CANCER CENTER PHASE 2

EL DORADO, ARKANSAS

PROJECT MANUAL **PSW PROJECT: 671AG**

100% CONSTRUCTION DOCUMENTS
ISSUE: MAY 30, 2024

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CARTI
CANCER CENTER PHASE 2
EL DORADO, ARKANSAS
PSW PROJECT NO. 671AG

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1.01 Sealed bids for an addition and renovation of an existing CARTI Cancer Clinic in El Dorado, Arkansas will be received until 2:00 P.M., Local Time on Friday June 28, 2024 at CARTI Corporate Center, 8901 CARTI Way, Little Rock, AR 72205, Executive Conference Room

A. Bids will be received and reviewed by the Owner privately. They will not be opened publicly and read aloud.

1.02 A **mandatory** pre-bid conference will be held at 10:00 AM on Tuesday June 18, 2024, at Carti Eldorado Cancer Center, 1601 N West Ave., El Dorado AR. 71730. General Contractors failing to attend this meeting or arriving late for this meeting will forfeit the right to submit a bid. Subcontractors are strongly encouraged to attend this meeting but are not required to attend. **The Owner reserves the right to schedule additional meetings.**

1.03 The work includes Site Preparation and Improvements, Demolition for addition and interior renovation, General Construction, Mechanical Work, Plumbing Work and Electrical Work, all to be let under one prime contract.

1.04 A cashier's check or acceptable bidder's bond payable to the Owner in an amount not less than 5% of the base bid submitted must accompany each bid as a guarantee that, if awarded the contract, the bidder will promptly enter into a contract and execute such bonds as may be required. If a Bid Bond is provided, the Bond must be signed by an authorized agent of the Bonding Company and the agent's power of attorney must be submitted with the Bid Bond.

1.05 Copies of drawings, specification and other proposed contract documents are on file and are open to inspection at the following places.

Southern Reprographics Plan Room

1.06 General Contractors may obtain up to three (3) sets of contract documents from Southern Reprographics, Inc., 901 West 7th, Little Rock, Arkansas 72201 (Phone 501-372-4011) free of charge.

1. Additional sets or partial sets of bid documents may be obtained for the actual cost of printing, which is not refundable.
2. Electronic copies of the bid documents may be obtained by arrangement with Southern Reprographics.

1.07 Bidders, sub-bidders, material suppliers and other interested parties are encouraged to obtain complete sets of Bid Documents. Complete sets of Bid Documents should always be used in preparing bids. Neither the Owner nor Architect assumes responsibility for errors in bidding or misinterpretations of Bid Documents resulting from the use of incomplete sets of Bid Documents. The documents obtained through the Architect are considered the official version and take precedence if any discrepancies occur. The use of incomplete or inaccurate Bid Documents does not relieve the bidder of the obligation to perform all work related to his bid as detailed in a complete set of Bid Documents.

1.08 All bidders shall conform to the requirements of Arkansas Code Annotated 17-25-101, Arkansas State Licensing Law for Contractors.

1.09 The Owner reserves the right to waive any formalities in, or to reject any or all bids.

1.10 No bidder may withdraw his bid within 60 days after the date of the opening thereof.

END OF DOCUMENT

PART 1 - GENERAL

1.01 GOVERNING STANDARD DOCUMENT

A. "Instructions to Bidders", Document No. A701 of American Institute of Architects, 2018 Edition is bound and incorporated into these specifications and is to be used as the Instructions to Bidders for this contract.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF DOCUMENT

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AIA Document A701 – 2018

Instructions to Bidders

for the following PROJECT:

CARTI Cancer Center Phase 2
El Dorado, Arkansas

THE OWNER:

Central Arkansas Radiation Treatment Institute (CARTI)

THE ARCHITECT:

Polk Stanley Wilcox
801 South Spring Street
Little Rock, Arkansas 72201

TABLE OF ARTICLES

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.

FEDERAL, STATE, AND LOCAL LAWS MAY IMPOSE REQUIREMENTS ON PUBLIC PROCUREMENT CONTRACTS. CONSULT LOCAL AUTHORITIES OR AN ATTORNEY TO VERIFY REQUIREMENTS APPLICABLE TO THIS PROCUREMENT BEFORE COMPLETING THIS FORM.

It is intended that AIA Document G612™–2017, Owner's Instructions to the Architect, Parts A and B will be completed prior to using this document.

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ARTICLE 1 DEFINITIONS

§ 1.1 Bidding Documents include the Bidding Requirements and the Proposed Contract Documents. The Bidding Requirements consist of the advertisement or invitation to bid, Instructions to Bidders, supplementary instructions to bidders, the bid form, and any other bidding forms. The Proposed Contract Documents consist of the unexecuted form of Agreement between the Owner and Contractor and that Agreement's Exhibits, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications, all Addenda, and all other documents enumerated in Article 8 of these Instructions.

§ 1.2 Definitions set forth in the General Conditions of the Contract for Construction, or in other Proposed Contract Documents apply to the Bidding Documents.

§ 1.3 Addenda are written or graphic instruments issued by the Architect, which, by additions, deletions, clarifications, or corrections, modify or interpret the Bidding Documents.

§ 1.4 A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with the Bidding Documents.

§ 1.5 The Base Bid is the sum stated in the Bid for which the Bidder offers to perform the Work described in the Bidding Documents, to which Work may be added or deleted by sums stated in Alternate Bids.

§ 1.6 An Alternate Bid (or Alternate) is an amount stated in the Bid to be added to or deducted from, or that does not change, the Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

§ 1.7 A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment, or services, or a portion of the Work, as described in the Bidding Documents.

§ 1.8 A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in the Bidding Documents.

§ 1.9 A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment, or labor for a portion of the Work.

ARTICLE 2 BIDDER'S REPRESENTATIONS

§ 2.1 By submitting a Bid, the Bidder represents that:

- **.1** the Bidder has read and understands the Bidding Documents;
- **.2** the Bidder understands how the Bidding Documents relate to other portions of the Project, if any, being bid concurrently or presently under construction;
- **.3** the Bid complies with the Bidding Documents;
- **.4** the Bidder has visited the site, become familiar with local conditions under which the Work is to be performed, and has correlated the Bidder's observations with the requirements of the Proposed Contract Documents;
- **.5** the Bid is based upon the materials, equipment, and systems required by the Bidding Documents without exception; and
- **.6** the Bidder has read and understands the provisions for liquidated damages, if any, set forth in the form of Agreement between the Owner and Contractor.

ARTICLE 3 BIDDING DOCUMENTS

§ 3.1 Distribution

§ 3.1.1 Bidders shall obtain complete Bidding Documents, as indicated below, from the issuing office designated in the advertisement or invitation to bid, for the deposit sum, if any, stated therein.

§ 3.1.2 Any required deposit shall be refunded to Bidders who submit a bona fide Bid and return the paper Bidding Documents in good condition within ten days after receipt of Bids. The cost to replace missing or damaged paper documents will be deducted from the deposit. A Bidder receiving a Contract award may retain the paper Bidding Documents, and the Bidder's deposit will be refunded.

§ 3.1.3 Bidding Documents will not be issued directly to Sub-bidders unless specifically offered in the advertisement or invitation to bid, or in supplementary instructions to bidders.

§ 3.1.4 Bidders shall use complete Bidding Documents in preparing Bids. Neither the Owner nor Architect assumes responsibility for errors or misinterpretations resulting from the use of incomplete Bidding Documents.

§ 3.1.5 The Bidding Documents will be available for the sole purpose of obtaining Bids on the Work. No license or grant of use is conferred by distribution of the Bidding Documents.

§ 3.2 Modification or Interpretation of Bidding Documents

§ 3.2.1 The Bidder shall carefully study the Bidding Documents, shall examine the site and local conditions, and shall notify the Architect of errors, inconsistencies, or ambiguities discovered and request clarification or interpretation pursuant to Section 3.2.2.

§ 3.2.2 Requests for clarification or interpretation of the Bidding Documents shall be submitted by the Bidder in writing and shall be received by the Architect at least Five (5) days prior to the date for receipt of Bids.

§ 3.2.3 Modifications and interpretations of the Bidding Documents shall be made by Addendum. Modifications and interpretations of the Bidding Documents made in any other manner shall not be binding, and Bidders shall not rely upon them.

§ 3.3 Substitutions

§ 3.3.1 The materials, products, and equipment described in the Bidding Documents establish a standard of required function, dimension, appearance, and quality to be met by any proposed substitution.

§ 3.3.2 Submit substitution requests in accordance with Section 01 30 00. Such requests shall include the name of the material or equipment for which it is to be substituted and a complete description of the proposed substitution including drawings, performance and test data, and other information necessary for an evaluation. A statement setting forth changes in other materials, equipment or other portions of the Work, including changes in the Work of other contracts that incorporation of the proposed substitution would require, shall be included. The burden of proof of the merit of the proposed substitution is upon the proposer. The Architect's decision of approval or disapproval of a proposed substitution shall be final. Substitutions will not be considred prior to the award of the Contract.

§ 3.4 Addenda

§ 3.4.1 Addenda will be transmitted to Bidders known by the issuing office to have received complete Bidding Documents.

§ 3.4.2 Addenda will be available where Bidding Documents are on file.

§ 3.4.3 Addenda will be issued no later than four days prior to the date for receipt of Bids, except an Addendum withdrawing the request for Bids or one which includes postponement of the date for receipt of Bids.

§ 3.4.4 Prior to submitting a Bid, each Bidder shall ascertain that the Bidder has received all Addenda issued, and the Bidder shall acknowledge their receipt in the Bid.

ARTICLE 4 BIDDING PROCEDURES

§ 4.1 Preparation of Bids

§ 4.1.1 Bids shall be submitted on the forms included with or identified in the Bidding Documents.

§ 4.1.2 All blanks on the bid form shall be legibly executed. Paper bid forms shall be executed in a non-erasable medium.

§ 4.1.3 Sums shall be expressed in both words and numbers, unless noted otherwise on the bid form. In case of discrepancy, the amount entered in words shall govern.

§ 4.1.4 Edits to entries made on paper bid forms must be initialed by the signer of the Bid.

§ 4.1.5 All requested Alternates shall be bid. If no change in the Base Bid is required, enter "No Change" or as required by the bid form.

§ 4.1.6 Where two or more Bids for designated portions of the Work have been requested, the Bidder may, without forfeiture of the bid security, state the Bidder's refusal to accept award of less than the combination of Bids stipulated by the Bidder. The Bidder shall neither make additional stipulations on the bid form nor qualify the Bid in any other manner.

§ 4.1.7 Each copy of the Bid shall state the legal name and legal status of the Bidder. As part of the documentation submitted with the Bid, the Bidder shall provide evidence of its legal authority to perform the Work in the jurisdiction where the Project is located. Each copy of the Bid shall be signed by the person or persons legally authorized to bind the Bidder to a contract. A Bid by a corporation shall further name the state of incorporation and have the corporate seal affixed. A Bid submitted by an agent shall have a current power of attorney attached, certifying the agent's authority to bind the Bidder.

§ 4.1.8 A Bidder shall incur all costs associated with the preparation of its Bid.

§ 4.2 Bid Security

§ 4.2.1 Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders. The Bidder pledges to enter into a Contract with the Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to the Owner as liquidated damages, not as a penalty. The amount of the bid security shall not be forfeited to the Owner in the event the Owner fails to comply with Section 6.2.

§ 4.2.2 If a surety bond is required, it shall be written on AIA Document A310, Bid Bond, unless otherwise provided in the Bidding Documents, and the attorney-in-fact who executes the bond on behalf of the surety shall affix to the bond a certified and current copy of the power of attorney.

§ 4.2.3 The Owner will have the right to retain the bid security of Bidders to whom an award is being considered until either (a) the Contract has been executed and bonds, if required, have been furnished, or (b) the specified time has elapsed so that Bids may be withdrawn or (c) all Bids have been rejected.

§ 4.3 Submission of Bids

§ 4.3.1 A Bidder shall submit its Bid as indicated below:

§ 4.3.2 Paper copies of the Bid, the bid security, and any other documents required to be submitted with the Bid shall be enclosed in a sealed opaque envelope. The envelope shall be addressed to the party receiving the Bids and shall be identified with the Project name, the Bidder's name and address, and, if applicable, the designated portion of the Work for which the Bid is submitted. If the Bid is sent by mail, the sealed envelope shall be enclosed in a separate mailing envelope with the notation "SEALED BID ENCLOSED" on the face thereof.

§ 4.3.3 Bids shall be submitted by the date and time and at the place indicated in the invitation to bid. Bids submitted after the date and time for receipt of Bids, or at an incorrect place, will not be accepted.

§ 4.3.4 The Bidder shall assume full responsibility for timely delivery at the location designated for receipt of Bids.

§ 4.3.5 A Bid submitted by any method other than as provided in this Section 4.3 will not be accepted.

§ 4.4 Modification or Withdrawal of Bid

§ 4.4.1 Prior to the date and time designated for receipt of Bids, a Bidder may submit a new Bid to replace a Bid previously submitted, or withdraw its Bid entirely, by notice to the party designated to receive the Bids. Such notice shall be received and duly recorded by the receiving party on or before the date and time set for receipt of Bids. The receiving party shall verify that replaced or withdrawn Bids are removed from the other submitted Bids and not considered. Notice of submission of a replacement Bid or withdrawal of a Bid shall be worded so as not to reveal the amount of the original Bid.

§ 4.4.2 Withdrawn Bids may be resubmitted up to the date and time designated for the receipt of Bids in the same format as that established in Section 4.3, provided they fully conform with these Instructions to Bidders. Bid security shall be in an amount sufficient for the Bid as resubmitted.

§ 4.4.3 After the date and time designated for receipt of Bids, a Bidder who discovers that it made a clerical error in its Bid shall notify the Architect of such error within two days, or pursuant to a timeframe specified by the law of the jurisdiction where the Project is located, requesting withdrawal of its Bid. Upon providing evidence of such error to the reasonable satisfaction of the Architect, the Bid shall be withdrawn and not resubmitted.

ARTICLE 5 CONSIDERATION OF BIDS

§ 5.1 Opening of Bids

If stipulated in an advertisement or invitation to bid, or when otherwise required by law, Bids properly identified and received within the specified time limits will be publicly opened and read aloud. A summary of the Bids may be made available to Bidders.

§ 5.2 Rejection of Bids

Unless otherwise prohibited by law, the Owner shall have the right to reject any or all Bids.

§ 5.3 Acceptance of Bid (Award)

§ 5.3.1 It is the intent of the Owner to award a Contract to the lowest responsive and responsible Bidder, provided the Bid has been submitted in accordance with the requirements of the Bidding Documents. Unless otherwise prohibited by law, the Owner shall have the right to waive informalities and irregularities in a Bid received and to accept the Bid which, in the Owner's judgment, is in the Owner's best interests.

§ 5.3.2 Unless otherwise prohibited by law, the Owner shall have the right to accept Alternates in any order or combination, unless otherwise specifically provided in the Bidding Documents, and to determine the lowest responsive and responsible Bidder on the basis of the sum of the Base Bid and Alternates accepted.

ARTICLE 6 POST-BID INFORMATION

§ 6.1 Contractor's Qualification Statement

Bidders to whom award of a Contract is under consideration shall submit to the Architect, upon request and within the timeframe specified by the Architect, a properly executed AIA Document A305™, Contractor's Qualification Statement, unless such a Statement has been previously required and submitted for this Bid.

§ 6.2 Owner's Financial Capability

A Bidder to whom award of a Contract is under consideration may request in writing, fourteen days prior to the expiration of the time for withdrawal of Bids, that the Owner furnish to the Bidder reasonable evidence that financial arrangements have been made to fulfill the Owner's obligations under the Contract. The Owner shall then furnish such reasonable evidence to the Bidder no later than seven days prior to the expiration of the time for withdrawal of Bids. Unless such reasonable evidence is furnished within the allotted time, the Bidder will not be required to execute the Agreement between the Owner and Contractor.

§ 6.3 Submittals

§ 6.3.1 After notification of selection for the award of the Contract, the Bidder shall, as soon as practicable or as stipulated in the Bidding Documents, submit in writing to the Owner through the Architect:

.1 a designation of the Work to be performed with the Bidder's own forces;

.2 names of the principal products and systems proposed for the Work and the manufacturers and suppliers of each; and

.3 names of persons or entities (including those who are to furnish materials or equipment fabricated to a special design) proposed for the principal portions of the Work.

§ 6.3.2 The Bidder will be required to establish to the satisfaction of the Architect and Owner the reliability and responsibility of the persons or entities proposed to furnish and perform the Work described in the Bidding Documents.

§ 6.3.3 Prior to the execution of the Contract, the Architect will notify the Bidder if either the Owner or Architect, after due investigation, has reasonable objection to a person or entity proposed by the Bidder. If the Owner or Architect has reasonable objection to a proposed person or entity, the Bidder may, at the Bidder's option, withdraw the Bid or submit an acceptable substitute person or entity. The Bidder may also submit any required adjustment in the Base Bid or Alternate Bid to account for the difference in cost occasioned by such substitution. The Owner may accept the adjusted bid price or disqualify the Bidder. In the event of either withdrawal or disqualification, bid security will not be forfeited.

§ 6.3.4 Persons and entities proposed by the Bidder and to whom the Owner and Architect have made no reasonable objection must be used on the Work for which they were proposed and shall not be changed except with the written consent of the Owner and Architect.

ARTICLE 7 PERFORMANCE BOND AND PAYMENT BOND

§ 7.1 Bond Requirements

§ 7.1.1 If stipulated in the Bidding Documents, the Bidder shall furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

§ 7.1.2 If the furnishing of such bonds is stipulated in the Bidding Documents, the cost shall be included in the Bid. If the furnishing of such bonds is required after receipt of bids and before execution of the Contract, the cost of such bonds shall be added to the Bid in determining the Contract Sum.

§ 7.1.3 The Bidder shall provide surety bonds from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located.

§ 7.1.4 Unless otherwise indicated below, the Penal Sum of the Payment and Performance Bonds shall be the amount of the Contract Sum.

§ 7.2 Time of Delivery and Form of Bonds

§ 7.2.1 The Bidder shall deliver the required bonds to the Owner not later than three days following the date of execution of the Contract. If the Work is to commence sooner in response to a letter of intent, the Bidder shall, prior to commencement of the Work, submit evidence satisfactory to the Owner that such bonds will be furnished and delivered in accordance with this Section 7.2.1.

§ 7.2.2 Unless otherwise provided, the bonds shall be written on AIA Document A312, Performance Bond and Payment Bond.

§ 7.2.3 The bonds shall be dated on or after the date of the Contract.

§ 7.2.4 The Bidder shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix to the bond a certified and current copy of the power of attorney.

ARTICLE 8 ENUMERATION OF THE PROPOSED CONTRACT DOCUMENTS

§ 8.1 Copies of the proposed Contract Documents have been made available to the Bidder and consist of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor, unless otherwise stated below.

.2 AIA Document A201™–2017, General Conditions of the Contract for Construction, unless otherwise stated below.

PART 1 - GENERAL

1.01 SOILS REPORT

A. A geotechnical investigation of the site has been made for use in site grading and foundation design for this Project. This report has been bound herein for information purposes only. Boring logs and test data are for information only. Conditions are not intended as representations or warranties of accuracy or continuity between soil borings. Architect and Owner will not be responsible for interpretations or conclusions drawn from this data by Contractor and advise Contractor to make his own investigations as he deems necessary.

B. Additional test borings and other exploratory operations may be performed by Contractor, at the Contractor's expense; however, no change in the Contract Sum will be authorized for such additional exploration.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF DOCUMENT

Grubbs, Hoskyn, Barton & Wyatt, INC.
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(501) 455-2536
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August 25, 2022
Project No. 22-068

Polk Stanley Wilcox
801 South Spring Street
Little Rock, Arkansas 72201

Attn: Mr. Jason Landrum, AIA

RESULTS of GEOTECHNICAL INVESTIGATION
PROPOSED CARTI LINEAR ACCELERATOR VAULT ADDITION
EL DORADO, ARKANSAS

INTRODUCTION

Submitted herein are the final results of the geotechnical investigation performed for the proposed linear accelerator vault (LAV) addition planned at the CARTI clinic in El Dorado, Arkansas. These services were authorized by Ms. Dian Bartlett of Polk Stanley Wilcox on May 24, 2022. This study has been performed in general accordance with our proposal of May 23, 2022 (GHBW Proposal No. 22-047). An interim report with preliminary recommendations was submitted on June 27, 2022. Additional recommendations have been developed for ductile iron piles (DIP's) since the submittal of the interim report.

