Elevate above grade.
5. Store plastic piping protected from direct sunlight. Support to prevent sagging and bending.

D. Handling:

1. Use slings to handle valves if size requires handling by crane or lift.
2. Rig valves to avoid damage to exposed parts.
3. Do not use hand wheels or stems as lifting or rigging points.

1.5 PROJECT CONDITIONS

A. Do not interrupt existing utility services unless approved and coordinated with Owner. Refer to Division 02 Section “Maintenance of Existing Conditions”.

B. Maintain 18” vertical and 10’ horizontal separation between all water lines and storm and sanitary sewers.

PART 2 - PRODUCTS

2.1 GENERAL

A. All products and materials must meet the requirements and specifications of the Water Company and Fire Department. Contact Water Company and Fire Department and confirm products and materials are approved prior to ordering or installing.

B. Unless otherwise indicated, pipe sizes refer to the nominal inside diameter.

C. Unless otherwise indicated or required by Water Company, Fire Department or Owner, the following materials shall be used as described below.

2.2 PIPING MATERIALS

A. Ductile Iron Pipe and Fittings (4” through 16”):

1. Piping: AWWA C151, pressure class 350, bell and plain spigot end.
2. Fittings: Ductile iron AWWA C110 standard pattern or AWWA C153 compact pattern.
3. Joints: Every joint shall be restrained:

    a. Rubber Field Lok 350 Gasket (U.S. Pipe) or approved equal.
    b. Restrained mechanical joint (EBAA Megalug) or approved equal, with rubber gasket per AWWA C111.
    c. Unrestrained mechanical joints are not acceptable.
    d. Concrete thrust blocking is not acceptable.

4. Interior lining: cement-mortar lining with seal coat per AWWA C104.
5. Exterior coating: standard asphaltic coating per AWWA C151.
6. Polyethylene encasement: AWWA C105 tube or sheet, Linear Low Density (LLD, minimum 8 mil) or High-Density Cross Laminated (HDCL, minimum 4 mil) with 2” wide polyethylene tape (minimum 12 mil).

B. PVC Pipe and Fittings (4” through 12”):

1. Piping: AWWA C900, DR 18, pressure class 235 psi, bell and plain-spigot end. Piping shall be same outside diameter as ductile iron and of a blue tint.
2. Fittings:

    a. Ductile iron AWWA C110 standard pattern or AWWA C153 compact pattern.
    b. Interior cement lining and seal coat per AWWA C104.

c. Exterior asphaltic coating per AWWA C151.
d. Polyethylene encasement: AWWA C105 tube or sheet, Linear Low Density (LLD, minimum 8 mil) or High-Density Cross Laminated (HDCL, minimum 4 mil) with 2" wide polyethylene tape (minimum 12 mil).

3. Joints: Every joint shall be restrained.

a. Restrained mechanical joint (2000PV or 1600 Series by EBAA or approved equal) with elastomeric gasket per AWWA C111.
b. Unrestrained mechanical joints are not acceptable.
c. Concrete thrust blocking is not acceptable.

C. HDPE Pipe and Fittings (4" through 12"):

1. Piping:

a. Polyethylene Pipe shall conform to ANSI/AWWA C901 and ANSI/AWWA C906
b. Pipe material used shall conform to the PE Standard PE 3408 high density polyethylene pipe meeting ASTM D3350, SDR9 pressure class 200 psi, bell and plain spigot end.
c. Piping shall be same outside diameter as ductile iron and of a blue tint or have a co-extruded blue striping for identification.

2. Fittings:

a. Molded fittings shall be manufactured and tested in accordance with ASTM D3261 and ASTM D2682 and shall be so marked.
b. Fitting shall also be tested in accordance with AWWA C906.

3. Joints:

a. Butt fusion joints shall be PE4308 HDPE and approved for AWWA use.
b. Shall meet the requirements of the pipe to which they are to be fused.
c. Shall be manufactured in accordance with AWWA C906 with a minimum pressure class of 200 psi

D. Polyethylene (PE) Pipe and Fittings (3" and smaller):

1. Piping:

a. Polyethylene pipe shall conform to ANSI/AWWA C901and ANSI/AWWA C906
b. Pipe material used shall conform to the PE Standard PE 3408 high density polyethylene pipe meeting ASTM D2239 and ASTM D3035.
c. Pipe shall be SDR9 pressure class 200 psi, bell and plain spigot end.
d. Piping shall be same outside diameter as ductile iron and of a blue tint or have a co-extruded blue striping for identification.

2. Fittings:

a. Molded fittings shall be manufactured and tested in accordance with ASTM D3261 and ASTM D2682 and shall be so marked.

b. Fittings shall also be tested in accordance with AWWA C906.

3. Joints:

a. Butt fusion joints shall be PE4308 HDPE and approved for AWWA use.
b. Shall meet the requirements of the pipe to which they are to be fused.
c. Shall be manufactured in accordance with AWWA C906 with a minimum pressure class of 200 psi

E. Transition Fittings (Joining Dissimilar Materials):

1. Manufactured couplings or fittings compatible with piping materials, outside diameter and system working pressure.

2.3 VALVES

A. Gate Valves (4” and greater):

1. AWWA C515, FM approved, ductile iron body, minimum 200 psi working pressure rating
2. Interior 6 mils fusion epoxy coating per AWWA C550, bronze stem and nut, non-rising stem.
3. End connections: restrained mechanical joint.
4. Seat: resilient molded rubber seat per ASTM D2000.
5. Application: water lines 4” and greater.

B. Gate Valves (3” and smaller):

1. Bronze, MSS SP-80, Class 125 or Class 150.
2. ASTM B 62 cast-bronze body and bonnet, solid-bronze wedge, copper-silicon-alloy rising stem, and PTFE-impregnated packing with bronze packing nut.
3. If valve is accessible by hand, provide with aluminum or malleable-iron hand wheel otherwise provide with connection compatible with operating wrench.
4. End connections: threaded or soldered.
5. Application: copper lines 1” – 3”.

2.4 OTHER

A. Tapping Sleeve Assemblies:

1. Stainless steel, two-piece bolted sleeve with flanged outlet for new branch connection.
2. Comply with AWWA C207 and MSS SP-60.
3. Include sleeve and valve compatible with drilling machine.
4. Include sleeve matching size and type of pipe material being tapped and with recesses flange for branch valve.
5. Approved manufacturers:

a. Mueller Company; Water Products Division.
b. JCM Industries

B. Valve Boxes:

1. AWWA M44 cast-iron.
2. Adjustable top section extension of length required for depth of burial of valve.
3. Bottom section with base of size to fit over valve.
4. Approximate 5” diameter barrel and plug with lettering “WATER”.
5. Operating wrenches: steel, tee-handle with one pointed end, stem of length to operate deepest buried valve and socket matching valve operating nut.

C. Indicator Posts:

1. UL 789, FMG-approved, vertical-type, cast-iron body with operating wrench, extension rod, and adjustable cast-iron barrel of length required for depth of burial of valve.
2. Valve: non-rising stem gate valve.
3. Include supervisory switches.

D. Fire Department Connections:

1. Fire department connections shall meet the requirements and standards of the Water Company and Fire Department.
2. Contact the Water Company and Fire Department and verify all requirements.

E. Freestanding Fire Hydrants:

1. Dry barrel, AWWA C502. UL listed and FM approved.
2. Minimum working pressure 200 psi and minimum test pressure 400 psi.
3. Hydrants shall meet the requirements and standards of the Water Company and Fire Department.
4. Contact the Water Company and Fire Department and verify all requirements.

F. Corporation Valves:

1. Service-saddle assemblies shall meet AWWA C800.
2. It includes saddles and valves compatible with tapping machines.
3. Service-saddle: Copper alloy with seal and AWWA C800, threaded outlet for corporation valve.
4. Corporation Valve: Bronze body and ground-key plug, with AWWA C800, threaded inlet and outlet matching service piping material.

G. Curb Valves:

1. Comply with AWWA C800.
2. Include bronze body, ground-key plug or ball, and wide tee head, with inlet and outlet matching service piping material.
3. Service boxes: Similar to AWWA M44 requirements for cast-iron valves boxes.
4. Include cast-iron telescoping top section of length required for depth of burial of valve, plug with lettering “WATER,” bottom section with base of size to fit over curb valve, and approximately 3-inch diameter barrel.
5. Shutoff rods: Steel, tee-handle with one pointed end, stem length to operate deepest buried valve, and slotted end matching curb valve.