We understand that the linear accelerator vault will have approximate footprint dimensions of 37 ft by 60 feet. A shared 15-ft wide, 50-ft long control room will be on the west side of the vault and connected to the existing building. The new vault will have concrete walls expected to be 4-ft thick as well as a concrete bottom mat and roof. Foundation dead loads will be approximately 4.0 kips per sq ft and live loads will be 1.0 kip per sq feet. Settlement tolerance will be low. The finish floor of the addition is planned at El 106.10. The existing truck well will be filled to match the finish floor. Site grading is expected to be minor, with approximately 1 ft of fill over most of the site. The truck well area is expected to require up to 4 ft of fill. A preliminary site grading plan is provided in Appendix A.

The purposes of this study were to explore subsurface conditions at the project site and to develop recommendations to guide design and construction of foundations. The results of the field and laboratory studies are discussed in the following report sections. Conclusions and recommendations are discussed in subsequent report sections.

SUBSURFACE EXPLORATION

Subsurface conditions at the LAV addition site were investigated by drilling three (3) sample borings to depths of 60- to 70-ft below existing grades. The project vicinity is shown on Plate 1. The approximate boring locations are shown on the Plan of Borings, Plate 2. The subsurface conditions encountered in the borings, and the results of field and laboratory tests, are shown on the boring logs, Plates 3 through 8. A key to the terms and symbols used on the logs is presented on Plate 9.

The borings were drilled with track-mounted Marooka 600 rotary-drilling rig using dry-auger and rotary-wash drilling techniques. Samples were obtained at approximately 2-ft intervals to 10-ft depth and at 5-ft intervals thereafter. Soil samples were recovered using a 2-in.-diameter split-barrel sampler driven into the strata by blows of a 140-lb hammer with 30-in. drop in accordance with Standard Penetration Test (SPT) procedures. The number of blows required to drive the standard split-barrel sampler the final 12 in. of an 18-in. total drive, or a portion thereof, is defined as the Standard Penetration Number (N). Recorded N-values are shown on the boring logs in the "Blows Per Ft" column.

All samples were removed from sampling tools in the field, examined and visually classified. Samples were then placed in appropriate containers to prevent moisture loss and/or change in condition during transfer to our laboratory for further examination and testing.

The borings were advanced using dry-auger procedures to the extent possible to facilitate evaluation of groundwater conditions. Observations regarding groundwater are noted in the lower-right portion of the logs and are discussed in subsequent sections of this report. All boreholes were backfilled with bentonite after obtaining final groundwater measurements.

LABORATORY TESTING

To evaluate pertinent soil properties, laboratory tests consisting of classification tests and natural water content determinations were performed. A total of 46 natural water content determinations were performed to develop information on *in-situ* soil water content. Water content results are plotted on the boring logs as solid circles in accordance with the scale and symbols shown in the legend located in the upper-right corner of the logs.

To verify field classification and to evaluate soil plasticity, nine (9) liquid and plastic (Atterberg) limits determinations and 11 sieve analyses were performed on selected representative samples. The Atterberg limits are plotted on the logs as pluses inter-connected with a dashed line

using the water content scale or are denoted as "Non-Plastic." The percentage of soil passing the No. 200 Sieve is noted in the "- No. 200 %" column on the log forms. Classification test results, along with soil classification by the Unified Soil Classification System, are summarized in Appendix B. Grain-size distribution curves are also included in Appendix B.

GENERAL SITE and SUBSURFACE CONDITIONS

Site Conditions

The project site is located at the existing CARTI facility at 1601 Northwest Avenue in El Dorado, Arkansas. The surrounding area to the north, west, and south of the subject site consists of light commercial development with numerous single-story buildings and associated pavements. The area to the east consists of undeveloped land with mature trees. The addition site is on the northeast corner of the existing building. The site is currently mostly covered by an asphalt concrete parking lot and a landscaped area. The pavements are in poor to fair condition. A concrete retaining wall is north of the addition site. The terrain falls several feet from the retaining wall down to the parking lot. A short grass cover and landscaping are the ground cover in the area between the retaining wall and the parking lot. The site terrain slopes gently eastward over the parking lot down to the tree cover. Surface drainage is considered fair to good in the addition location.

Seismic Conditions

The Union County, Arkansas site is located in Seismic Zone 1, noted by the Arkansas Building Authority (2005) as the zone of least anticipated seismic potential. In light of the results of the borings performed for this study and our knowledge of the local geology, a Seismic Site Class C (very dense soils and soft rock profile) is considered applicable to the site in accordance with the criteria of the International Building Code (IBC 2012). The liquefaction potential is considered negligible for the predominantly cohesive soils encountered within the exploration depths of the borings.

Subsurface Conditions

The project site is located in the mapped exposure of the Tertiary Period, Eocene Epoch Claiborne Group. The Claiborne is primarily non-marine in origin but with occasional marine intervals. This formation is composed of medium- to very fine-grained sand, silt, and silty clay. The Claiborne contains some intervals enriched in carbonaceous materials, indicated by a dark brown or black color. Lignite beds are also present in the Claiborne. The lower contact of the Claiborne is poorly known, but the formation is generally considered unconformable to the Wilcox

Group. The thickness of the Claiborne Group varies from a few feet to about 1500 feet. Bedrock (Paleozoic rocks) in the El Dorado area is reported to be in excess of 6800-ft depth.

In light of the results of the borings performed for this study, the subsurface stratigraphy may be generalized into pavements and four (4) primary strata as follows.

Pavements: Existing pavements cover much of the ground surface of the addition site. Approximately 3 to 5 in. of asphalt concrete and 1 to 4 in. of crushed stone aggregate base were encountered in the borings.

Stratum I: The surface stratum to 2 to 6 ft below existing grades is comprised of on-site fill. The fill is comprised of a variable content of very soft to firm tan, gray, and grayish tan fine sandy clay and medium dense fine sandy silt with gravel and some decayed organics. The of on-site fill has low plasticity, poor compaction, and high to moderate compressibility. The sandy silt is moisture-sensitive and will lose considerable strength when saturated. The depth, content, and compaction of the on-site fill is likely to vary across the site.

Stratum II: Locally below the fill (see Borings 1 and 3) and extending to 6- to 8-ft depth is natural very soft to stiff gray and tan fine sandy clay with ferrous stains and nodules and a trace of organics. The fine sandy clay exhibits low plasticity, very low to low shear strength, and high compressibility.

Stratum III: The Stratum I surficial fill and the localized sandy clay of Stratum II is underlain by soft to stiff brown, dark brown, tan, and gray clay extending to 18- to 33-ft depth. The clay has a blocky structure and contains silt partings and ferrous stains. The clay exhibits medium to high plasticity. However, the depth to the clay reduces the potential for shrink-swell activity. The clay also has low shear strength with moderate compressibility.

Stratum IV: The basal stratum encountered within the exploration depths of the borings is interbedded dark brown, gray, dark gray and grayish brown stiff to very stiff silty clay and sandy clay and dense to very dense silty fine sand with organic inclusions. These units are interbedded and either the silty sand or silty clay can be predominant across the site. The silty, sandy clay and silty fine sand exhibit moderate to high shear/high relative density and low compressibility.

Groundwater Conditions

Shallow groundwater was encountered between 19- to 20-ft depth in the borings drilled in June 2022. In addition, shallow perched groundwater could be present in the on-site fill, the sandy near-surface soils, underground utility trenches, and around existing foundations, particularly during wet seasons of the year. Groundwater levels will vary, depending upon seasonal precipitation, surface runoff and infiltration.

ANALYSES and RECOMMENDATIONS

Foundation Design

Foundations for the new LAV addition must satisfy two (2) basic and independent design criteria. First, the maximum bearing pressure transmitted to the supporting strata must not exceed the allowable bearing pressure based on an allowable factor of safety with respect to bearing stratum shear strength. Secondly, foundation movements resulting from consolidation, shrinkage, or swelling of the supporting strata should be within tolerable limits for the structure. Construction factors such as installation of foundation units, fill placement, excavation procedures, and surface and groundwater conditions must also be considered.

In view of the results of the borings, the predominance of weak and highly-compressible soils to about 12-ft depth, and the limited tolerance for settlement, we recommend the foundation loads of the LAV addition be supported on a deep foundation system. A foundation system comprised of ductile iron piles (DIP's) is recommended. To limit differential settlement between the control room and vault and to facilitate construction, we recommend that the control room also be supported on DIP's.

Based on information discussed with the Design Team, Contractor, and the Specialty Subcontractor, we understand that 118mm ductile iron piles with a 220mm grout shoe have been selected for this project. Other pile types or sizes can be evaluated if desired. Recommendations for DIP's are discussed in the following paragraphs.

Ductile Iron Piles (DIP's)

We recommend the foundation loads of the LAV addition be supported on a deep foundation system comprised of ductile iron piles. DIP's must extend through the upper zones of weak and highly-compressible clayey soils into the very stiff to hard silty clay and sandy clay units below about 35 feet.

An allowable DIP capacity curve for 118mm ductile iron piles is provided in Appendix C. The calculated capacity was developed assuming a friction displacement pile installed using continuous grouting during driving and a 220mm grout shoe. Total settlement is expected to be less than 0.5 in. for properly-installed piles. Differential settlement of properly installed piles extending to the very stiff silty clay and sandy clay units below about 35-ft depth is expected to be negligible and within tolerable limits for the new LAV. A minimum DIP length of 35 ft below existing grades is recommended. We have assumed that piles will be installed from about 3 ft

below existing grades. Minor variations in the pile cap bottom elevation are not expected to impact pile capacity providing the embedment remains the same as shown on the capacity curve.

Ultimate capacities have been developed using static pile capacity formulae. The allowable pile capacities shown in Appendix C include a minimum factor of safety of 2.0 for compression and 3.0 for uplift.

We strongly recommend that the calculated pile capacity of DIP's be verified by a pile load test program. The compression pile load test should be performed on a sacrificial DIP in general conformance with ASTM D1143-07. The quick test procedure is expected to be sufficient for the compression load test. The Specialty Subcontractor should provide a work plan for the load test. The work plan should include jack calibration, a list of equipment, and loading/unloading sequence.

The allowable capacities are based on single, isolated foundations. We recommend a minimum pile spacing of three (3) pile diameters, center to center. Piles spaced closer than about three (3) pile diameters may develop lower individual axial capacity due to group effects. Further analysis is recommended for a closely-spaced pile layout.

We have assumed that site grading associated with the LAV addition will be minor with no more that about 1 ft of fill and that the LAV bottom mat will be fully supported on piling. Therefore, downdrag loads due to settlement have not been considered in developing the pile capacity curves.

The DIP's must be installed using a high-frequency impact hammer with sufficient energy to penetrate the predominantly clayey foundation soils. The foundation soils generally exhibit an increase in shear strength with depth. Advancing DIP's into very stiff clay/silty clay will be increasingly difficult with depth.

Floor Slabs/Bottom Mat

Slab-on-fill construction will be suitable for the addition floor slabs and bottom mats. As noted, it is expected that the LAV and Control Room floor slabs/bottom mats will be fully supported on DIP's. The weak soil zone in the addition area extends to 6-ft depth or more. However, given support of the bottom mat on piling, subgrade improvement and undercuts can be limited to that required to facilitate construction. In lieu of deep undercuts, consideration can be given to utilizing a minimum of 1.5 to 2 ft of select clayey gravel or crushed stone aggregate base (ARDOT Class 7) over a heavy geotextile such as Mirafi HP270 or approved equal to develop a

stable working platform. Care should be taken that use of select granular fill and a heavy geotextile do not impede DIP installation

We also recommend that all floor slabs be supported on a 4- to 6-in.-thick clean crushed stone layer placed on a properly prepared subgrade. The granular layer should be densified with vibrating equipment prior to floor slab construction. Impervious sheeting should be placed between the slab and granular course to act as a vapor retarder.

Structural Overlay

Where the existing pavement is stable and distress is relatively minor, a structural overlay may be used to restore the pavement surface course, provide additional traffic capacity, and to grade pavement areas to facilitate drainage. Based on the current pavement condition and the average thickness of the existing pavement section components, a minimum overlay thickness of 2 in. is recommended. Asphalt concrete surface course (Asphalt Concrete Hot Mix Surface Course (Standard Specifications for Highway Construction, 2014 Edition, Section 407, ½ inch, N_{max} = 115) is suitable for use as an overlay. It is possible that reflection cracking will occur with any overlay. The extent of reflection cracking will be directly related to the pavement condition when the overlay is placed.

Prior to applying an overlay, all areas of full-depth failure should be repaired. Full-depth repair areas can be backfilled with crushed stone aggregate base underlain by Mirafi 140N fabric or an approved alternate. The overlay may then be applied over the surface of the base.

In addition to repair of full-depth pavement failures and areas of severe alligator cracking, all cracks with width greater than about ⅛ inch should be sealed prior to overlaying. We recommend use of a bituminous tack coat prior to applying the overlay. The tack coat should be applied in accordance with ARDOT Standard Specifications Section 401.

Site Grading

We recommend that existing pavements be left in place wherever possible to facilitate construction operations and to minimize the potential for undercuts. However, where additional fill is placed over existing pavements, the pavement should be randomly perforated to prevent trapping infiltrated water.

Some demolition of the existing pavements is anticipated. Following pavement demolition and any cut, and prior to any fill placement, the subgrade should be proof-rolled with a loaded tandem-wheel dump truck or similar equipment. Any soft or loose soils in project area should be excavated, processed, and recompacted or replaced with select fill, whichever is appropriate. Where

pavements are removed, undercuts of 2 to 6 ft, more or less, below existing grade should be anticipated for areas where a stable subgrade is required. As noted, undercuts in the floor slab/bottom mat areas can be limited to those required to develop sufficient stability for construction. Consideration may be given to utilizing geotextiles and select granular fill to reduce undercut depths.

Mass undercuts should extend at least 5 ft beyond addition limits to the extent possible. All undercuts should be observed by the Geotechnical Engineer to verify adequate removal of soft, compressible soils.

The on-site soils are not suitable for use as select backfill or fill in building or pavement areas but may be used in landscaped areas away from structures. Imported borrow for fill or backfill should consist of low-plasticity clayey sand (SC), sandy clay (CL), or clayey gravel (GC) with a liquid limit less than 40 and a maximum plasticity index (PI) of 18, or an approved alternate. Fill and backfill should have a maximum particle size of about 3 inches and must be free of organic materials and debris. Fill and backfill should be approved by the Geotechnical Engineer.

Recompacted soils, fill, and backfill should be compacted to at least 98 percent of the maximum Standard Proctor (ASTM D698) dry density within a water content range of optimum to 3 percent above the optimum value. All fill and backfill should be placed in nominal 6- to 8-in.-thick lifts. Each lift of fill or backfill should be properly compacted, tested and approved prior to placing subsequent lifts.

CONSTRUCTION CONSIDERATIONS

Positive surface drainage should be established at the start of the work, be maintained during construction and following completion of the work to prevent surface water ponding and subsequent saturation of subgrade soils. Density and water content of all earthwork should be maintained until the work is completed. Subgrade or foundation soils that become saturated by ponding water or runoff should be excavated to undisturbed soils.

Groundwater was encountered between 19 and 20 ft June 2022. However, it is possible that some shallow perched water could be present during construction. Limited seepage into shallow excavations can probably be controlled by ditching or via sump-and-pump methods. If seepage infiltration cannot be controlled, construction of drains and/or the use of stone backfill (i.e., “B” stone or #57 stone) will be warranted. Stone backfill should be fully encapsulated in geotextile

filter fabric and vented to positive discharge into storm lines or to daylight. Caution should be applied in use of stone backfill where piling will be installed.

Ductile iron pile load testing and installation should be observed by the Geotechnical Engineer. The Specialty Subcontractor should have appropriate equipment with sufficient energy capabilities to install piles to the plan tip elevation. Installation of the test pile and the reaction piles can be helpful in assessing driveability of DIP's.

CLOSURE

The Architect or a designated representative thereof should monitor site preparation, grading work and all foundation construction. Subsurface conditions significantly at variance with those encountered in the borings should be brought to the attention of the Geotechnical Engineer. The conclusions and recommendations of this report should then be reviewed in light of the new information.

The following illustrations are attached and complete this submittal.

Plate 1	Site Vicinity
Plate 2	Plan of Borings
Plates 3 through 8	Boring Logs
Plate 9	Key to Terms and Symbols
Appendix A	Preliminary Site Grading Plan
Appendix B	Classification Test Results
Appendix C	Allowable DIP Capacity Curve

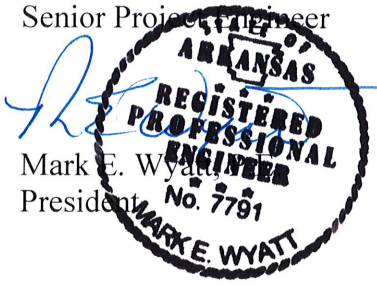
* * * * *

We appreciate the opportunity to be of service to you on this project. Should you have any questions regarding this report, or if we may be of additional assistance during final design or construction, please call on us.

Sincerely,

GRUBBS, HOSKYN,
BARTON & WYATT, INC.

Velleta M. Scott, P.E.
Senior Project Engineer



Mark E. Wyatt
President

VMS/MEW:jw

Copies submitted:

Polk Stanley Wilcox
Attn: Mr. Jason Landrum, AIA (1-email)
Attn: Ms. Dian Barlett, AIA, LEED AP (1-email)

PE, Inc. Structural Engineering
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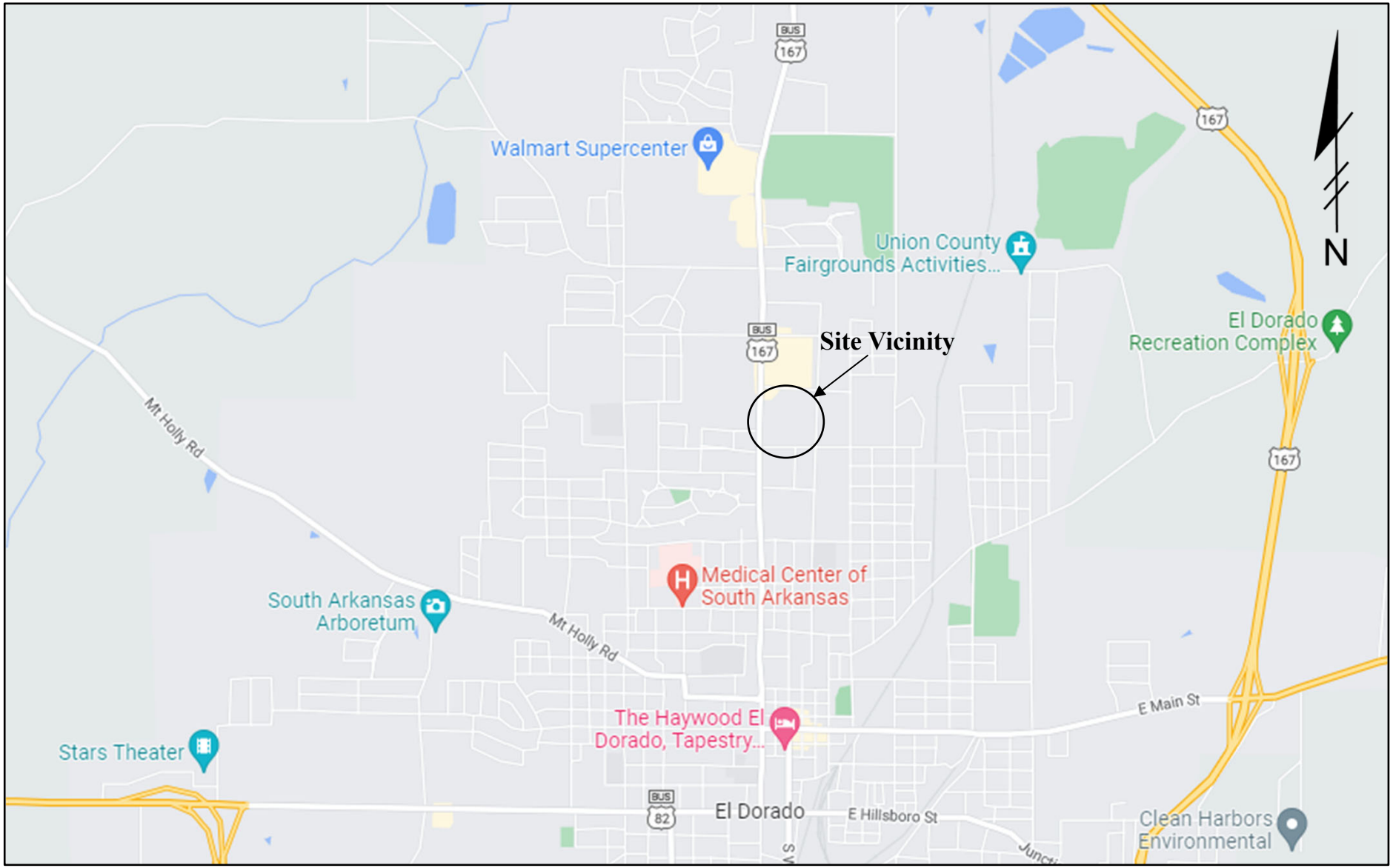
Clark Contractors, LLC
Attn: Mr. Stephen Lane, CHC (1-email)

Foundation Specialties, Inc.
Attn: Mr. Kert Thielen (1-email)



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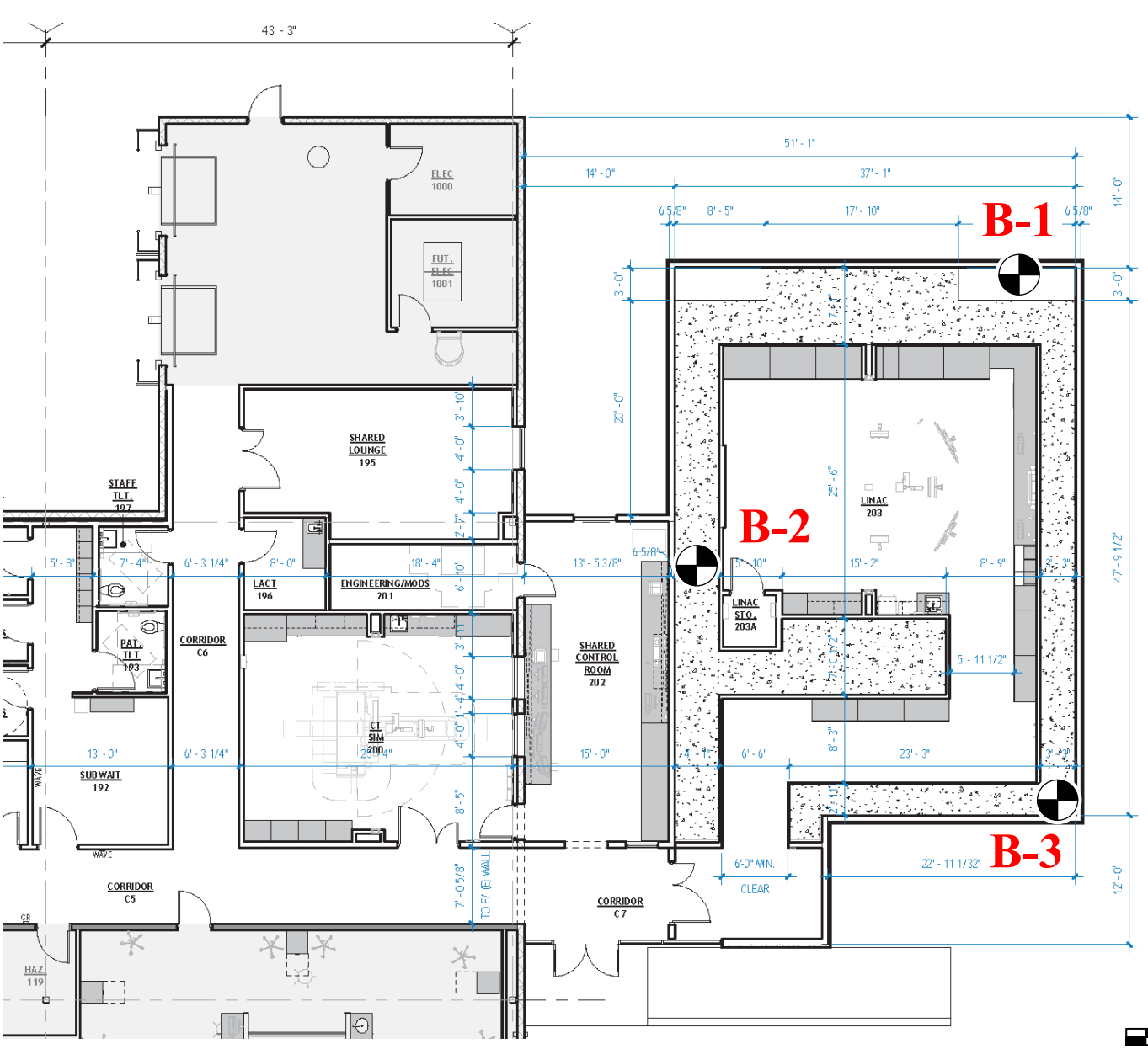
CONSULTING ENGINEERS

SITE VICINITY MAP
CARTI LAV Addition
El Dorado, Arkansas

Job No. 22-068

Plate 1



Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS

PLAN of BORINGS
CARTI LAV Additions
El Dorado, Arkansas

Scale: As Shown

Job No. 22-068

Plate 2

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 1

CARTI Linear Accelerator Vault Addition
El Dorado, Arkansas

TYPE: Auger to 18 ft /Wash

LOCATION: See Plate 2

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			SURF. EL: 106±				
			Medium dense grayish tan fine sandy silt, slightly clayey w/crushed stone (fill)	18			32
			Soft gray w/tan fine sandy clay w/ferrous stains and nodules and rootlets	6			
5			- very soft to soft at 4 to 6 ft	4			
			- stiff with less tan below 6 ft	13			
			Firm gray clay, blocky w/occasional silt partings and rootlets	9			
10							
			- stiff below 12 ft				
15				12		81	100
			Stiff dark brown silty clay	15			
20							
			- very stiff, dark grayish brown below 22 ft	27			
25							
			- with silt partings below 28 ft	34			
30							
				28			
35							
				27			
40							
				30			

COMPLETION DEPTH: 70.0 ft
DATE: 6-15-22

DEPTH TO WATER IN BORING: 19.5 ft

DATE: 6/15/2022

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Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 1

CARTI Linear Accelerator Vault Addition
El Dorado, Arkansas

TYPE: Auger to 18 ft /Wash LOCATION: See Plate 2

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
50			(continued)	28			
55			Dense to very dense gray silty fine sand w/occasional silty clay seams and layers	50/10"			
60				50/10"			28
65			- dense with occasional organic inclusions below 62 ft	47			
70				49			
75							
80							
85							

COMPLETION DEPTH: 70.0 ft
DATE: 6-15-22

DEPTH TO WATER IN BORING: 19.5 ft
DATE: 6/15/2022

LGBNEW 22-068.GPJ 6-27-22

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 2

CARTI Linear Accelerator Vault Addition
El Dorado, Arkansas

TYPE: Auger to 20 ft /Wash

LOCATION: See Plate 2

SURF. EL: 105±

DEPTH, FT	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	- No. 200 %
	5 inches: Asphalt Cement Concrete 1 inch: Crushed Stone Base	6		
	Soft gray w/tan fine sandy clay w/some river gravel (fill)	7		
5	- firm at 2 to 4 ft - very soft below 4 ft	WOH		64
	Firm gray clay, blocky w/silt partings and ferrous stains	9		
10		9		98
	- stiff with tan below 12 ft			
15		12		
	Stiff dark brown clay w/occasional silt partings	22		
20				
25		22		
		19		
30				
35	Very stiff dark gray and grayish brown silty clay w/interbedded silty fine sand seams and layers and occasional organic inclusions	26		
40		39		
		44		

COHESION, TON/SQ FT: 0.2 0.4 0.6 0.8 1.0 1.2 1.4

PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT: 10 20 30 40 50 60 70

COMPLETION DEPTH: 60.0 ft
DATE: 6-15-22

DEPTH TO WATER IN BORING: 19.8 ft
DATE: 6/15/2022

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Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 2

CARTI Linear Accelerator Vault Addition
El Dorado, Arkansas

TYPE: Auger to 20 ft /Wash

LOCATION: See Plate 2

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			(continued)				
50				38			
55				50/11"			
60				50/11"			
65							
70							
75							
80							
85							

COMPLETION DEPTH: 60.0 ft
DATE: 6-15-22

DEPTH TO WATER IN BORING: 19.8 ft
DATE: 6/15/2022

LGBNEW 22-068.GPJ 6-27-22

Grubbs, Hoskyn, Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 3

CARTI Linear Accelerator Vault Addition
El Dorado, Arkansas

TYPE: Auger to 20 ft /Wash

LOCATION: See Plate 2

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT — WATER CONTENT — LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			SURF. EL: 104±				
			3 inches: Asphalt Cement Concrete	7			
			4 inches: Crushed Stone Base				
			Firm gray w/tan fine sandy clay w/decayed organics (fill)	2			59
5			Very soft gray w/tan fine sandy clay, wet	WOH			
			Soft gray clay w/occasional silt partings	5			89
			- firm, blocky below 8 ft	9			
10							
			- stiff with tan below 12 ft	12			
15							
				11			
20							
			- brown at 22 to 27 ft	22			
25							
				22			
30							
			Very stiff brownish gray fine sandy clay w/silty fine sand seams and layers and organic inclusions	40			
35							
				30			51
40							
				31			

COMPLETION DEPTH: 70.0 ft
DATE: 6-14-22

DEPTH TO WATER IN BORING: 19.2 ft

DATE: 6/14/2022

LGBNEW 22-068.GPJ 6-27-22

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Barton & Wyatt, Inc.
Consulting Engineers

LOG OF BORING NO. 3

CARTI Linear Accelerator Vault Addition
El Dorado, Arkansas

TYPE: Auger to 20 ft /Wash

LOCATION: See Plate 2

DEPTH, FT	SYMBOL	SAMPLES	DESCRIPTION OF MATERIAL	BLOWS PER FT	UNIT DRY WT LB/CU FT	COHESION, TON/SQ FT (0.2 0.4 0.6 0.8 1.0 1.2 1.4) / PLASTIC LIMIT / WATER CONTENT / LIQUID LIMIT (10 20 30 40 50 60 70)	- No. 200 %
			(continued)				
50				29			
55				42			
60				50/11"			
			- with fewer organics below 62 ft				
65				44			
70				49			
75							
80							
85							

COMPLETION DEPTH: 70.0 ft
DATE: 6-14-22

DEPTH TO WATER
IN BORING: 19.2 ft
DATE: 6/14/2022

LGBNEW 22-068.GPJ 6-27-22

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Consulting Engineers

SYMBOLS AND TERMS USED ON BORING LOGS

SOIL TYPES

(SHOWN IN SYMBOLS COLUMN)

Gravel Sand Silt Clay

Predominant type shown heavy

SAMPLER TYPES

(SHOWN ON SAMPLES COLUMN)

Shelby Tube | Rock Core | Split Spoon | No Recovery | Cutting

TERMS DESCRIBING CONSISTENCY OR CONDITION

COARSE GRAINED SOILS (major portion retained on No. 200 sieve): Includes (I) Clean gravels and sands, and (2) silty or clayey gravels and sands. Condition is rated according to relative density, as determined by laboratory tests.

DESCRIPTIVE TERM	N-VALUE	RELATIVE DENSITY
VERY LOOSE	0-4	0-15%
LOOSE	4-10	15-35%
MEDIUM DENSE	10-30	35-65%
DENSE	30-50	65-85%
VERY DENSE	50 and above	85-100%

FINE GRAINED SOILS (major portion passing No. 200 sieve): Includes (1) Inorganic and organic silts and clays, (2) gravelly, sandy, or silty clays, and (3) clayey silts. Consistency is rated according to shearing strength, as indicated by penetrometer readings or by unconfined compression tests.

DESCRIPTIVE TERM	UNCONFINED COMPRESSIVE STRENGTH TON/SQ. FT.
VERY SOFT	Less than 0.25
SOFT	0.25-0.50
FIRM	0.50-1.00
STIFF	1.00-2.00
VERY STIFF	2.00-4.00
HARD	4.00 and higher

NOTE: Slickensided and fissured clays may have lower unconfined compressive strengths than shown above, because of planes of weakness or cracks in the soil. The consistency ratings of such soils are based on penetrometer readings.

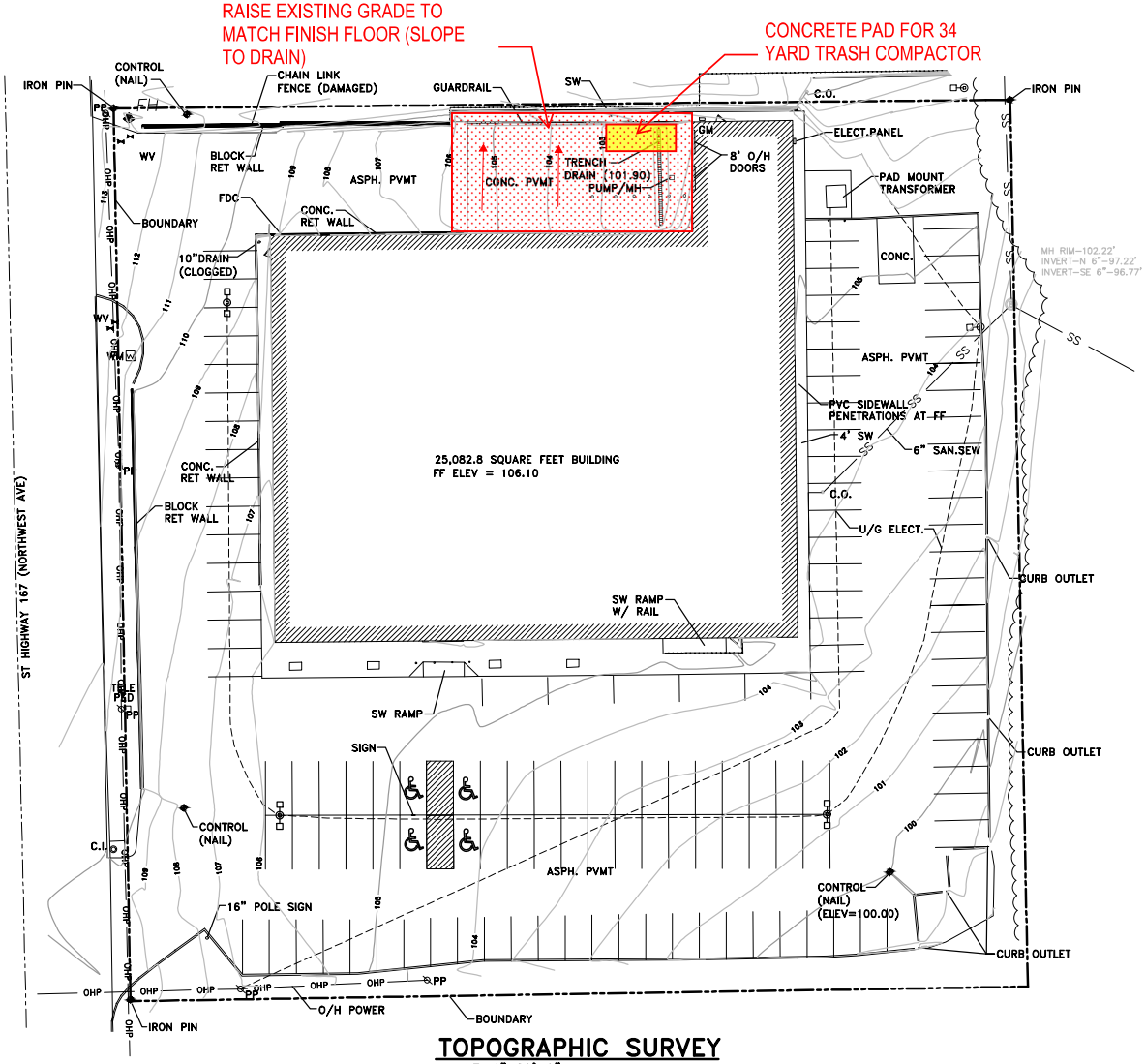
TERMS CHARACTERIZING SOIL STRUCTURE

SLICKENSIDED - having inclined planes of weakness that are slick and glossy in appearance.
FISSURED - containing shrinkage cracks, frequently filled with fine sand or silt; usually more or less vertical.
LAMINATED - composed of thin layers of varying color and texture.
INTERBEDDED - composed of alternate layers of different soil types.
CALCAREOUS - containing appreciable quantities of calcium carbonate.
WELL GRADED - having a wide range in grain sizes and substantial amounts of all intermediate particle sizes.
POORLY GRADED - predominantly of one grain size, or having a range of sizes with some intermediate sizes missing.