PART 3 - EXECUTION

3.1 GENERAL

A. Refer to Division 31 Section “Earthwork” and Drawings for excavation, trenching and backfilling.

B. Identification: Install continuous underground detectable warning tape over all water lines during backfilling. See Division 33 Section “Common Work Results for Utilities” for underground warning tapes and further information.

C. Do not use flanges, unions or keyed couplings for underground piping.

3.2 CONNECTIONS

A. Water Company Mains:

1. Contact the Water Company and verify the size, location, materials and all other requirements for connection.
2. Connect to Water Company mainly in accordance with the Water Company’s requirements and specifications.
3. Connections to Water Company mains shall be hot tapped, unless otherwise specified on Drawings or agreed to in writing by Water Company.
4. The Contractor is responsible for all costs and fees associated with connecting to Water Company mains.

B. Owner Lines:

1. Connections to existing Owner lines shall be hot tapped, unless specified otherwise on Drawings or agreed to in writing by Owner.
2. Contact Owner and coordinate connections.
3. Existing water service shall be always maintained.

3.3 PIPING INSTALLATION

A. General:

1. Comply with NFPA 24 for fire-service-main piping material and installation.
2. Install ductile iron water service piping according to AWWA C600 and AWWA M41.
3. Install PVC pipe according to AWWA M23 and ASTM F645.
4. Install copper tube and fittings according to CDA’s “Copper Tube Handbook.”
5. Install fittings for all changes in direction and for branch connections.
6. Unless otherwise indicated, install two 45-degree fittings at all horizontal and vertical 90-degree changes in direction.
7. Unless otherwise indicated, install all water piping with a minimum 60” burial depth, from top of pipe to top of finished grade, for frost protection. If local conditions or regulations warrant, increase burial depth such that the top of the pipe is at least 12” below the maximum frost penetration depth.

3.4 FIRE HYDRANT INSTALLATION

A. General:

1. Install each fire hydrant with separate gate valve in supply pipe.
2. Minimum size for supply line is 6".
3. Install with anchor coupling or other appropriate mechanically restrained method and support in upright condition. Do not use concrete thrust blocks, unless requested or required by the Water Company or Fire Department.
4. Comply with NFPA 24.

3.5 JOINT RESTRAINT

A. General:

1. Every joint shall be restrained. Un-restrained push-on joints or plain mechanical joints are not acceptable. Refer to Part 2 for each type of pipe.
2. Fire hydrants shall utilize anchor couplings or other appropriate restraining methods.
3. Apply a full coat of asphalt or other acceptable corrosion-resistant material to surfaces of installed ferrous anchorage devices.

3.6 VALVE INSTALLATION

A. Gate Valves:

1. Comply with AWWA C600, AWWA M44 and NFPA 24.
2. Install each underground valve with stem pointing up and with valve box.

B. Indicator Posts:

1. Comply with NFPA 24.
2. All post indicator valves shall be supervised with tamper switches as specified in Division 28 Section "Fire Alarm."

C. Corporation stops unless otherwise required by the Water Company or Owner, do not install service saddles on ductile iron pipe. Use saddles on plastic pipe as specified in Part 2.

3.7 CLEANING AND TESTING

A. Cleaning:

1. Purge new water piping systems and parts of existing systems which have been altered, extended or repaired before being put in service.
2. Contact the Water Company to coordinate cleaning and disinfection and meet all requirements and specifications of the Water Company.
3. If the method is not prescribed by Water Company, use procedure per AWWA C651.
4. Submit reports of cleaning and disinfecting to Water Company and Architect/Engineer.

B. Testing:

1. The contractor is responsible for all costs for testing and inspection, including labor, equipment and supplies.
2. The contractor is responsible for coordinating and scheduling testing.
3. Any work failing testing and inspection requirements shall be repaired or replaced and retested at the Contractor's expense.
4. All testing shall be done per the Water Company requirements and specifications.
5. Contact the Water Company and coordinate all the testing.
6. If testing requirements are not specified by the Water Company, the following shall be used:

    a. Conduct piping tests before joints are covered (and after thrust blocks have hardened sufficiently, if applicable).
    b. Fill pipeline 24 hours before testing and apply test pressure to stabilize system.
    c. Ensure all air has been expelled from lines.
    d. Hydrostatic test: Test at not less than 1-1/2 times the working pressure (but not more than the rated pressure) for 2 hours.
    e. Increase pressure in 50-psig increments and inspect each joint between increments.
    f. Hold at pressure for 1 hour; decrease to 0 psig. Slowly increase again to test pressure and hold for 1 more hour.
    g. Maximum allowable leakage is 2 quarts per hour per 100 joints.