Terms used on this report for describing soils according to their texture or grain size distribution are in accordance with the UNIFIED SOIL CLASSIFICATION SYSTEM, as described in Technical Memorandum No.3-357, Waterways Experiment Station, March 1953

KEY 4-30-10

APPENDIX A



TOPOGRAPHIC SURVEY

SCALE: 1"=80'-0"

Date	Revision	By

Designed JMM
Checked RCF
Drawn JWR
Approved DBW

A.L. FRANKS ENGINEERING
118 East Broad Street
Texarkana, Arkansas 71854
Phone (870) 216-1906
Fax (870) 216-1907

CARTI
8901 CARTI WAY
LITTLE ROCK, AR

EXISTING SITE CONDITIONS
1601 NORTHWEST AVE
CARTI – EL DORADO, AR

Job No.: ID
Scale: 1"=80'
Date: 3/17/2021
Sheet 1

APPENDIX B

SUMMARY of CLASSIFICATION TEST RESULTS

PROJECT: CARTI Linear Accelerator Vault Addition

LOCATION: El Dorado

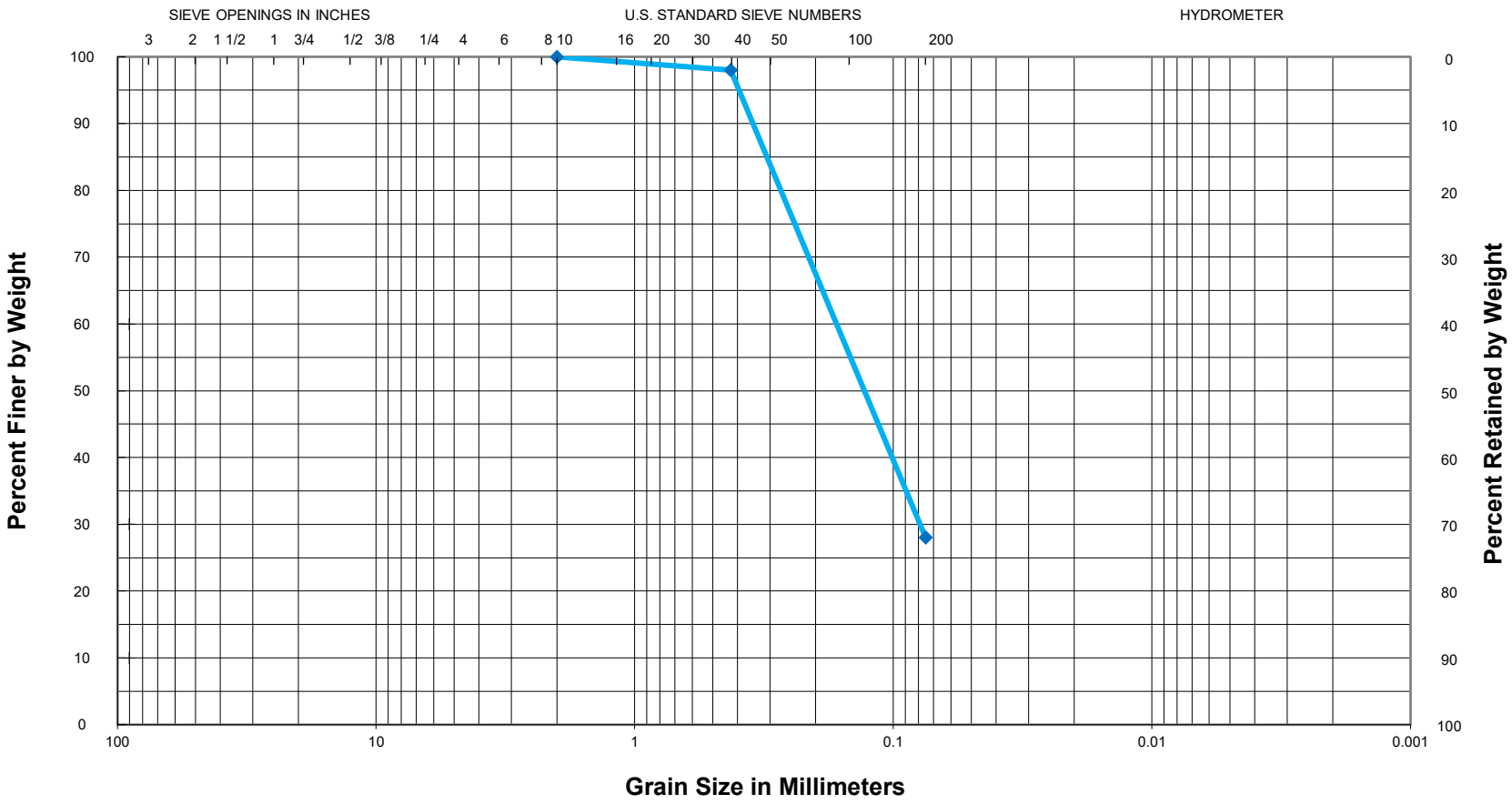
GHBW JOB NUMBER: 22-068

BORING No.	SAMPLE DEPTH (ft)	WATER CONTENT (%)	ATTERBERG LIMITS			SIEVE ANALYSIS PERCENT PASSING								USCS CLASS.	AASHTO CLASS.
			LIQUID LIMIT	PLASTIC LIMIT	PLASTICITY INDEX	2 in.	1 in.	3/4 in.	3/8 in.	#4	#10	#40	#200		
1	0.5-1.5	8	22	18	4	---	---	---	---	78	---	---	32	CL-ML	A-2-4
1	14-15	33	81	25	56	---	---	---	---	100	---	---	99	CH	A-7-6
1	59-60	27	---	---	---	100	100	100	100	100	100	98	28	SM	A-2-4
2	4.5-5.5	23	30	18	12	---	---	---	---	100	---	---	64	CL	A-6
2	9-10	33	68	28	40	---	---	---	---	100	---	---	98	CH	A-7-6
2	34-35	24	37	17	20	---	---	---	---	100	---	---	70	CL	A-6
3	2.5-3.5	19	26	15	11	---	---	---	---	99	---	---	59	CL	A-6
3	6.5-7.5	30	67	23	44	---	---	---	---	100	---	---	89	CH	A-7-6
3	39-40	27	32	22	10	---	---	---	---	100	---	---	51	CL	A-4

22-068

GRAIN SIZE CURVE

Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS



GRAVEL		SAND			SILT OR CLAY
COARSE	FINE	COARSE	MEDIUM	FINE	

Sample: B-1, 59-60 ft
Description: Gray silty fine SAND

USCS Classification = SM
AASHTO Classification = A-2-4

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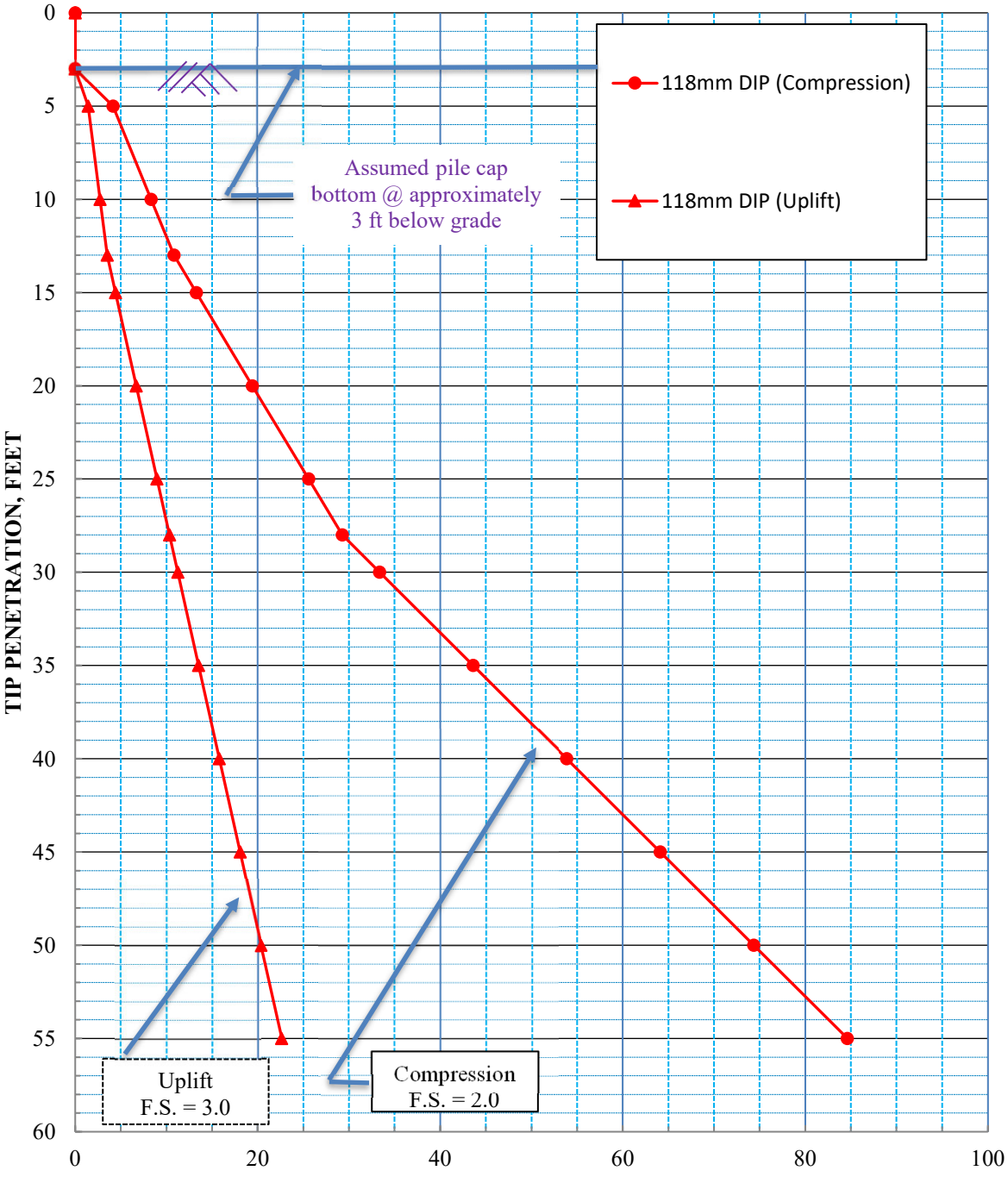
APPENDIX C

ALLOWABLE SINGLE PILE CAPACITY, TONS



ALLOWABLE SINGLE PILE CAPACITY, TONS

118mm DUCTILE IRON PILES
CARTI Linear Accelerator Vault Addition
El Dorado, Arkansas
GHBW Job No. 22-068

Note: 1. Pile cap bottom assumed to be at approximately 3 ft below existing grade.
2. Axial capacity must be verified by load test program.

Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS

P.O. Box 30970
Little Rock, Arkansas 72260-0970
#1 Trigon Place 72209
(501) 455-2536
FAX (501) 455-4137

August 26, 2022
Project No. 22-068

Polk Stanley Wilcox
801 South Spring Street
Little Rock, Arkansas 72201

Attn: Ms. Dian Barlett, AIA, LEED AP

REF: SUPPLEMENTAL RECOMMENDATIONS
LOADING DOCK INFILL and HEAVY-DUTY PAVEMENTS
PROPOSED CARTI LINEAR ACCELERATOR VAULT ADDITION
EL DORADO, ARKANSAS

Dear Ms. Barlett:

Supplemental recommendations are provided herein for the proposed linear accelerator vault (LAV) addition planned at the CARTI clinic in El Dorado, Arkansas. The results of the geotechnical investigation were provided in our report of August 25, 2022.

Loading Dock Infill

We understand that the existing depressed loading dock drive at the northwest corner of the facility will be infilled. Preliminary information indicates this encompasses an area with about 40 ft by 80 ft dimensions. The grade of the depressed loading dock drive varies from about El 106 on the west to approximately El 103 on the east, adjacent to the building, about 3 ft below the existing finish floor (El 106.1). The final grade of the infill will approximately match the existing finish floor elevation.

The south and west sides of the infill adjoin the existing building. The west side of the infill matches existing grade at approximately El 106. The north side of the infill borders the north property line. An existing segmental retaining wall and higher terrain or present on the adjoining property to the north. The infill area is shown on the portion of the site survey of March 17, 2021 provided in Attachment 1. Photographs of this area are also included in Attachment 1.

Infill. It is expected that infill will be placed inside the depressed loading dock drive, with backfill confined by the existing retaining wall on the north and the building walls on the south and east. We recommend that the loading dock drive be backfilled with cementitious, controlled low strength flowable fill. Use of flowable fill backfill would minimize any issues with surface water or groundwater infiltration and lateral earth pressures while providing good subgrade support with minimal post-construction settlement. A flowable fill mix with a maximum compressive strength of 200 lbs per sq in. is recommended to facilitate potential excavation of backfill.

Alternatively, the loading dock drive may be backfilled with clean crushed stone (ASTM D448, #57 or #67 stone) or crushed stone aggregate base (ARDOT Standard Specifications Section 303, Class 7). With clean stone or crushed stone base backfill, provision must be made for dealing

with infiltrated surface water and groundwater. Some seepage will like get into the backfill, infiltrating from the higher terrain on the north or from surface water accumulation.

With use of granular backfill, we recommend that the building walls inside the infill be waterproofed. If possible, infiltrated water should be discharged from a sump into existing drain lines. It should be noted that if accumulated water levels in the backfill rise to the level of the pavement subbase, the performance of pavements will be impaired. An existing trench drain and sump is shown in the loading dock well. If the sump has sufficient capacity, it may be utilized for discharge of infiltrated water which accumulates in the backfilled loading dock drive.

After backfilling, the building walls on the east and south and the existing retaining wall on the north will be acted on by at-rest earth pressures. Lateral earth pressures will vary with backfill type and any surcharge loads. Walls must also be adequate to withstand hydrostatic pressures that may develop.

Equivalent fluid pressures (EFP) anticipated for alternative backfill conditions are summarized in the table below.

Backfill	**At-Rest Equivalent Fluid Pressure, lbs per sq ft per ft depth, fully drained**	**At-Rest Equivalent Fluid Pressure, lbs per sq ft per ft depth, no drainage provided**
Flowable fill	Not applicable	140 (for fluid backfill)
Flowable fill	Not applicable	0 (for cured backfill)
Clean crushed stone (ASTM D448, #57 or #67)	45	80
Class 7 base	55	95

Surcharge loads may be evaluated using earth pressure coefficients of 0.45 and 0.38 for clean stone and Class 7 base, respectively.

Clean granular backfill behind the retaining wall should be placed in maximum 12-in.-thick lifts and densified by vibrating equipment, rodding or other suitable means. Crushed stone aggregate base backfill should be compacted to a minimum of 95 percent of the maximum dry density as determined by Modified Proctor (ASTM D1557) methods. If Class 7 base backfill will be drained, then a drainage zone of clean stone encapsulated in filter fabric or a geosynthetic drain board such as Mirafi G100W should be installed against walls. The drainage zone or drain board should direct seepage inflow to positive discharge.

Care must be taken to achieve the required compaction against walls. Use of hand-portable compaction equipment and thin backfill lifts are expected to be required for crushed stone base placed against walls.

Infill Pavement. It is understood that a 34 cu yd trash compactor will be placed over the infilled loading dock drive. Traffic is expected to include trucks as well as the compactor. We recommend the following pavement section for the infilled dock drive.

7 in. Portland cement concrete ($f_c' \geq 4000$ psi)
6 in. Crushed Stone Base (ARDOT Standard Specifications Section 303, Class 7)

Aggregate base below the concrete pavement should be compacted to a minimum of 98 percent of the AASHTO T 180 maximum dry density as per ARDOT criteria.

Proposed Parking and Drives

New pavements may be included in the addition project. At this time, anticipated traffic volume and loading for pavements are not known. Traffic is expected to be primarily automobile and light utility vehicle traffic, with occasional and infrequent heavy delivery truck traffic.

Based on the results of the borings, the surficial soils are weak and will provide very poor subgrade support for pavements. The zone of weak subgrade soils is relatively deep, extending to 6 ft or more. To reduce undercut requirements, we recommend the use of select granular fill over a heavy geotextile or stone backfill/"B"-stone. Concepts for subgrade improvement are shown on the sketches provided in Attachment 2.

Recommended alternatives for pavement sections are summarized below. Should subgrade conditions vary from those discussed, pavement sections should be re-evaluated.

Parking

3 in. Asphalt Concrete Hot Mix Surface Course (ARDOT Standard Specifications for Highway Construction, 2014 Edition, Section 407, ½ inch, N_{max} = 115)

6 in. Crushed Stone Base (ARDOT Standard Specifications for Highway Construction, 2014 Edition, Section 303, Class 7)

Drives

3 in. Asphalt Concrete Hot Mix Surface Course (ARDOT Standard Specifications for Highway Construction, 2014 Edition, Section 407, ½ inch, N_{max} = 115)

9 in. Crushed Stone Base (ARDOT Standard Specifications for Highway Construction, 2014 Edition, Section 303, Class 7)

We recommend that all subgrade be proof-rolled immediately prior to placing base course. Aggregate base should be compacted to a minimum of 98 percent of the AASHTO T 180 maximum dry density as per ARDOT criteria.

The pavement subgrade should be prepared in accordance with the recommendations of the Site Grading section of the August 25, 2022 report. Particular attention should be given to maintaining subgrade moisture and density until pavements are constructed. Immediately prior to base construction, the subgrade should be proof-rolled. All weak, soft or wet areas should be excavated, processed, and re-compacted or replaced with select fill, whichever is appropriate. Positive drainage must be incorporated into design. The importance of positive drainage to satisfactory pavement performance cannot be overemphasized.

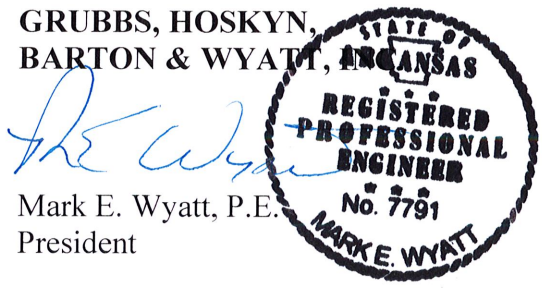
* * * * *

The recommendations discussed herein have been based on the results of the borings drilled in June 2022 (GHBW Project No. 22-068) and our understanding of the project. This report does not constitute a warranty or guarantee of subsurface conditions at the loading dock location, neither expressed nor implied. Suitability of the recommendations provided herein must be field verified. All pavement subgrade should be observed by the Geotechnical Engineer prior to pavement construction. Depending on specific subgrade conditions encountered at the time of construction, modification of the recommendations provided herein could be warranted.

We hope this supplemental information is helpful in design and construction. Should you have any questions regarding this supplemental information, or if we may be of additional assistance during final design or construction, please call on us.

Sincerely,

GRUBBS, HOSKYN, BARTON & WYATT, INC.



Mark E. Wyatt, P.E.
President

MEW:jw

Attachments

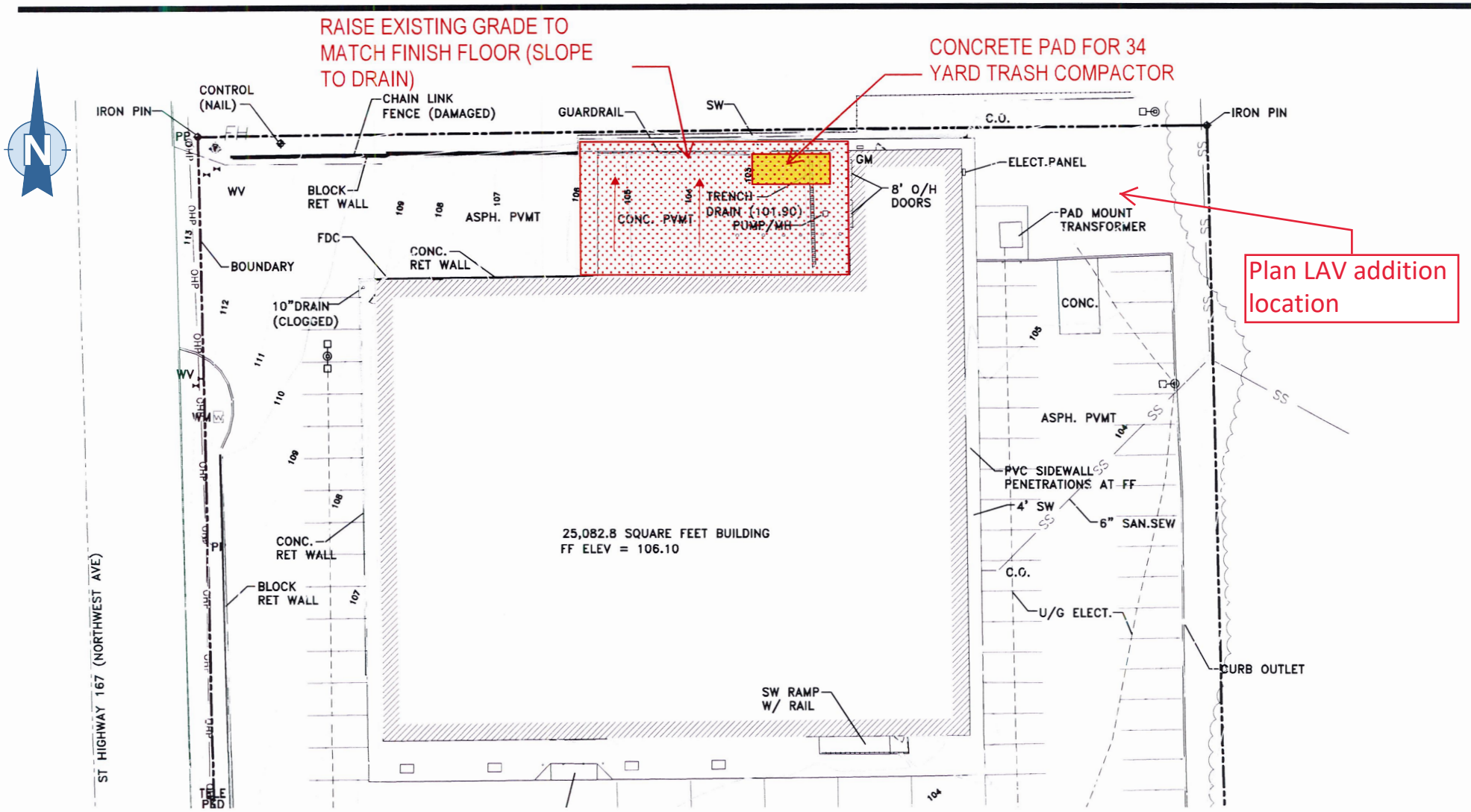
Copies submitted:

Polk Stanley Wilcox
Attn: Ms. Dian Barlett, AIA, LEED AP (1-email)
Attn: Mr. Jason Landrum, AIA (1-email)

PE, Inc. Structural Engineering
Attn: Mr. Jacques Pierini, P.E. (1-email)

Clark Contractors, LLC
Attn: Mr. Stephen Lane, CHC (1-email)