C. Prepare reports of cleaning and testing and submit to Water Company and Architect/Engineer.

SECTION 33 30 00
SANITARY SEWERS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Sanitary sewers outside of the building.

B. Related Sections:

1. Division 33 Section “Common Work Results for Utilities”.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements:

1. Comply with the requirements of the utility company which receives the wastewater and otherwise has authority over the sanitary infrastructure “Sanitary Utility”.
2. All materials and work within the right-of-way or easement of any local government or other agency having jurisdiction over sewage, shall meet the requirements of such an agency.
3. All sanitary work and testing shall conform to the Indiana Department of Environmental Management (IDEM) and the Indiana State Department of Health (ISDH).

1.3 SUBMITTALS

A. General: Each item in submittal must state that the item meets or exceeds the specified standards referenced herein. In addition, if multiple sizes or types are included in the submittal, clearly indicate which is to be used, and where, if applicable.

B. Product Data:

1. Sewer pipe, fittings and joint materials.
2. Pipe connectors (flexible connectors into sanitary manholes).
3. Cleanouts.

C. Shop Drawings:

1. Pre-cast concrete manholes, including castings, steps, sealing materials and any other required appurtenances.

D. Test Reports: Submit results for all testing and inspections to Architect/Engineer.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Notes:

1. Unless otherwise indicated, pipe sizes refer to the nominal inside diameter.
2. Unless otherwise indicated, the following materials shall be used as described below.

B. Sanitary Sewer:

1. Polyvinyl chloride (PVC) pipe and fittings (4” through 15”):

a. Pipe: ASTM D3034, SDR-35.
b. Fittings: ASTM D3034, SDR-35.
c. Joints: ASTM D3212, compression bell and spigot.
d. Gaskets: ASTM F477, elastomeric.

2. Ductile iron pipe and fittings (6” and larger):

a. Pipe: AWWA C151, pressure class 350.
b. Fittings: AWWA C110, standard pattern or AWWA C153 compact pattern.
c. Joints: bell and spigot with push-on joints and gaskets.
d. Gaskets: AWWA C111, rubber.
e. Interior lining: epoxy coating (do not use cement mortar lining).
f. Exterior coating: standard asphaltic per AWWA C151.
g. Polyethylene encasement: AWWA C105 tube or sheet, Linear Low Density (LLD, minimum 8 mil) or High-Density Cross Laminated (HDCL, minimum 4 mil) with 2” polyethylene tape (minimum 12 mil).
h. Application: Required when crossing water lines with less than 18” vertical or 10’ horizontal clearance.

2.2 EXTERIOR CLEANOUTS

A. General:

1. Unless otherwise indicated, cleanouts shall be the same diameter as the sewer they serve for pipe sizes up to 8”, pipes greater than 8” shall use an 8” cleanout.
2. Unless otherwise indicated, riser pipes and cleanout bodies shall be the same material as the sewer they serve.
3. Each cleanout shall have an exterior housing to prevent transfer of load to the cleanout.
4. Medium duty housing may be used in non-vehicular areas, all others shall be heavy duty.
5. Exterior housing:

a. ASME A112.36.2M gray iron with round, secured, scoriated and gray iron cover.
b. Refer to Part 3 for concrete anchorage.

6. Cast iron cleanouts:

a. Gray iron ferrule with tapered-thread, brass closure plug, ASME A112.36.2M.

b. Riser pipe and fittings: cast iron soil pipe, ASTM A74.
c. Ferrule connection may be inside caulk, spigot or no-hub. The connection must be water and airtight.

7. Plastic cleanouts:

a. PVC body with PVC tapered thread plug.
b. Riser pipe and fittings: SDR 35, ASTM D3034.

2.3 MANHOLES

A. General:

1. Precast concrete per ASTM C478 and watertight, See Part 3.
2. Manhole base shall be minimum 8" thick. To prevent flotation, increase the thickness of precast sections or add concrete to base section as required.
3. Steps: Polypropylene encased #4 rebar per ASTM D4101, meeting OSHA requirements.
4. Castings: All frames and castings shall be heavy duty and constructed of gray iron free from blowholes, porosity, hard spots, shrinkage distortion, etc. They shall be smooth and clean. Watertight manhole covers shall be used for any sanitary manhole located within a floodplain, floodway or other areas subject to flooding.
5. Adjusting rings: Precast concrete, interlocking with ½ butyl rubber base or extrudable preformed gasket material. Bricks, blocks or other means are not acceptable.
6. Pipe connectors: each pipe entering a sanitary manhole shall have a gasketed, flexible, watertight connector per ASTM C923.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Piping:

1. Install PVC gravity sewer piping according to ASTM D2321.
2. Install cleanouts and manholes in sewer lines where shown on the Drawings and as required by applicable Codes and/or field conditions.
3. Install manholes and cleanouts at all changes in direction. Blind turns or gradual deflection of pipe is not permitted.
4. The maximum distance between manholes is 400'.
5. Verify existing and proposed grades before installing any pipe. Notify Architect/Engineer of any conflicts with Drawings or Specifications.
6. Pipe installation shall proceed with spigot ends of bell and spigot pipe pointing into direction of flow. Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with adjoining pipe and to prevent sudden offset in the flow line.
7. Pipe trenches shall be excavated parallel to the specified pipe, slope and grade. The bottom of the pipe shall be supported by a minimum 6" thick layer of #8 crushed stone. The #8 crushed stone shall extend 6" on each side of the pipe and 12" above the top of the pipe. The remaining backfill in lawn and non-pavement areas shall be suitable fill material

approved by the Geotechnical Engineer. Pipes under and within 5' of pavements, slabs, sidewalks and other hard surfaces shall be backfilled with compacted granular fill. All backfilling and compaction shall be in accordance with Division 31 Section "Earthwork".

8. During backfilling, install detectable warning tape. See Division 33 Section "Common Work Results for Utilities" for warning tape requirements.
9. Any breaks or defects in pipe must be immediately repaired. Any pipe which has been disturbed after being laid must be taken up, joints cleaned and properly re-laid.
10. The interior of all pipes shall be cleaned of all dirt and superfluous materials as the work progresses. After pipe installation, install erosion control measures as shown on Drawings and as necessary to prevent sediment or other materials from entering or building up in pipe.
11. Water and sewer minimum clearances:

    a. Where minimum 18" vertical or 10' horizontal separation cannot be provided between sewers and water lines, the sewer shall be ductile iron, refer to Part 2.
    b. At crossings, extend ductile iron sewer pipe a minimum of 10 feet on both sides of the water line.
    c. Do not install water and sewer lines in the same trench under any circumstances.

B. Manholes:

1. Set castings flush with grade in pavement areas and 1" above grade in other areas.
2. Install 2 to 4 precast adjusting rings for an overall 6" to 12" adjustment height.
3. Grade to drain away from castings.
4. Install steps from 12" below top to 12" above bottom at 16" on center.
5. Bench bottom of manholes per Drawings.
6. If required by Sanitary Utility, apply mastic or other approved sealing material to outside of sanitary manholes per Sanitary Utility's specifications.

C. Cleanouts:

1. Install piping so cleanouts open in direction of flow in sewer pipe.
2. Set clean out covers flush with grade.
3. In areas other than concrete walks and concrete pavements, install concrete anchor pad.
4. Unless otherwise indicated, pad dimensions are 12" height with a diameter of the cleanout housing diameter + 12", to provide a 6" ring around the cleanout frame. Place on properly compacted subgrade and stone per Division 31 Section "Earthwork" and Division 32 Section "Site Concrete".

3.2 SANITARY SEWER TESTING

A. General:

1. The Contractor is responsible for all costs for testing and inspection, including labor, equipment and supplies.
2. The Contractor is responsible for coordinating and scheduling testing.
3. Any work failing testing and inspection requirements shall be repaired or replaced at the Contractor's expense and re-tested.