ATTACHMENT 1


RAISE EXISTING GRADE TO MATCH FINISH FLOOR (SLOPE TO DRAIN)
CONCRETE PAD FOR 34 YARD TRASH COMPACTOR
Plan LAV addition location
IRON PIN
CONTROL (NAIL)
CHAIN LINK FENCE (DAMAGED)
GUARDRAIL
SW
C.O.
IRON PIN
GM
ELECT.PANEL
WV
BLOCK RET WALL
ASPH. PVMT
CONC. PVMT
TRENCH DRAIN (101.90) PUMP/MH
8' O/H DOORS
PAD MOUNT TRANSFORMER
FDC
CONC. RET WALL
BOUNDARY
10"DRAIN (CLOGGED)
CONC.
ASPH. PVMT
PVC SIDEWALL PENETRATIONS AT FF
4' SW
6" SAN.SEW
25,082.8 SQUARE FEET BUILDING
FF ELEV = 106.10
CONC. RET WALL
BLOCK RET WALL
C.O.
U/G ELECT.
CURB OUTLET
SW RAMP W/ RAIL
ST HIGHWAY 167 (NORTHWEST AVE)


CAPTI CANCER CENTER
COMING SUMMER 2021

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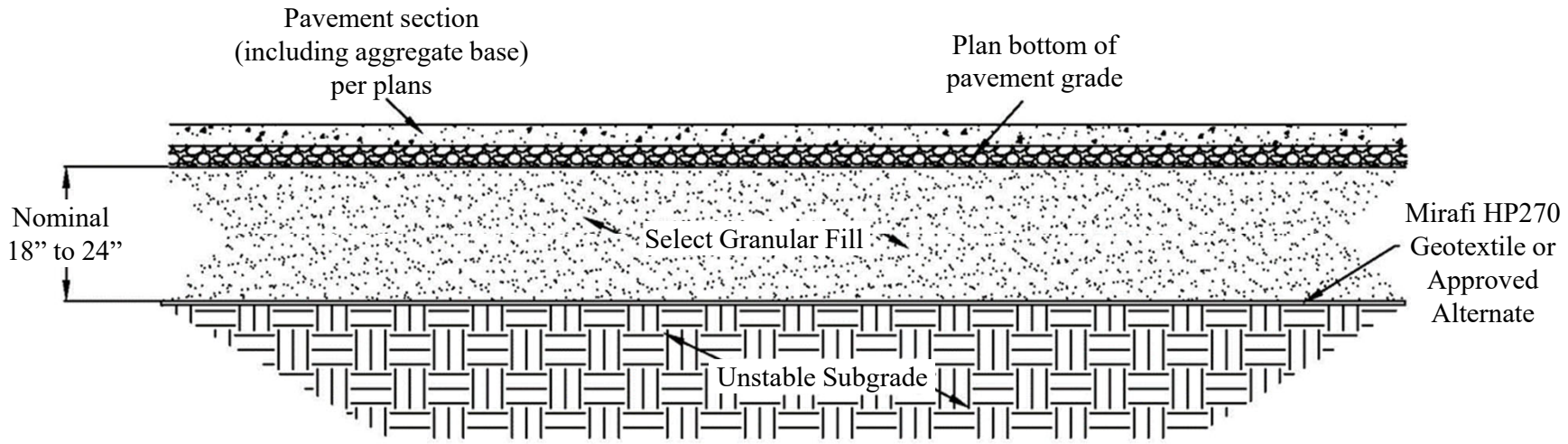
ATTACHMENT 2



Notes:

1. Stability to be field verified by the Engineer or Geotechnical Engineer.
2. Granular fill thickness may require field modification, either thickening or thinning..
3. Fill/backfill thickness can be attained by raising grade, undercut, or a combination of both.
4. Unsuitable subgrade may warrant additional undercut.
5. Suitable select granular fill materials include ARDOT Class 7 base or Class 3 base, select clayey gravel or sandy gravel, or approved alternates.
6. All select granular fill to be approved by the Geotechnical Engineer.

Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS

Subgrade Stabilization Concept
Select Granular Fill on Geotextile

CARTI LAV Additions
El Dorado, Arkansas

GHBW Job No. 22-068

TENCATE Mirafi®

Mirafi® HP270

Mirafi® HP270 geotextile is composed of high-tenacity polypropylene yarns, which are woven into a network such that the yarns retain their relative position. Mirafi® HP270 geotextile is inert to biological degradation and resistant to naturally encountered chemicals, alkalis, and acids.

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Tensile Strength (at ultimate)	ASTM D4595	kN/m (lbs/ft)	38.5 (2640)	35.9 (2460)
Tensile Strength (at 2% strain)	ASTM D4595	kN/m (lbs/ft)	7.0 (480)	8.6 (588)
Tensile Strength (at 5% strain)	ASTM D4595	kN/m (lbs/ft)	17.7 (1212)	19.8 (1356)
Tensile Strength (at 10% strain)	ASTM D4595	kN/m (lbs/ft)	34.1 (2340)	35.2 (2412)
Factory Seam Strength	ASTM D4884	kN/m (lbs/ft)	18.4 (1250)	
Flow Rate	ASTM D4491	l/min/m^2 (gal/min/ft^2)	2037 (50)	
Permeability	ASTM D4491	cm/sec	0.04	
Permittivity	ASTM D4491	sec^{-1}	0.70	
Apparent Opening Size (AOS) [1]	ASTM D4751	mm (U.S. Sieve)	0.60 (30)	
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	80	

[1] ASTM D 4751: AOS is a Maximum Opening Diameter Value
NOTE: To obtain Secant Modulus, divide tensile strength by the appropriate strain level
(i.e. Secant Modulus at 5% = 1,212/0.05 = 24,240 lbs/ft)

Physical Properties	Test Method	Unit	Typical Value
Mass/Unit Area	ASTM D5261	g/m^2 (oz/yd^2)	227 (6.7)
Roll Dimensions (width x length)	--	m (ft)	4.5 (15) x 91 (300)
Roll Area	--	m^2 (yd^2)	418 (500)
Estimated Roll Weight	---	kg (lbs)	100 (220)

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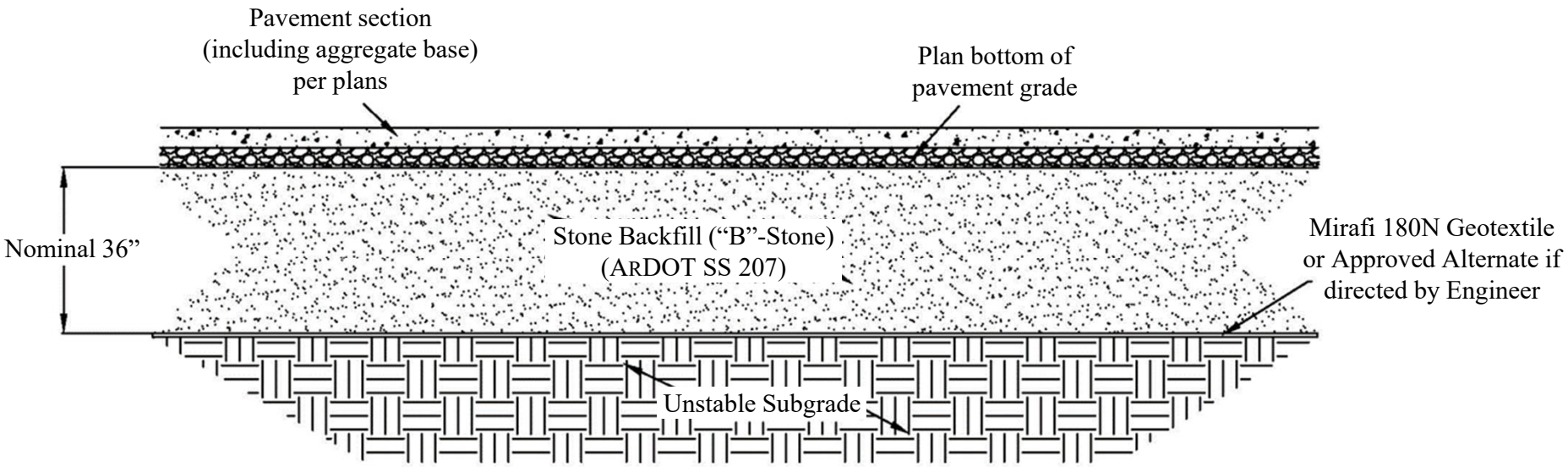

Notes:

1. Stability to be field verified by the Engineer or Geotechnical Engineer.
2. Stone backfill thickness may require field modification, either thickening or thinning.
3. Stone backfill thickness can be attained by raising grade, undercut, or a combination of both.
4. Unsuitable subgrade may warrant additional undercut.
5. Stone backfill as per ARDOT Standard Specifications Section 207 or approved “B”-stone. As per Item 207, surface of stone backfill/”B”-stone must be sealed with 4 to 6 in. of Class 7 crushed stone aggregate base.
6. Geotextile filter fabric will be required where seepage is encountered. Discharge to be directed to positive drainage.

Grubbs, Hoskyn, Barton & Wyatt, INC.
CONSULTING ENGINEERS

Subgrade Stabilization Concept
Stone Backfill

CARTI LAV Additions
El Dorado, Arkansas

GHBW Job No. 22-068

TENCATE Mirafi®

Mirafi® 180N

Mirafi® 180N is a needlepunched nonwoven geotextile composed of polypropylene fibers, which are formed into a stable network such that the fibers retain their relative position. Mirafi® 180N geotextile is inert to biological degradation and resists naturally encountered chemicals, alkalis, and acids.

Mechanical Properties	Test Method	Unit	Minimum Average Roll Value	
			MD	CD
Grab Tensile Strength	ASTM D4632	N (lbs)	912 (205)	912 (205)
Grab Tensile Elongation	ASTM D4632	%	50	50
Trapezoid Tear Strength	ASTM D4533	N (lbs)	356 (80)	356 (80)
CBR Puncture Strength	ASTM D6241	N (lbs)	2225 (500)	
Apparent Opening Size (AOS) [1]	ASTM D4751	mm (U.S. Sieve)	0.18 (80)	
Permittivity	ASTM D4491	sec^{-1}	1.1	
Flow Rate	ASTM D4491	$l/min/m^2$ ($gal/min/ft^2$)	3870 (95)	
UV Resistance (at 500 hours)	ASTM D4355	% strength retained	70	

[1] ASTM D 4751: AOS is a Maximum Opening Diameter Value

Physical Properties	Test Method	Unit	Typical Value	
Weight	ASTM D5261	g/m^2 (oz/yd^2)	271 (8.0)	
Thickness	ASTM D5199	mm (mils)	1.8 (72)	
Roll Dimensions (width x length)	--	m (ft)	3.8 x 110 (12.5 x 360)	4.5 x 91 (15 x 300)
Roll Area	--	m^2 (yd^2)	418 (500)	
Estimated Roll Weight	--	kg (lb)	120 (265)	

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CARTI
CANCER CENTER PHASE 2
EL DORADO, ARKANSAS
PSW PROJECT NO. 671AG

Proposal of _____
(hereinafter called "Bidder"): (Strike Out Following Inapplicable Items)

1. An _____ Corporation,
   (State)
2. A Partnership, or

3. An Individual doing business as _____

_____

Bidder, in compliance with bid solicitation for Addition and renovation of an existing CARTI Cancer Clinic in El Dorado, Arkansas, having examined plans and specifications with related documents and site of the proposed Work, and being familiar with all conditions surrounding proposed project, including availability of materials and labor, hereby proposes to furnish labor, materials, and supplies, and construct project in accordance with Contract Documents, within time set forth therein, and at prices stated below. Prices are to cover all expenses incurred in performing Work required under Contract Documents, of which this proposal is a part.

Bidder hereby agrees to commence work under this contract on date specified in written "Notice to Proceed" and substantially complete work within _____ consecutive calendar days.

Bidder acknowledges receipt of the following addenda:

No.____ Date:_____ No.____ Date:_____ No.____ Date:_____

No.____ Date:_____ No.____ Date:_____ No.____ Date:_____

BASE BID: Bidder agrees to perform all Work described in the Project Manual and shown on the Drawings for the sum of _____

_____Dollars ($_____).

LIST OF DEDUCTIVE ALTERNATES

(Refer to Section 01 2300 - Alternates for detailed description)

DEDUCTIVE ALTERNATE NO.1: Deduct the sum of _____

_____ Dollars ($_____).

DEDUCTIVE ALTERNATE NO.2: Deduct the sum of _____

_____ Dollars ($_____).

DEDUCTIVE ALTERNATE NO.3: Deduct the sum of _____

_____ Dollars ($_____).

LIST OF SUBCONTRACTORS

I, the undersigned General Contractor, certify that proposals from the following subcontractors were used in the preparation of my proposal. I agree that if I am the successful bidder, and if following subcontractors are approved, I will not enter into contracts with others for these divisions of the Work without written approval from Architect and Owner.

NAME:

MECHANICAL: _____

PLUMBING: _____

ELECTRICAL: _____

ROOFING AND SHEETMETAL: _____

Bidder understands that Owner reserves right to reject any or all bids and to waive any formalities in the bidding. Bidder agrees bid shall be good and may not be withdrawn for period of sixty (60) days after scheduled closing time for receiving bids.

Upon receipt of written notice of acceptance of bid, Bidder will execute formal contract within ten (10) days and deliver Surety Bond or Bonds as required by Document 00 7000. Bid security attached in amount of 5% of base bid is to become property of Owner in event above contract and bond are not executed within time set forth above as liquidated damages and additional expenses to Owner.

By:_____ Date:_____

(Typed Name)

_____ Contractor License No._____

(Signature)

_____

(Title)

_____

(Business Address)

_____

(Seal - If bid is by a Corporation)

END OF DOCUMENT

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PART 1 - GENERAL

1.01 GOVERNING STANDARD DOCUMENT

A. ***Standard Form of Agreement Between Owner and Contractor*** *where the basis of payment is a Stipulated Sum*, Document No. A101 of American Institute of Architects, 2017 Edition is bound and incorporated into these specifications and is to be used as the Contract for this project.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF DOCUMENT

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AIA Document A101 – 2017

Standard Form of Agreement Between Owner and Contractor *where the basis of payment is a Stipulated Sum*

AGREEMENT made as of the «XXX » day of «XXX » in the year «XXX »
(In words, indicate day, month and year.)

BETWEEN the Owner:

Central Arkansas Radiation Treatment Institute (CARTI)

and the Contractor:

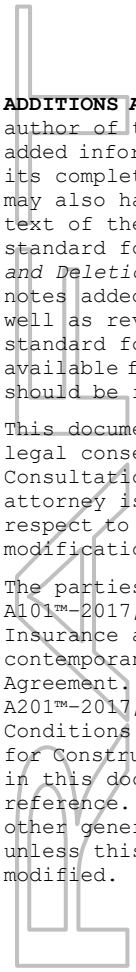
for the following Project:

CARTI Cancer Center Phase 2
El Dorado, Arkansas

The Architect:

Polk Stanley Wilcox
801 South Spring Street
Little Rock, Arkansas 72201

The Owner and Contractor agree as follows.



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.

The parties should complete A101™–2017, Exhibit A, Insurance and Bonds, contemporaneously with this Agreement. AIA Document A201™–2017, General Conditions of the Contract for Construction, is adopted in this document by reference. Do not use with other general conditions unless this document is modified.

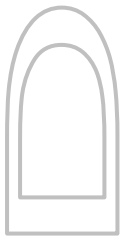


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TABLE OF ARTICLES

ARTICLE 1 THE CONTRACT DOCUMENTS

The Contract Documents consist of this Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to execution of this Agreement, other documents listed in this Agreement, and Modifications issued after execution of this Agreement, all of which form the Contract, and are as fully a part of the Contract as if attached to this Agreement or repeated herein. The Contract represents the entire and integrated agreement between the parties hereto and supersedes prior negotiations, representations, or agreements, either written or oral. An enumeration of the Contract Documents, other than a Modification, appears in Article 9.

ARTICLE 2 THE WORK OF THIS CONTRACT

The Contractor shall fully execute the Work described in the Contract Documents, except as specifically indicated in the Contract Documents to be the responsibility of others.

ARTICLE 3 DATE OF COMMENCEMENT AND SUBSTANTIAL COMPLETION

§ 3.1 The date of commencement of the Work shall be:
(Check one of the following boxes.)

[« »] The date of this Agreement.

[« »] A date set forth in a notice to proceed issued by the Owner.

[« »] Established as follows:
(Insert a date or a means to determine the date of commencement of the Work.)

« »

If a date of commencement of the Work is not selected, then the date of commencement shall be the date of this Agreement.

§ 3.2 The Contract Time shall be measured from the date of commencement of the Work.

§ 3.3 Substantial Completion

§ 3.3.1 Subject to adjustments of the Contract Time as provided in the Contract Documents, the Contractor shall achieve Substantial Completion of the entire Work:
(Check one of the following boxes and complete the necessary information.)

[«X »] Not later than calendar days from the date of commencement of the Work.

[« »] By the following date: « »

§ 3.3.2 Subject to adjustments of the Contract Time as provided in the Contract Documents, if portions of the Work are to be completed prior to Substantial Completion of the entire Work, the Contractor shall achieve Substantial Completion of such portions by the following dates:

Portion of Work	Substantial Completion Date

§ 3.3.3 If the Contractor fails to achieve Substantial Completion as provided in this Section 3.3, liquidated damages, if any, shall be assessed as set forth in Section 4.5.

ARTICLE 4 CONTRACT SUM

§ 4.1 The Owner shall pay the Contractor the Contract Sum in current funds for the Contractor's performance of the Contract. The Contract Sum shall be «xxx » ($ «xxx »), subject to additions and deductions as provided in the Contract Documents.

§ 4.2 Alternates

§ 4.2.1 Alternates, if any, included in the Contract Sum:

Item	Price

§ 4.2.2 Subject to the conditions noted below, the following alternates may be accepted by the Owner following execution of this Agreement. Upon acceptance, the Owner shall issue a Modification to this Agreement.
(Insert below each alternate and the conditions that must be met for the Owner to accept the alternate.)

Item	Price	Conditions for Acceptance

§ 4.3 Allowances, if any, included in the Contract Sum:
(Identify each allowance.)

Item	Price

§ 4.4 Unit prices, if any:
(Identify the item and state the unit price and quantity limitations, if any, to which the unit price will be applicable.)

Item	Units and Limitations	Price per Unit ($0.00)

§ 4.5 Liquidated damages, if any:
(Insert terms and conditions for liquidated damages, if any.)

« »

§ 4.6 Other:
(Insert provisions for bonus or other incentives, if any, that might result in a change to the Contract Sum.)

« »

ARTICLE 5 PAYMENTS

§ 5.1 Progress Payments

§ 5.1.1 Based upon Applications for Payment submitted to the Architect by the Contractor and Certificates for Payment issued by the Architect, the Owner shall make progress payments on account of the Contract Sum to the Contractor as provided below and elsewhere in the Contract Documents.

§ 5.1.2 The period covered by each Application for Payment shall be one calendar month ending on the last day of the month, or as follows:

« »

§ 5.1.3 Provided that an Application for Payment is received by the Architect not later than the «25th» day of a month, the Owner shall make payment of the amount certified to the Contractor not later than the «15th» day of the « following» month. If an Application for Payment is received by the Architect after the application date fixed above, payment of the amount certified shall be made by the Owner not later than « twenty» («20») days after the Architect receives the Application for Payment.
(Federal, state or local laws may require payment within a certain period of time.)

§ 5.1.4 Each Application for Payment shall be based on the most recent schedule of values submitted by the Contractor in accordance with the Contract Documents. The schedule of values shall allocate the entire Contract Sum among the various portions of the Work. The schedule of values shall be prepared in such form, and supported by such data to substantiate its accuracy, as the Architect may require. This schedule of values shall be used as a basis for reviewing the Contractor's Applications for Payment.

§ 5.1.5 Applications for Payment shall show the percentage of completion of each portion of the Work as of the end of the period covered by the Application for Payment.

§ 5.1.6 In accordance with AIA Document A201™–2017, General Conditions of the Contract for Construction, and subject to other provisions of the Contract Documents, the amount of each progress payment shall be computed as follows:

§ 5.1.6.1 The amount of each progress payment shall first include:

.1 That portion of the Contract Sum properly allocable to completed Work;

.2 That portion of the Contract Sum properly allocable to materials and equipment delivered and suitably stored at the site for subsequent incorporation in the completed construction, or, if approved in advance by the Owner, suitably stored off the site at a location agreed upon in writing; and

.3 That portion of Construction Change Directives that the Architect determines, in the Architect's professional judgment, to be reasonably justified.

§ 5.1.6.2 The amount of each progress payment shall then be reduced by:

.1 The aggregate of any amounts previously paid by the Owner;

.2 The amount, if any, for Work that remains uncorrected and for which the Architect has previously withheld a Certificate for Payment as provided in Article 9 of AIA Document A201–2017;

.3 Any amount for which the Contractor does not intend to pay a Subcontractor or material supplier, unless the Work has been performed by others the Contractor intends to pay;

.4 For Work performed or defects discovered since the last payment application, any amount for which the Architect may withhold payment, or nullify a Certificate of Payment in whole or in part, as provided in Article 9 of AIA Document A201–2017; and

.5 Retainage withheld pursuant to Section 5.1.7.

§ 5.1.7 Retainage

§ 5.1.7.1 For each progress payment made prior to Substantial Completion of the Work, the Owner may withhold the following amount, as retainage, from the payment otherwise due:
(Insert a percentage or amount to be withheld as retainage from each Application for Payment. The amount of retainage may be limited by governing law.)

« Retainage shall be held in the amount of 5% of the contractor's request for payment. »

§ 5.1.7.1.1 The following items are not subject to retainage:
(Insert any items not subject to the withholding of retainage, such as general conditions, insurance, etc.)

« »

§ 5.1.7.2 Reduction or limitation of retainage, if any, shall be as follows:
(If the retainage established in Section 5.1.7.1 is to be modified prior to Substantial Completion of the entire Work, including modifications for Substantial Completion of portions of the Work as provided in Section 3.3.2, insert provisions for such modifications.)

« When the value of the work reaches 50% of the scheduled value, including changes, the Owner may, but is not required to, reduce the amount of the retainage for subsequent pay requests. »

§ 5.1.7.3 Except as set forth in this Section 5.1.7.3, upon Substantial Completion of the Work, the Contractor may submit an Application for Payment that includes the retainage withheld from prior Applications for Payment pursuant to this Section 5.1.7. The Application for Payment submitted at Substantial Completion shall not include retainage as follows:
(Insert any other conditions for release of retainage upon Substantial Completion.)

« »

§ 5.1.8 If final completion of the Work is materially delayed through no fault of the Contractor, the Owner shall pay the Contractor any additional amounts in accordance with Article 9 of AIA Document A201–2017.

§ 5.1.9 Except with the Owner's prior approval, the Contractor shall not make advance payments to suppliers for materials or equipment which have not been delivered and stored at the site.

§ 5.2 Final Payment

§ 5.2.1 Final payment, constituting the entire unpaid balance of the Contract Sum, shall be made by the Owner to the Contractor when

.1 the Contractor has fully performed the Contract except for the Contractor's responsibility to correct Work as provided in Article 12 of AIA Document A201–2017, and to satisfy other requirements, if any, which extend beyond final payment; and

.2 all required close out documents, completed any project closeout checklists, punch lists for nonconforming work, and a final Application for Payment; and

.3 a final Certificate for Payment has been issued by the Architect.

§ 5.2.2 The Owner's final payment to the Contractor shall be made no later than 30 days after the issuance of the Architect's final Certificate for Payment, or as follows:

« »

ARTICLE 6 DISPUTE RESOLUTION

In the case of any dispute, claim or question, or disagreement arising from or related to the Project or arising out of this Contract, the parties shall first attempt resolution through mutual discussion.

§ 6.1 Initial Decision Maker

The Architect will serve as the Initial Decision Maker pursuant to Article 15 of AIA Document A201–2017, unless the parties appoint below another individual to serve as the Initial Decision Maker.
(If the parties mutually agree, insert the name, address and other contact information of the Initial Decision Maker, if other than the Architect.)

§ 6.2 Binding Dispute Resolution

For any Claim subject to, but not resolved by, mediation pursuant to Article 15 of AIA Document A201–2017, the method of binding dispute resolution shall be as follows:
(Check the appropriate box.)

[« »] Arbitration pursuant to Section 15.4 of AIA Document A201–2017

[« »] Litigation in a court of competent jurisdiction

[« »] Other *(Specify)*

If the Owner and Contractor do not select a method of binding dispute resolution, or do not subsequently agree in writing to a binding dispute resolution method other than litigation, Claims will be resolved by litigation in a court of competent jurisdiction. Nothing in the Contract Documents shall be deemed a waiver by Owner of its sovereign immunity.

ARTICLE 7 TERMINATION OR SUSPENSION

§ 7.1 The Contract may be terminated by the Owner or the Contractor as provided in Article 14 of AIA Document A201–2017.

§ 7.1.1 If the Contract is terminated for the Owner's convenience in accordance with Article 14 of AIA Document A201–2017, then the Owner shall pay the Contractor a termination fee as follows:
(Insert the amount of, or method for determining, the fee, if any, payable to the Contractor following a termination for the Owner's convenience.)

« »

§ 7.2 The Work may be suspended by the Owner as provided in Article 14 of AIA Document A201–2017.

ARTICLE 8 MISCELLANEOUS PROVISIONS

§ 8.1 Where reference is made in this Agreement to a provision of AIA Document A201–2017 or another Contract Document, the reference refers to that provision as amended or supplemented by other provisions of the Contract Documents.

§ 8.2 The Owner's representative:
(Name, address, email address, and other information)

« »
« »

§ 8.3 The Contractor's representative:
(Name, address, email address, and other information)

« »
« »

§ 8.4 Neither the Owner's nor the Contractor's representative shall be changed without ten days' prior notice to the other party.

§ 8.5 Insurance and Bonds

§ 8.5.1 The Owner and the Contractor shall purchase and maintain insurance as set forth in AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor where the basis of payment is a Stipulated Sum, Exhibit A, Insurance and Bonds, and elsewhere in the Contract Documents.

§ 8.5.2 The Contractor shall provide bonds as set forth in AIA Document A101™–2017 Exhibit A, and elsewhere in the Contract Documents.

§ 8.6 Notice in electronic format, pursuant to Article 1 of AIA Document A201–2017, may be given in accordance with AIA Document E203™–2013, Building Information Modeling and Digital Data Exhibit, if completed, or as otherwise set forth below:
(If other than in accordance with AIA Document E203–2013, insert requirements for delivering notice in electronic format such as name, title, and email address of the recipient and whether and how the system will be required to generate a read receipt for the transmission.)

« »

§ 8.7 Other provisions:

§ 8.7.1 Equal Opportunity and Affirmative Action
The Contractor shall comply with applicable laws, regulations and special requirements of the Contract Documents regarding equal employment opportunity and affirmative action programs.

§ 8.7.2 Certifications
If not already provided, the Contractor will, immediately upon execution of this Agreement, provide the Owner with all certifications and representations required by the bid documents or required by Arkansas law.

« »

ARTICLE 9 ENUMERATION OF CONTRACT DOCUMENTS

§ 9.1 This Agreement is comprised of the following documents:

.1 AIA Document A101™–2017, Standard Form of Agreement Between Owner and Contractor

.2 Exhibit A, Insurance and Bonds

.3 AIA Document A201™–2017, General Conditions of the Contract for Construction as amended

(Insert the date of the E203-2013 incorporated into this Agreement.)

« »

.5 Drawings

Title of Drawings exhibit:

To be determined« »

Number	Title	Date

.6 Specifications

Title of Specification exhibit:

To be determined

Section	Title	Date	Pages

.7 Addenda, if any:

Number	Date	Pages

Portions of Addenda relating to bidding or proposal requirements are not part of the Contract Documents unless the bidding or proposal requirements are also enumerated in this Article 9.

.8 Other Exhibits:
(Check all boxes that apply and include appropriate information identifying the exhibit where required.)

[« »] AIA Document E204™–2017, Sustainable Projects Exhibit, dated as indicated below:
(Insert the date of the E204-2017 incorporated into this Agreement.)

« »

[« »] The Sustainability Plan:

Title	Date	Pages

[« »] Supplementary and other Conditions of the Contract:

Document	Title	Date	Pages

.9 Other documents, if any, listed below:
(List here any additional documents that are intended to form part of the Contract Documents. AIA Document A201™–2017 provides that the advertisement or invitation to bid, Instructions to Bidders, sample forms, the Contractor's bid or proposal, portions of Addenda relating to bidding or proposal requirements, and other information furnished by the Owner in anticipation of receiving bids or proposals, are not part of the Contract Documents unless enumerated in this Agreement. Any such documents should be listed here only if intended to be part of the Contract Documents.)

« »

This Agreement entered into as of the day and year first written above.

OWNER *(Signature)*	**CONTRACTOR** *(Signature)*
«XXX» « » *(Printed name and title)*	« XXX » « XXX » *(Printed name and title)*

AIA Document A102™ – 2017

Exhibit A

Insurance and Bonds

This Insurance and Bonds Exhibit is part of the Agreement, between the Owner and the Contractor, dated the « » day of « » in the year « »
(In words, indicate day, month and year.)

for the following **PROJECT**:
CARTI Cancer Center Phase 2
El Dorado, Arkansas

THE OWNER:
Central Arkansas Radiation Treatment Institute (CARTI)

THE CONTRACTOR:
(Name, legal status and address)

« »« »
« »

TABLE OF ARTICLES

The Owner and Contractor shall purchase and maintain insurance, and provide bonds, as set forth in this Exhibit. As used in this Exhibit, the term General Conditions refers to AIA Document A201™–2017, General Conditions of the Contract for Construction.

ARTICLE A.2 OWNER'S INSURANCE

§ A.2.1 General

Prior to commencement of the Work, the Owner shall secure the insurance, and provide evidence of the coverage, required under this Article A.2 and, upon the Contractor's request, provide a copy of the property insurance policy or policies required by Section
A.2.3. The copy of the policy or policies provided shall contain all applicable conditions, definitions, exclusions, and endorsements.

§ A.2.2 Liability Insurance

The Owner shall be responsible for purchasing and maintaining the Owner's usual general liability insurance.

§ A.2.3 Required Property Insurance

§ A.2.3.1 Unless this obligation is placed on the Contractor pursuant to Section A.3.3.2.1, the Owner shall purchase and maintain, from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located, property insurance written on a builder's risk "all-risks" completed value or equivalent policy form and sufficient to cover the total value of the entire Project on a

replacement cost basis. The Owner's property insurance coverage shall be no less than the amount of the initial Contract Sum, plus the value of subsequent Modifications and labor performed and materials or equipment supplied by others. The property insurance shall be maintained until Substantial Completion and thereafter as provided in Section A.2.3.1.3, unless otherwise provided in the Contract Documents or otherwise agreed in writing by the parties to this Agreement. This insurance shall include the interests of the Owner, Contractor, Subcontractors, and Sub-subcontractors in the Project as insureds. This insurance shall include the interests of mortgagees as loss payees.

§ A.2.3.1.1 Causes of Loss. The insurance required by this Section A.2.3.1 shall provide coverage for direct physical loss or damage, and shall not exclude the risks of fire, explosion, theft, vandalism, malicious mischief, collapse, earthquake, flood, or windstorm. The insurance shall also provide coverage for ensuing loss or resulting damage from error, omission, or deficiency in construction methods, design, specifications, workmanship, and materials. Sub-limits, if any, are as follows:
(Indicate below the cause of loss and any applicable sub-limit.)

Causes of Loss	Sub-Limit

§ A.2.3.1.2 Specific Required Coverages. The insurance required by this Section A.2.3.1 shall provide coverage for loss or damage to falsework and other temporary structures, and to building systems from testing and startup. The insurance shall also cover debris removal, including demolition occasioned by enforcement of any applicable legal requirements, and reasonable compensation for the Architect's and Contractor's services and expenses required as a result of such insured loss, including claim preparation expenses. Sub-limits, if any, are as follows:
(Indicate below type of coverage and any applicable sub-limit for specific required coverages.)

Coverage	Sub-Limit

§ A.2.3.1.3 Unless the parties agree otherwise, upon Substantial Completion, the Owner shall continue the insurance required by Section A.2.3.1 or, if necessary, replace the insurance policy required under Section A.2.3.1 with property insurance written for the total value of the Project that shall remain in effect until expiration of the period for correction of the Work set forth in Section 12.2.2 of the General Conditions.

§ A.2.3.1.4 Deductibles and Self-Insured Retentions. If the insurance required by this Section A.2.3 is subject to deductibles or self-insured retentions, the Owner shall be responsible for all loss not covered because of such deductibles or retentions.

§ A.2.3.2 Occupancy or Use Prior to Substantial Completion. The Owner's occupancy or use of any completed or partially completed portion of the Work prior to Substantial Completion shall not commence until the insurance company or companies providing the insurance under Section A.2.3.1 have consented in writing to the continuance of coverage. The Owner and the Contractor shall take no action with respect to partial occupancy or use that would cause cancellation, lapse, or reduction of insurance, unless they agree otherwise in writing.

§ A.2.3.3 Insurance for Existing Structures
If the Work involves remodeling an existing structure or constructing an addition to an existing structure, the Owner shall purchase and maintain, until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, "all-risks" property insurance, on a replacement cost basis, protecting the existing structure against direct physical loss or damage from the causes of loss identified in Section A.2.3.1, notwithstanding the undertaking of the Work. The Owner shall be responsible for all co-insurance penalties.

§ A.2.4 Optional Extended Property Insurance.
The Owner shall purchase and maintain the insurance selected and described below.
(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance. For each type of insurance selected, indicate applicable limits of coverage or other conditions in the fill point below the selected item.)

[« »] **§ A.2.4.1 Loss of Use, Business Interruption, and Delay in Completion Insurance**, to reimburse the

Owner for loss of use of the Owner's property, or the inability to conduct normal operations due to a covered cause of loss.

« »

[« »] § A.2.4.2 **Ordinance or Law Insurance**, for the reasonable and necessary costs to satisfy the minimum requirements of the enforcement of any law or ordinance regulating the demolition, construction, repair, replacement or use of the Project.

« »

[« »] § A.2.4.3 **Expediting Cost Insurance**, for the reasonable and necessary costs for the temporary repair of damage to insured property, and to expedite the permanent repair or replacement of the damaged property.

« »

[« »] § A.2.4.4 **Extra Expense Insurance**, to provide reimbursement of the reasonable and necessary excess costs incurred during the period of restoration or repair of the damaged property that are over and above

the total costs that would normally have been incurred during the same period of time had no loss or damage occurred.

« »

[« »] § A.2.4.5 **Civil Authority Insurance**, for losses or costs arising from an order of a civil authority prohibiting access to the Project, provided such order is the direct result of physical damage covered under the required property insurance.

« »

[« »] § A.2.4.6 **Ingress/Egress Insurance**, for loss due to the necessary interruption of the insured's business due to physical prevention of ingress to, or egress from, the Project as a direct result of physical damage.

« »

[« »] § A.2.4.7 **Soft Costs Insurance**, to reimburse the Owner for costs due to the delay of completion of the Work, arising out of physical loss or damage covered by the required property insurance: including construction loan fees; leasing and marketing expenses; additional fees, including those of architects, engineers, consultants, attorneys and accountants, needed for the completion of the construction, repairs, or reconstruction; and carrying costs such as property taxes, building permits, additional interest on loans, realty taxes, and insurance premiums over and above normal expenses.

« »

§ A.2.5 Other Optional Insurance.

The Owner shall purchase and maintain the insurance selected below.

(Select the types of insurance the Owner is required to purchase and maintain by placing an X in the box(es) next to the description(s) of selected insurance.)

[« »] § A.2.5.1 **Cyber Security Insurance** for loss to the Owner due to data security and privacy breach, including costs of investigating a potential or actual breach of confidential or private information. *(Indicate applicable limits of coverage or other conditions in the fill point below.)*

« »

[« »] **§ A.2.5.2 Other Insurance**

(List below any other insurance coverage to be provided by the Owner and any applicable limits.)

Coverage	Limits

ARTICLE A.3 CONTRACTOR'S INSURANCE AND BONDS

§ A.3.1 General

§ A.3.1.1 Certificates of Insurance. The Contractor shall provide certificates of insurance acceptable to the Owner evidencing compliance with the requirements in this Article A.3 at the following times: (1) prior to commencement of the Work; (2) upon renewal or replacement of each required policy of insurance; and (3) upon the Owner's written request. An additional certificate evidencing continuation of commercial liability coverage, including coverage for completed operations, shall be submitted with the final Application for Payment and thereafter upon renewal or replacement of such coverage until the expiration of the periods required by Section A.3.2.1 and Section A.3.3.1. The certificates will show the Owner as an additional insured on the Contractor's Commercial General Liability and excess or umbrella liability policy or policies.

§ A.3.1.2 Deductibles and Self-Insured Retentions. The Contractor shall disclose to the Owner any deductible or self-insured retentions applicable to any insurance required to be provided by the Contractor.

§ A.3.1.3 Additional Insured Obligations. To the fullest extent permitted by law, the Contractor shall cause the commercial general liability coverage to include (1) the Owner, the Architect, and the Architect's consultants as additional insureds for claims caused in whole or in part by the Contractor's negligent acts or omissions during the Contractor's operations; and (2) the Owner as an additional insured for claims caused in whole or in part by the Contractor's negligent acts or omissions for which loss occurs during completed operations. The additional insured coverage shall be primary and non-contributory to any of the Owner's general liability insurance policies and shall apply to both ongoing and completed operations. To the extent commercially available, the additional insured coverage shall be no less than that provided by Insurance Services Office, Inc. (ISO) forms CG 20 10 07 04, CG 20 37 07 04, and, with respect to the Architect and the Architect's consultants, CG 20 32 07 04.

§ A.3.2 Contractor's Required Insurance Coverage

§ A.3.2.1 The Contractor shall purchase and maintain the following types and limits of insurance from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correction of Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain insurance for a duration other than the expiration of the period for correction of Work, state the duration.)

« »

§ A.3.2.2 Commercial General Liability

§ A.3.2.2.1 Commercial General Liability insurance for the Project written on an occurrence form with policy limits of not less than «One-Million Dollars » ($ «1,000,000 ») each occurrence, «Two-Million Dollars » ($ «2,000,000 ») general aggregate, and «Two-Million Dollars » ($ «2,000,000 ») aggregate for products-completed operations hazard, providing coverage for claims including

- **.1** damages because of bodily injury, sickness or disease, including occupational sickness or disease, and death of any person;
- **.2** personal injury and advertising injury;
- **.3** damages because of physical damage to or destruction of tangible property, including the loss of use of such property;
- **.4** bodily injury or property damage arising out of completed operations; and
- **.5** the Contractor's indemnity obligations under Section 3.18 of the General Conditions.

§ A.3.2.2.2 The Contractor's Commercial General Liability policy under this Section A.3.2.2 shall not contain an exclusion or restriction of coverage for the following:

.1 Claims by one insured against another insured, if the exclusion or restriction is based solely on the fact that the claimant is an insured, and there would otherwise be coverage for the claim.

.2 Claims for property damage to the Contractor's Work arising out of the products-completed operations hazard where the damaged Work or the Work out of which the damage arises was performed by a Subcontractor.

.3 Claims for bodily injury other than to employees of the insured.

.4 Claims for indemnity under Section 3.18 of the General Conditions arising out of injury to employees of the insured.

.5 Claims or loss excluded under a prior work endorsement or other similar exclusionary language.

.6 Claims or loss due to physical damage under a prior injury endorsement or similar exclusionary language.

.7 Claims related to residential, multi-family, or other habitational projects, if the Work is to be performed on such a project.

.8 Claims related to roofing, if the Work involves roofing.

.9 Claims related to exterior insulation finish systems (EIFS), synthetic stucco or similar exterior coatings or surfaces, if the Work involves such coatings or surfaces.

.10 Claims related to earth subsidence or movement, where the Work involves such hazards.

.11 Claims related to explosion, collapse and underground hazards, where the Work involves such hazards.