B. Requirements:

1. Testing and inspection shall meet all requirements of local Sanitary Utility and applicable State regulations. The contractor shall contact the local Sanitary Utility to verify testing and inspection requirements.

C. Gravity Sewer Pipe:

1. Deflection test: No sooner than 30 days after the installation, backfill and final compaction, each flexible sewer pipe shall be tested for deflection. No pipe shall exceed a deflection of 5%. The diameter of the mandrel shall be no less than 95% of the inside diameter of the pipe. The test shall not be performed with the aid of a mechanical pulling device.
2. Air pressure test: Each flexible sewer pipe shall be air pressure tested and conform to ASTM F1417. The leakage exfiltration or infiltration shall not exceed 200 gallons per inch of pipe diameter per mile per day for any section of pipe with a minimum positive head of two feet.

D. Manholes:

1. Each manhole shall be visually inspected after installation, backfilling and final compaction. If manhole shows leakage or signs thereof, it shall be repaired to the satisfaction of the Architect/Engineer and reinspected.
2. Vacuum test: Each manhole shall be air tested and conform to ASTM C1244.

SECTION 33 40 00
STORM DRAINAGE

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Storm sewers and drainage structures outside of the building.

B. Related Sections:

1. Division 33 Section “Common Work Results for Utilities”.

1.2 QUALITY ASSURANCE

A. Regulatory Requirements:

1. All materials and work within the right-of-way or easement of any local government or other agency having jurisdiction over storm drainage, shall meet the requirements of such an agency.

1.3 SUBMITTALS

A. Each item in submittal must state that the item meets or exceeds the specified standards referenced herein. If multiple sizes or types are included in the submittal, clearly indicate which are to be used, and where, if applicable.

B. Product Data:

1. Sewer pipe, fittings and joint materials.
2. Frames and grates.
3. Steps.
4. Cleanouts.

C. Shop Drawings: Reinforced concrete manholes, inlets, and any other structures, including steps, sealing materials and any other required appurtenances.

D. Test Reports: Submit results for all testing and inspections to Architect/Engineer.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

A. Unless otherwise indicated, pipe sizes refer to the nominal inside diameter.

B. Unless otherwise indicated, the following materials shall be used as described below.

1. High density polyethylene (HDPE) pipe and fittings:

a. ASTM D3350 and AASHTO M294 Type S, corrugated with smooth interior wall.
b. Silt-tight joints ASTM D3212 with ASTM F477 gaskets.
c. Application: Storm sewer 6" to 36" where sewer has a minimum cover of 3 feet from top of pipe to top of finished grade.

2. Polyvinyl chloride (PVC) pipe and fittings:

a. SDR 35 ASTM D1784, ASTM D3034.
b. Compression type bell and spigot joints ASTM D3212 with ASTM F477 gaskets.
c. Application: Storm sewer 12" and smaller which runs directly from building. Do not use in between storm structures or for culverts.

3. Ductile iron (DI) pipe and fittings:

a. Pipe: AWWA C151, pressure class 350.
b. Fittings: AWWA C110, standard pattern or AWWA C153 compact pattern.
c. Joints: bell and spigot with push-on joints and gaskets.
d. Gaskets: AWWA C111, rubber.
e. Interior lining: epoxy coating (do not use cement mortar lining).
f. Polyethylene encasement: AWWA C105 tube or sheet, Linear Low Density (LLD, minimum 8 mil) or High-Density Cross Laminated (HDCL, minimum 4 mil) with 2" polyethylene tape (minimum 12 mil).
g. Application: Sewers 6" and larger. Required when crossing water lines with less than 18" vertical or 10' horizontal clearance.

2.2 EXTERIOR CLEANOUTS

A. General:

1. Unless otherwise indicated, cleanouts shall be the same diameter as the sewer they serve for pipe sizes up to 8", pipes greater than 8" shall use an 8" cleanout.
2. Unless otherwise indicated, riser pipes and cleanout bodies shall be the same material as the sewer they serve.
3. Each cleanout shall have an exterior housing to prevent transfer of load to the cleanout.
4. Medium duty housing may be used in non-vehicular areas, all others shall be heavy duty.
5. Exterior housing:

a. ASME A112.36.2M gray iron with round, secured, scoriae and gray iron cover.
b. Refer to Part 3 for concrete anchorage.