§ A.3.2.3 Automobile Liability covering vehicles owned, and non-owned vehicles used, by the Contractor, with policy limits of not less than «One-Million Dollars » ($ «1,000,000 ») per accident, for bodily injury, death of any person, and property damage arising out of the ownership, maintenance and use of those motor vehicles along with any other statutorily required automobile coverage.

§ A.3.2.4 The Contractor may achieve the required limits and coverage for Commercial General Liability and Automobile Liability through a combination of primary and excess or umbrella liability insurance, provided such primary and excess or umbrella insurance policies result in the same or greater coverage as the coverages required under Section A.3.2.2 and A.3.2.3, and in no event shall any excess or umbrella liability insurance provide narrower coverage than the primary policy. The excess policy shall not require the exhaustion of the underlying limits only through the actual payment by the underlying insurers.

§ A.3.2.5 Workers' Compensation at statutory limits.

§ A.3.2.6 Employers' Liability with policy limits not less than « One-Million Dollars » ($ «1,000,000 ») each accident, « One-Million Dollars » ($ «1,000,000 ») each employee, and « Two-Million Dollars » ($ «2,000,000 ») policy limit.

§ A.3.2.7 Jones Act, and the Longshore & Harbor Workers' Compensation Act, as required, if the Work involves hazards arising from work on or near navigable waterways, including vessels and docks

§ A.3.2.8 If the Contractor is required to furnish professional services as part of the Work, the Contractor shall procure Professional Liability insurance covering performance of the professional services, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate.

§ A.3.2.9 If the Work involves the transport, dissemination, use, or release of pollutants, the Contractor shall procure Pollution Liability insurance, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate.

§ A.3.2.10 Coverage under Sections A.3.2.8 and A.3.2.9 may be procured through a Combined Professional Liability and Pollution Liability insurance policy, with combined policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate.

§ A.3.2.11 Insurance for maritime liability risks associated with the operation of a vessel, if the Work requires such activities, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate.

§ A.3.2.12 Insurance for the use or operation of manned or unmanned aircraft, if the Work requires such activities, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate.

§ A.3.3 Contractor's Other Insurance Coverage

§ A.3.3.1 Insurance selected and described in this Section A.3.3 shall be purchased from an insurance company or insurance companies lawfully authorized to issue insurance in the jurisdiction where the Project is located. The Contractor shall maintain the required insurance until the expiration of the period for correctio n oi Work as set forth in Section 12.2.2 of the General Conditions, unless a different duration is stated below:

(If the Contractor is required to maintain any of the types of insurance selected below for a d ura ion other than the expiration of the period for correction of Work, state the duration.)

nce in accordance with

§ A.3.3.2 The Contractor shall purchase and maintain the following types and limits of insura Section A.3.3.1.

(Select the types of insurance the Contractor is required to purchase and maintain by placing an X in the bo (e.) next to the description(s) of selected insurance. Where policy limits are provided, include the policy lim it in the ap ropriate fill point.)

[« X »] **§ A.3.3.2.1** Property insurance of the same type and scope satisfying the requir eme nts identi ied in Section A.2.3, which, if selected in this section A.3.3.2.1, relieves the Owner o f the responsibility to purchase and maintain such insurance except insurance required by Section A.2.3.1.3 and Section A.2.3.3. The Contractor shall comply with all obligations of the Owner under Section A.2.3 except to the extent provided below. The Contractor shall disclose to the Owner the amount of any deductible, and the Owner shall be responsible for losses within the deductible. Upon request, the Contractor shall provide the Owner with a copy of the property insurance policy or policies required. The Owner shall adjust and settle the loss with the insurer and be the trustee of the proceeds of the property insurance in accordance with Article 11 of the General Conditions unless otherwise set forth below:

(Where the Contractor's obligation to provide property insurance differs from the Owner's obligations as described under Section A.2.3, indicate such differences in the space below. Additionally, if a party other than the Owner will be responsible for adjusting and settling a loss with the insurer and acting as the trustee of the proceeds of property insurance in accordance with Article 11 of the General Conditions, indicate the responsible party below.)

« »

[« »] **§ A.3.3.2.2 Railroad Protective Liability Insurance**, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate, for Work within fifty (50) feet of railroad property.

[« »] **§ A.3.3.2.3 Asbestos Abatement Liability Insurance**, with policy limits of not less than « » ($ « ») per claim and « » ($ « ») in the aggregate, for liability arising from the encapsulation, removal, handling, storage, transportation, and disposal of asbestos-containing materials.

[«X »] **§ A.3.3.2.4** Insurance for physical damage to property while it is in storage and in transit to the construction site on an "all-risks" completed value form.

[«X »] **§ A.3.3.2.5** Property insurance on an "all-risks" completed value form, covering property owned by the Contractor and used on the Project, including scaffolding and other equipment.

[«X »] **§ A.3.3.2.6 Other Insurance**

(List below any other insurance coverage to be provided by the Contractor and any applicable limits.)

The Contractor shall procure and maintain during the term of this contract, Owner's Protective Liability Insurance with an endorsement to the policy to include as additional insured, the Architect, with limits not less than $1,000,000 each occurrence and $1,000,000 in the aggregate for property damage liability.

§ A.3.4 Performance Bond and Payment Bond

The Contractor shall provide surety bonds, from a company or companies lawfully authorized to issue surety bonds in the jurisdiction where the Project is located, as follows:
(Specify type and penal sum of bonds.)

Type	Penal Sum ($0.00)
Payment Bond	100% of Contract
Performance Bond	100% of Contract

Payment and Performance Bonds shall be AIA Document A312™, Payment Bond and Performance Bond, or contain provisions identical to AIA Document A312™, current as of the date of this Agreement.

ARTICLE A.4 SPECIAL TERMS AND CONDITIONS

Special terms and conditions that modify this Insurance and Bonds Exhibit, if any, are as follows:

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PART 1 - GENERAL

1.01 GOVERNING STANDARD DOCUMENT

A. "General Conditions of the Contract for Construction", Document No. A201 of American Institute of Architects, 2017 Edition is bound and incorporated into these specifications and is to be used as the General Conditions for this contract.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF DOCUMENT

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AIA® Document A201™ – 2017

General Conditions of the Contract for Construction

for the following PROJECT:

CARTI Cancer Center Phase 2
El Dorado, Arkansas

THE OWNER:

Central Arkansas Radiation Treatment Institute (CARTI)

THE ARCHITECT:

Polk Stanley Wilcox
801 South Spring Street
Little Rock, Arkansas 72201

TABLE OF ARTICLES

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.

INDEX
(Topics and numbers in bold are Section headings.)

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.

§ 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 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.

§ 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 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.

§ 3.3.4 Contractor (1) shall review any specified Construction or Installation Procedure (including those recommended by Manufacturers); (2) shall advise the Architect (a) if the specified procedure deviates from good construction practice, (b) if following the procedure will affect any warranties; including the Contractor's General Warranty, or (c) of any objections the Contractor may have to the procedure; and (3) to propose any alternative procedure which the Contractor will warrant.

§ 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.

§ 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.

§ 3.5.3 The Contractor shall guarantee and warrant his and his subcontractor's work and materials (including the materials and work of suppliers of the Contract and his subcontractors) for a period of one year from the date of Substantial Completion. This Warranty shall be for a longer period on certain items if so designed in the Specifications. The foregoing one-year guaranty and warranty shall not in any way limit, restrict or affect the liability of the Contractor, or his subcontractors, for indemnity as provided for in this Contract, nor shall it in any way shorten the period of limitation fixed by law for the filing of any action against the Contractor for enforcement of the or breach of any provisions of the contract documents. Should the Contractor elect to use any of the equipment in the building during the construction period, he shall make arrangements with the subcontractor or supplier of the equipment for any extension of warranty of that equipment made necessary by such use. The Warranty period for such equipment to the Owner shall not be reduced by the use of equipment by the Contractor.

§ 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.

§ 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 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 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.

§ 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.

§ 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 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.

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.

§ 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 All requests for changes, additions or deductions, shall be submitted in a complete itemized breakdown acceptable to the Architect.

§ 7.2.2 Wherein unit prices are stated in the Contract, submit itemized breakdown showing each unit price and its quantities.

§ 7.2.3 The Contractor shall present an itemized accounting together with appropriate supporting data for the purposes of considering additions or deductions. Supporting data shall include but is not limited to the following:

.1 Costs of labor, including social security, old age and unemployment insurance, fringe benefits required by agreement or custom, and worker or orkens compensation insurance;

.2 Cost 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 related to the Work; and;

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

.6 The value of all such additions and deductions shall then be computed as set forth in Paragraph 7.2.5.

§ 7.2.4 The burden of proof of cost rests upon the Contractor. Contractor agrees that Owner or Owner's Representative shall have the right, at reasonable times, to inspect and audit the books and records of Contractor to verify the propriety and granting of such cost.

§ 7.2.5 Compute requests for changes be they additions or deductions as follows:

.1 For work performed by the Contractor:

Net cost of material and delivery	a
State Sales Tax	b
Net Placing Cost	c
W.C. Insurance Premium and FICA Tax	**d**
	a+b+c+d
Overhead and profit, 12%X (a+b+c+d)	e
Allowable Bond Premium	**f**
TOTAL COST	(a+b+c+d)+e+f

.2 Credit for work omitted shall be computed as outlined in 7.2.5.1 "a through e". To the cost of the Contractor's share of overhead and profit is 7%.

.3 For work performed by Subcontractors:Subcontractors shall compute their work as outlined in 1.2.5.1 "a through e". To the cost of that portion of the work (change) that is performed by the subcontractor, the general contractor shall add an overhead and profit change of five (5%) percent plus the allowable bond premium.

§ 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;

.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.

§ 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.

§ 8.3.4 The Construction Completion date stated shall include an allowance for calendar days per month which may not be available for Construction out-of-doors (normal inclement weather). Refer to Article 15.1.6.

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.

§ 9.3.1.3 Until Substantial Completion of the Work, 5% of each progress payment will be retained. Refer to Article 9.8.5 for adjustment in retainage upon Substantial Completion of Work.

§ 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
- **.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.

§ 9.6.1.1 Progress payments will be made for work completed or for materials delivered and properly stored, in accordance with subparagraph 9.6.1 through the Contracted Construction Period. No payments will be made after the Contracted Construction Period has expired until Final Payment, unless an extension of the Contract Time has been granted. In which case, an additional progress payment will be made for work performed during the extension time period only.

§ 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.

§ 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. The Payment shall be sufficient to increase the total payments of 95% of the Contract Sum, less such amounts as the Architect shall determine for incomplete Work and unsettled claims.§ 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.

§ 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.

§ 9.11 Liquidated Damages: The Contractor and the Contractor's surety, if any, shall be liable for and shall pay the Owner the sum hereinafter stipulated as liquidated damages for each calendar day of delay until the Work is Substantially Complete: $500.00.

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;
- **.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 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 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

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.

§ 11.6 PERFORMANCE BOND AND PAYMENT BOND

§ 11.6.1 The Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds must be issued by a Surety licensed to do work in the state in which the project is located. Cost shall be included in the Contract sum. The amount shall be equal to 100% of the Contract Sum

§ 11.6.1.1 The Contractor shall deliver 2 copies of the required bonds to the Architect not later than 3 days following the date of 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 Architect that such bonds will be furnished.

§ 11.6.1.2 The Contractor shall require the attorney-in-fact who executes the required bond on behalf of the surety to affix thereto a certified and current copy of the power of attorney.

§ 11.6.1.3 File a copy of the bond with Circuit Clerk in the County where work is to be performed. Copies of Bonds are to be certified by the Clerk as having been filed. Submit these copies to Architect.

§ 11.6.2 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.

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.

§ 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 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 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

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.

§ 15.1.6.3 In order for a claim for additional time due to adverse weather conditions to be considered valid, the Contractor must show that adverse weather conditions beyond those normally expected have occurred. For claims related specifically to "Rain Days" the following table of normal rain days will be employed to determine if the

Contractor is entitled to a time extension. A "Rain Day" is defined as a 24 hour period in which 1/100" (.01) of rain or more falls and is recorded by the National Weather Service or other official reporting service in the immediate vicinity of the project. Extensions of time will be granted if the number of officially reported "Rain Days" is greater than normal during a given month. Claims for additional time must be submitted with the Contractor's monthly payment application for review. Failure to make timely and proper request for additional time will result in no time extension being allowed.

Average Days with 1/100" of Precipitation or More: Central Arkansas

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
9	9	10	10	10	9	8	7	7	7	8	9

Average Days with 1/100" of Precipitation or More: Northwest Arkansas

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
8	8	9	10	11	9	7	7	7	7	7	7

Average Days with 1/100" of Precipitation or More: Northeast Arkansas

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
9	8	11	11	11	9	9	8	8	8	9	9

Average Days with 1/100" of Precipitation or More: Southern Arkansas

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
9	8	9	7	8	9	12	11	9	6	8	9

§ 15.1.6.4 Days per month which may not be available for construction may be further defined as days lost to inclement weather in which the project site is inaccessible due to the inclement weather beyond the day of the incident, examples of which would include frozen ground, mud, colder temperatures than specifiications allow concrete and masonry work to proceed, rain, snow, sleet, ice, frozen precipitation accumulated on the work surfaces, and excessive wind.

§ 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

.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.

§ 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 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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PART 1 - GENERAL

1.01 WORK UNDER THIS CONTRACT

A. Addition and renovation of an existing CARTI Cancer Clinic in El Dorado, Arkansas as shown on the Drawings and described in the Project Manual.

1.02 RESPONSIBILITIES OF CONTRACTOR

A. Except as otherwise specifically stated in the contract, Contractor shall provide and pay for all materials, labor, tools, equipment, transportation, superintendence, temporary construction of every nature, taxes legally collectible because of the Work and all other services and facilities of any nature necessary to execute Work as shown and/or specified under the contract and deliver it complete in every respect within specified time.

B. If, during the course of construction of this project, the Contractor discovers errors, inconsistencies or omissions in the Contract Documents, the Contractor will report them to the Architect who will issue written instructions to the Contractor. If the Contractor performs Work knowing there is an error, inconsistency or omission in the Contract Documents without giving notice to the Architect or receiving written instruction from the Architect, the Contractor assumes responsibility for the Work and will bear all costs associated with the performance or correction of the Work.

1.03 PERMITS

A. Utilizing the contract documents (Project Manual and Drawings) prepared by the Architect and his Consultants, along with information provided by the Owner or his Consultants, the Contractor is responsible for securing permits required to successfully complete the project. This responsibility includes payment for the permit and coordination of all submittals.

B. Storm Water Discharge Permit: Contractor shall be responsible for obtaining this permit from Arkansas Department of Environmental Quality for construction sites where one (1) acre or more is disturbed, and meet all other storm water regulations. Contractor shall keep a copy of his Storm Water Discharge Permit on the jobsite at all times.

1.04 COORDINATION

A. Provide administrative and supervisory requirements necessary for coordination of work, including meetings, administrative and supervisory personnel, survey, records, reports, limitations for use of site, installation provisions, cutting and patching, cleaning, protection, and conservation.

B. Coordinate construction activities included under various sections of these specifications to assure efficient and orderly installation of each part of the work. Coordinate construction operations included under different sections of the specifications that are dependent upon each other for proper installation, connection, and operation.
   1. Where installation of one part of the work is dependent on installation of other components, either before or after its own installation, schedule construction activities in the sequence required to obtain its best results.
   2. Where availability of space is limited, coordinate installation of different components to assure maximum accessibility for required maintenance, service and repair.
   3. Make adequate provisions to accommodate items scheduled for later installation.

C. Where necessary, prepare memoranda for distribution to each party involved outlining special procedures required for coordination. Include such items as required notices, reports, and attendance at meetings.

D. Coordinate scheduling and timing of required administrative procedures with other construction activities to avoid conflicts and ensure orderly progress of the work. Such administrative activities include, but are not limited to, the following:
   1. Preparation of schedules
   2. Installation and removal of temporary facilities
   3. Delivery and processing of submittals
   4. Progress meetings
   5. Project close-out activities

E. Coordinate construction activities to ensure that operations are carried out with consideration given to conservation of energy, water and materials.

1.05 PROJECT MEETINGS

A. Pre-Construction Meeting: Within 15 days after execution of agreement, the Architect will prepare an agenda and schedule a pre-construction meeting. Written notice of meeting date, time and place, and agenda items will be sent to the Owner, Contractor, and Separate Contractors. The Contractor shall be responsible for notifying major subcontractors of meeting.

B. Progress Meetings: The Contractor shall schedule and hold regular progress meetings to coordinate, expedite and schedule work of all contracts. Hold additional meetings as progress of work dictates or when requested by the Architect. Send written notice of meeting date, time and place, and agenda of meeting to the Owner, Architect/Engineer, Separate Contractors, Subcontractors and others as pertinent to agenda. Record results of meetings and distribute copies to everyone in attendance and to others affected by the decisions or actions resulting from each meeting.

1.06 CONTRACTOR USE OF PREMISES

A. Confine operations at site to areas permitted under Contract. Portions of site beyond areas on which work is indicated are not to be disturbed.

B. Limit use of premises to work indicated, allowing for Owner occupancy and public use.
   1. Keep existing driveways and entrances serving premises clear and available to Owner, employees, and public at all times. Do not use these areas for parking or storage of materials.
   2. Do not unreasonably encumber site with materials or equipment.
   3. Lock automotive type vehicles, such a passenger cars and trucks and other mechanized or motorized construction equipment, when parked and unattended, to prevent unauthorized use. Do not leave vehicles or equipment unattended with motor running or ignition key in place.
   4. Open fires will not be permitted on premises.

1.07 INDUSTRY STANDARDS

A. Applicability of Standards: Except where more explicit or stringent requirements are written into the contract documents, applicable construction industry standards have the same force and effect as if bound into or copied directly into the contract documents. Such industry standards are made a part of the contract documents by reference. Individual specification sections indicate which codes and standards the Contractors must keep available at project site for reference.

B. Publication Dates: Except as otherwise indicated, where compliance with an industry standard is required, comply with standard in effect as of date of contract documents.

C. Conflicting Requirements: Where compliance with two or more standards is specified, and where these standards establish different or conflicting requirements for minimum quantities or quality levels, the most stringent requirement will be enforced, unless the contract documents specifically indicate otherwise. Refer requirements that are different, but apparently equal, and uncertainties as to which quality level is more stringent to the Architect for a decision before proceeding.

D. Copies of Standards: The Contract Documents require that each entity performing work be experienced in that part of the work being performed. Each entity is also required to be familiar with industry standards applicable to that part of the work. Copies of applicable standards are not bound with the contract documents. Where copies of standards are needed for proper performance of the work, the Contractors are required to obtain such copies directly from the publication source.

E. Abbreviations and Names: Trade association names and titles of general standards are frequently abbreviated. Where acronyms or abbreviations are used in the specifications or other contract documents they are defined to mean the recognized name of the trade association, standards generating organization, governing authority, or other entity applicable to the context of the text provisions.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION OF REQUIREMENTS

A. Type of Alternates: The alternates for this project are deductive type. The work described under the alternates shall be included in the Contractor's base bid and indicated as set forth on the Bid Form.

B. Definition: An alternate is an amount proposed by the Contractor and stated in the proposal to the Owner that will be deducted from the base bid amount if the Owner decides to accept the corresponding change in either scope of work or in products, materials, equipment, systems or installation methods described in Contract Documents.

C. Coordination: Coordinate related work and modify or adjust adjacent work as required to ensure that work affected by each alternate is complete and fully integrated into the project.

D. Include as part of each alternate, miscellaneous devices, appurtenances and similar items incidental to or required for a complete installation whether or not mentioned as part of the alternate.

1.02 DESCRIPTION OF DEDUCTIVE ALTERNATES

See Sheet A100-P2 for area extents of each Deductive Alternate

A. Deductive Alternate No 1: Provide Deductive Alternate to remove all finish construction within the boundary show in Deductive Alternate No.1, Phase 2.3. This will eliminate the construction and finish out of the MRI Suite and leave the space as a warm box. Systems and services required for the build out of the MRI Suite will be brought to the boundary of the phase area and stubbed into the space for future finish out without requiring disturbance or rework to adjacent areas. Exterior perimeter wall work, Interior X1 furring wall and insulation shall be installed to create a fully tempered space – Do not install interior gypsum face of X1 wall. Interior slab removal and replacement as shown on structural drawings for MRI support shall be completed as part of the base bid.