6. Cast iron cleanouts:

a. Gray iron ferrule with tapered-thread, brass closure plug, ASME A112.36.2M.
b. Riser pipe and fittings: cast iron soil pipe, ASTM A74.
c. Ferrule connection may be inside caulk, spigot or no-hub; however, connection must be water and air-tight.

7. Plastic cleanouts:

    a. PVC body with PVC tapered thread plug.
    b. Riser pipe and fittings: SDR 35, ASTM D3034.

2.3 MANHOLES AND CATCH BASINS

A. General:

1. Precast concrete per ASTM C478.
2. Manhole base shall be minimum 8” thick. To prevent flotation, increase thickness of precast sections or add concrete to base section as required.
3. Steps: Polypropylene encased #4 rebar per ASTM D4101, meeting OSHA requirements.
4. Castings: All frames and castings shall be heavy duty and constructed of gray iron free from blowholes, porosity, hard spots, shrinkage distortion, etc. They shall be smooth and clean.
5. Adjusting rings: Precast concrete, interlocking with ½ butyl rubber base or extrudable preformed gasket material. Bricks, blocks or other means are not acceptable.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Piping:

1. Cleanouts and manholes shall be installed in sewer where shown on the Drawings and as required by applicable Codes and/or field conditions.
2. Install manholes and cleanouts at all changes in direction. Blind turns or gradual deflection of pipe is not permitted.
3. The maximum distance between manholes is 400’.
4. Verify existing and proposed grades, connections and pipe sizes before installing any pipe. Notify Architect/Engineer of any conflicts with Drawings or Specifications.
5. Pipe installation shall proceed with spigot ends of bell and spigot pipe pointing into direction of flow.
6. Each pipe shall be laid true to line and grade and in such a manner as to form a close concentric joint with adjoining pipe and to prevent sudden offset in the flow line.
7. During backfilling, install detectable warning tape. See Division 33 Section “Common Work Results for Utilities” for warning tape requirements.
8. Pipe trenches shall be excavated parallel to the specified pipe, slope and grade.
9. The bottom of the pipe shall be supported by a minimum 6" thick layer of #8 crushed stone. The #8 crushed stone shall extend 6" on each side of the pipe and 12" above the top of the pipe unless indicated otherwise.
10. The remaining backfill in lawn and non-pavement areas shall be suitable fill material approved by the soils testing laboratory.
11. Pipes under and within 5' of pavements, slabs, sidewalks and other hard surfaces shall be backfilled with compacted granular fill.
12. All backfilling and compaction shall be in accordance with Division 31 Section” Earthwork"

13. Any breaks or defects in pipe must be immediately repaired. Any pipe which has been disturbed after being laid must be taken up, joints cleaned and properly re-laid.
14. The interior of all pipes shall be cleaned of all dirt and superfluous materials as the work progresses. After pipe installation, install erosion control measures as shown on Drawings and as necessary to prevent sediment or other materials from entering or building up in pipe.
15. Water and sewer minimum clearances:

    a. Where minimum 18" vertical or 10' horizontal separation cannot be provided between sewers and water lines, the sewer shall be ductile iron, refer to Part 2.
    b. At crossings, extend ductile iron sewer pipe a minimum of 10 feet on both sides of the water line.
    c. Do not install water and sewer lines in the same trench under any circumstances.

B. Manholes and Catch Basins:

1. Set solid lid castings flush with grade in pavement areas and 1" above grade in other areas. Set inlet castings at elevation grades per Drawings.
2. Install 2 to 4 precast adjusting rings for an overall 6" to 12" adjustment height.
3. Grade to drain into inlet castings positively and adequately.
4. Install steps from 12" below top to 12" above bottom at 16" on center.
5. Bench bottom of structures per Drawings.

C. Cleanouts:

1. Install piping so cleanouts open in direction of flow in sewer pipe.
2. Set clean out covers flush with grade.
3. In areas other than concrete walks and concrete pavements, install concrete anchor pad.
4. Unless otherwise indicated, pad dimensions are 12" height with a diameter of the cleanout housing diameter + 12", to provide a 6" ring around the cleanout frame. Place on properly compacted subgrade and stone per Division 31 Section "Earthwork" and Division 32 Section "Site Concrete".