B. Deductive Alternate No 2: Provide Deductive Alternate to remove all finish construction within the boundary show in Deductive Alternate No.2, Phase 2.2. This will eliminate the construction and finish out of the Mammography and Ultrasound Suite and leave the space as a warm box. Systems and services required for the build out of the Mammography and Ultrasound Suite will be brought to the boundary of the phase area and stubbed into the space for future finish out without requiring disturbance or rework to adjacent areas. Exterior perimeter wall work, Interior X1 furring wall, and insulation shall be installed to create a fully tempered space – Do not install interior gypsum face of X1 wall. Interior slab removal and replacement as shown on structural drawings for Mammography equipment support shall be completed as part of the base bid.

C. Deductive Alternate No 3: Provide Deductive Alternate to remove all finish construction within the boundary show in Deductive Alternate No.3, Phase 2.1A. This will eliminate the construction and finish out of the additional exam rooms, offices, multipurpose room and staff lounge and leave the space as a warm box. Systems and services required for the build out of these spaces will be brought to the boundary of the phase area and stubbed into the space for future finish out without Requiring disturbance or rework to adjacent areas. Exterior perimeter wall work, Interior X1 furring wall, and insulation shall be installed to create a fully tempered space – Do not install interior gypsum face of X1 wall.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Make submittals required by Contract Documents; revise and resubmit as necessary to establish compliance with specified requirements. Submittals which are received from sources other than through the General Contractor's office will be returned by the Architect without action.

B. Submit documents in the following formats:
   1. Color selection requires actual materials or color cards. Reproductions and electronic copies will not be accepted.
   2. Electronic submittals of product and material data and shop drawings are preferred unless specifically requested to be hard copy by Architect.

C. Contractor's submittal of (and Architect's review of) shop drawings, product data or samples which relate to work not complying with requirements of Contract Documents, does not constitute an acceptable or valid request for a substitution, nor approval thereof.

1.02 ELECTRONIC SUBMITTAL PROCEDURES

A. Summary
   1. Shop drawing and product data submittals shall be transmitted to Architect in electronic (PDF) format.
   2. The electronic submittal process is not intended for color samples, color charts, or physical material samples.

B. Procedures
   1. Contractor shall review and apply electronic stamp certifying that the submittal complies with the requirements of the Contract Documents including verification of manufacturer / product, dimensions and coordination of information with other parts of the work.
   2. Contractor shall transmit each submittal to Architect.
   3. Architect / Engineer review comments will be made available.
   4. Distribution of reviewed submittals to subcontractors and suppliers is the responsibility of the Contractor.
   5. Submit electronic copies of reviewed submittals at project closeout for record purposes in accordance with Section 01 3250 – Closeout Submittals

C. Contractor's submittal of (and Architect's review of) shop drawings, product data or samples which relate to work not complying with requirements of Contract Documents, does not constitute an acceptable or valid request for a substitution, nor approval thereof.

1.03 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section.

1.04 QUALITY ASSURANCE

A. Coordination of Submittals: Prior to each submittal, carefully review and coordinate all aspects of each item being submitted. By affixing Contractor's approval stamp to each submittal, certify that coordination has been performed.

B. Verify that each item and submittal for it conforms in all respects with specified requirements.

1.05 TIMING OF SUBMITTALS

A. General: Make submittals far enough in advance of scheduled dates of installation to provide required time for reviews, securing necessary approvals, possible revision and resubmittal, placing orders and securing delivery.

B. Owner will not bear costs of delays due to late submittals.

1.06 COORDINATION AND SEQUENCING

A. Coordinate preparation and processing of submittals with performance of work so that work will not be delayed by submittals.

B. Coordinate and sequence different categories of submittals for same work, and for interfacing units of work, so that one will not be delayed for coordination of Architect's review with another.

PART 2 - PRODUCTS

2.01 PROGRESS SCHEDULE

A. Within 7 days after Notice to Proceed, submit to Architect a bar-chart type progress schedule indicating time bar for each trade or operation of work to be performed. Time bar shall demonstrate planned work, properly sequenced and intermeshed, for expeditious completion of Work. Identify phases if required.

B. Distribute progress schedule including all updates to Architect, Owner, subcontractor, suppliers, fabricators, and others with need-to-know schedule compliance requirements. Post copy in field office.

2.02 SCHEDULE OF VALUES

A. Immediately after execution of the Contract Documents, Contractor shall submit for approval a Schedule of Values totaling the amount of the Contract.

2.03 SCHEDULE OF SUBMITTALS

A. In accordance with General Conditions Document AIA A201, within 30 calendar days after execution of the Contract Documents, Contractor shall submit a Schedule of Submittals to the Architect. Note any critical submittals and long lead items that need to be expedited.
   1. Unless otherwise agreed between Contractor and Architect, the Architect will have 10 working days for initial review of submittals.

2.04 LIST OF SUBCONTRACTORS

A. Immediately after execution of the Contract Documents, Contractor shall submit for approval a listing of all subcontractors to be used for the project stating portions of Work to be performed, address and telephone number of firm, and contact at firm familiar with project.

B. If all subcontrators have not been determined, submit a partial listing with regular updates indicating newly added subcontractors.

2.05 SUBSTITUTION REQUESTS

A. Products specified herein establish a quality standard for comparison by manufacturers of similar products. Products of other manufacturers may be substituted for those specified herein on an "Approved Equal" basis. DO NOT propose the substitution of products that do not meet or exceed the quality standards established by the specified product. Products proposed as equivalent MUST be submitted through the General Contractor for review by the Architect after the Contract for Construction is awarded. DO NOT request approval of products prior to the awarding of the contract.

B. Requests for substitution will be reviewed when extensive revisions to contract documents are not required and changes are in keeping with general intent of Contract Documents; when timely, fully documented and properly submitted; and when one or more of following conditions is satisfied, all as judged by Architect/Engineer. Otherwise, requests will be returned without action except to record non-compliance with these requirements.
   1. Where request is directly related to an "or equal" clause or other language of same effect in Contract Documents.
   2. Where required product, material or method cannot be provided within Contract Time, but not as a result of Contractor's failure to pursue the Work promptly or to coordinate various activities properly.
   3. Where required product, material or method cannot be provided in a manner which is compatible with other materials of the Work, or cannot be properly coordinated therewith, or cannot be warranted as required, or cannot be used without adversely affecting Owner's insurance coverage on completed work, or

will encounter other substantial non-compliances which are not possible to otherwise overcome except by making requested substitution, which Contractor thereby certified to overcome such non-compatibility, non-coordination, non-warranty, non-insurability or other non-compliance as claimed.

4. Where required product, material or method cannot receive required approval by a governing authority, and requested substitution can be so approved.
5. Where substantial advantage is offered Owner, in terms of cost, time, energy conservation or other valuable considerations, after deducting offsetting responsibilities Owner may be required to bear increased cost of other work by Owner or separate contractors, and similar considerations.

C. **SUBSTITUTIONS REQUESTS MUST BE SUBMITTED WITHI 30 DAYS AFTER THE DATE OF THE NOTICE TO PROCEED**. Substitution requests received after that time will be returned and the Contractor will be required to provide the product specified, except as follows:

1. Unavailability of product, material or method, not due to the Contractor's failure to pursue the work promptly or to coordinate various activities properly.

D. Submit request for substitutions in writing using the Substitution Request form found at the end of this Section. This is the only form that will be accepted.

E. Submit substitution request, fully identified for product or method being replaced by substitution, including related specification section and drawing number(s), and fully documented to show compliance with requirements for substitutions. Include manufacturer's product data/drawings, description of installation methods, material samples where applicable, complete color and finish selection cards or samples, Contractor's detailed comparison of significant qualities between specified item and proposed substitution, statement of effect on construction time and coordination with other affected work, cost information or proposal, and Contractor's statement to the effect that proposed substitutions will result in overall work equal-to-or-better-than work originally indicated.

F. Failure to provide the requested data and samples within the specified time frame will be grounds for rejection as a comparable product.

G. Do not incorporate substitutions into Shop Drawings until they have been reviewed by the Architect and written permission has been issued to make the proposed substitution a part of the contract.

H. Under no circumstances shall Architect's review of any such substitution relieve Contractor from timely, full and proper performance of Work.

I. In the event that the substitution of a product by the General Contractor necessitates the redrawing, redesign, modification or other change to the Contract Documents, the General Contractor will bear all associated costs of these changes.

2.06 REQUEST FOR SUPPLEMENTARY INFORMATION

A. Make timely requests of Architect for additional information required in planning and production of Work.

B. File requests in ample time to permit appropriate action by all parties involved and avoid delay in performance of Work.

C. Owner will not bear costs for delays due to Contractor's failure to request information in a timely manner.

2.07 SHOP DRAWINGS

A. Provide newly-prepared information with graphic information at accurate scale (except as otherwise indicated), with name of preparer indicated (firm name). Do not duplicate and submit Architect's construction drawings as shop drawings. Show dimensions and notes which are based on field measurement. Identify materials and products in work shown. Indicate compliance with standards, and special coordination requirements.

1. Contract Document electronic files (including all drawings, specifications, addenda and supplemental information) will not be made available to Bidders or Sub-bidders before the award of a Contract. After the award of the Contract, the General Contractor may make request for release of electronic document files.

B. Shop drawings must bear Contractor's approval stamp. This approval stamp certifies that the Contractor has reviewed the shop drawings, product data, samples or similar submittals for conformance with the Contract Documents. All deviations will be noted in writing and highlighted on the submittal for Architect's review. The Architect is not responsible for errors, omissions or deviations in the shop drawings, product data, samples or similar submittals by the Contractor.

C. Submittals are reviewed by the Architect for design intent only. The Contractor is responsible for verification of dimensional requirements, compliance with contract documents and local codes, quantities and coordination of all affected trades.

D. Under no circumstances shall Architect's review of shop drawings or submittals relieve Contractor from timely, full and proper performance of Work in accordance with the Contract Documents.

2.08 PRODUCT DATA

A. Collect required data into one submittal for each unit of work or system; mark each copy to show which choices and options are applicable to project AND WHICH ARE AVAILABLE FOR SELECTION BY THE ARCHITECT WITHOUT ADDITIONAL COST. NO PAYMENT WILL BE MADE FOR ADDITIONAL COST OF ANY CHOICES OR OPTIONS SUBMITTED BY THE CONTRACTOR FOR SELECTION BY THE ARCHITECT AND NOT CLEARLY SHOWN AS NOT AVAILABLE WITHIN THE CONTRACT.

B. Include manufacturer's standard printed recommendations for application and use, compliance with standards, application of labels and seals, notation of field measurements which have been checked, and special coordination requirements.

C. Maintain one set of product data (for each submittal) at project site, available for reference by Architect and others.

D. Do not submit product data until compliance with requirements of contract documents has been confirmed by Contractor.

E. Installer's Copy: Do not proceed with installation of materials, products or systems until final copy of applicable product data is in possession of installer.

2.09 SAMPLES

A. Unless precise color and pattern is specified in Contract Documents, submit accurate color and pattern charts or actual material samples to Architect for selection. Refer to pertinent sections of specifications for detailed submittal requirements. Provide units identical with final condition of proposed materials or products for the work. Include "range" samples (not less than 3 units) where unavoidable variations must be expected, and describe or identify variations between units of each set.

B. Make all submissions affecting color selection within sufficient time to allow selection without causing delay in Work.

C. Submit items requiring color selection or verification as <u>one submittal</u> to facilitate coordination of all colors at one time. Interior items may be submitted separately from exterior items.

D. Provide full set of optional samples where Architect's selection is required. <u>DO NOT INCLUDE OPTIONS REQUIRING ADDITIONAL COST.</u>

E. Samples are submitted for review and confirmation of color, pattern, texture and "kind" by Architect. Architect will not "test" samples (except as otherwise indicated) for compliance with other requirements, which are therefore the exclusive responsibility of Contractor.

F. Submit 3 sets of samples in final submittal.
   1. Furnish two sets to Architect and assemble one set on site. When all samples are on site, Owner and Architect are to review. Contractor shall provide job samples indicating finished color selections for any and all items requiring finish color for project.
   2. Quality Control Set: Maintain returned final set of samples at project site, in suitable condition and available for quality control comparisons by Architect and Owner. Written approval from Owner is required before the work is begun for any finish requiring color review.

G. Reusable Samples: Returned samples which are intended or permitted to be incorporated into Work must be in undamaged condition at time of use.

2.10 STRUCTURAL SUBMITTALS

A. Structural submittals include shop drawings, design calculations, diagrams, illustrations, schedules, performance charts, nomenclature charts, samples, brochures and other data prepared by the Contractor or any subcontractor, manufacturer, supplier, fabricator, or distributor and which illustrate some portion of the Project directly related to the structural design of the project.

B. Contractor shall make all submittals in advance of installation or construction to allow sufficient time for review.

C. Work requiring shop drawings, whether called for by the Contract Documents or requested by the Contractor, shall not commence until the submission has been reviewed by the Architect/Structural Engineer. Work may commence if the Contractor verifies the accuracy of the Architect/Structural Engineer's corrections and notations and complies with them without exception and without requesting change in Contract Sum or Contract Time.

PART 3 - EXECUTION

3.01 SUBMITTAL PREPARATION

A. Permanently mark each submittal to identify project, date, Contractor, subcontractor, submittal name and similar information to distinguish it from other submittals. Show Contractor's executed review and approval marking.

B. Indicate project, date, "To:"; "From:"; names of subcontractors, suppliers, manufacturers, required references, category and type of submittal, purpose, description, distribution record and signature of transmitter.

C. Indicate drawing number and specifications section number to which submittal applies.

3.02 ARCHITECTS ACTION ON SUBMITTALS

A. Architect's Submittal Review: Submittal review does not relieve Contractor(s) of compliance with Contract Documents or local codes. Review is only for conformance with the design intent of the Project and compliance with information given in the Contract Documents. The contractor is responsible to coordinate and to confirm all dimensions for use at the site. The contractor is responsible for coordination of the work of all trades.

B. Architect's Action: Where action and return is required or requested, Architect will review each submittal and mark per the following, and where possible return within ten (10) working days of receipt. When a submittal must be coordinated with submittals of other trades, Contractor is responsible for gathering all information and forwarding to Architect as a single submittal.

C. Architect's Response:

1. Final Unrestricted Release: Work may proceed, provided it complies with notations and corrections on submittal and with Contract Documents, when submittal is returned with the following: **Marking: "Reviewed".**
2. Final-But-Restricted Release: Work may proceed, provided it complies with notations and corrections on submittal and with Contract Documents, when submittal is returned with the following: **Marking: "Furnish as Corrected".**
3. Returned for Resubmittal: Do not proceed with work. Revise submittal in accordance with notations thereon, and resubmit without delay to obtain a different action marking. Do not allow submittals with the following marking (or unmarked submittals where a marking is required) to be used in connection with performance of the Work: **Marking: "Revise & Resubmit".**
4. Other Actions: Where submittal is returned **"Rejected"** or **"Submit Specific Item"**, an explanation will be provided.

END OF SECTION

POLK STANLEY WILCOX ARCHITECTS
801 South Spring Street
Little Rock, Arkansas 72201

SUBSTITUTION REQUEST

Project: CARTI Cancer Center Phase 2 Date:
Project No: 671AG Contractor: Clark Contractors
Contact Person:

Contractor hereby requests consideration of a product substitution as follows:

1. Refer To: Section - _____ and/or Drawing - _____
2. Item Description: _____
3. Proposed Substitution:
   Manufacturer: _____
   Model Number: _____
   Description: _____
4. Reason for Substitution:
   ____ Availability ____ Quality Advantage
   ____ Delivery Schedule ____ Performance Advantage
   ____ Cost Advantage ____ Other: _____
5. Coordination:
   Difference in dimensions between the specified and proposed substitute **(WILL) (WILL NOT)** affect dimensions on drawings and adjacent items.

   Describe the effect of the substitution on work of other trades: _____

   Describe the effect of the substitution on other required new or existing materials including electrical wiring, piping, ductwork, finishes, structure, etc.: _____

   Acceptance of this substitution will cause **(NO CHANGE IN) (A REDUCTION OF _____ DAYS FROM)** the completion date of this project.

   Describe any required architectural or engineering design changes required to accommodate the substitution: _____
6. Differences:
   The proposed substitution **(MEETS) (DOES NOT MEET)** the reference standards (ASTM, AWI, UL, etc.) as specified.

   The proposed substitution **(MEETS) (DOES NOT MEET)** the fire rating classification (class, type, FM, UL, NFPA) as specified.

   The proposed substitution is available in the following **(COMPARABLE) (LIMITED) (ADDITIONAL)** finishes.

   Note: Any additional cost associated with proposed substitute finishes will be absorbed by the contractor if this substitution is approved and implemented.

7. Warranty:
   Specified Warranty Length and Coverage:_____
   Substitute Warranty Length and Coverage (Sample warranty attached):_____
   _____
8. This substitution will result in a cost savings and credit of $_____.
9. The proposed substitute has been used in the following installations (attached):_____
   _____
10. Service and replacement material are available from the following (attached):_____
    _____

By submitting this Request for Substitution, the Contractor accepts the following terms and conditions:

1. The proposed substitution, if accepted, will provide performance equivalent to the material or equipment specified. Should a substitution be accepted and should the substitute material or equipment prove defective or otherwise unsatisfactory for the service intended, the Contractor will replace the material or equipment with the material or equipment specified.
2. If the substitution will affect a correlated function, adjacent construction, or work of other trades or contractors, the necessary changes and modifications to affected work are considered to be part of the substitution and will be accomplished without additional cost to the Owner.
3. In the event that the substitution of materials or equipment necessitates the redrawing, redesign, modification or other change to the Contract Documents, the General Contractor will bear all associated costs of these changes.

Contractor warrants that they have verified and believe this substitute is equal or superior to the specified item in all respects. There will be no additional cost associated with coordinating installation of this substitute. Costs and effects of the substitution, as outlined herein, are certified and complete. Claims for additional costs related to acceptance of this substitution, which may become apparent later, are waived.

Manufacturer's product cut sheets, drawings, samples, data sheets, sample warranties, manufacturer's certification, etc. for the substitute are attached.

Contractor:_____ Date:_____

By:_____

Typed Name:_____

Architect's Action:

Substitution is Accepted:_____

Substitution is Rejected for the following reason(s):_____
_____

By:_____

Typed Name:_____

Date:_____

PART 1 - GENERAL

2.01 CLOSEOUT SUBMITTALS

A. Upon completion of Work and **prior to final payment**, **electronic copies** of the following items must be submitted to Architect:
   1. General Contractors letter of warranty
   2. General Contractors letter stating that all deficiency list items are complete
   3. Lien releases
   4. Consent of Surety to pay final retainage
   5. List of all subcontractors and suppliers, including portions of the work performed, address and telephone number of firm, and a contact name familiar with the project.
   6. Guarantees and Warranties: Two fully executed copies of each guarantee and warranty specified. Note that all guarantees and warranties begin at the date of substantial completion.
   7. Certificates: Fully executed copy of each certificate specified.
      a. Certificate of Occupancy
      b. Final Termite Inspection
      c. Final Plumbing Inspection
      d. Final Electrical Inspection
      e. Certificate of Air Balance
   8. Miscellaneous other inspection reports:
      a. Backflow Preventers on Potable Water
      b. Fire Suppression System
      c. Fire Alarm System
      d. Security System
   9. Instructions: Operating, service and maintenance manual or instruction sheet for each item as requested by specifications and required for Owner's use.
   10. Shop Drawings: A complete file of final copies of all shop drawings used in construction of project.
   11. Complete set of all submittals for products used in construction of project.

B. Project Record Drawings: The Contractor shall provide one (1) complete set of project record drawings and electronic copies of scanned images of the drawings.
   1. Cloud and reference each of the following items on the Record Drawings:
      a. written addendum items
      b. Addendum Drawings
      c. Supplemental Drawings
      d. Supplemental Instructions
      e. Change Orders
      f. responses to RFI's
      g. any other deviations from the original drawings that are made in the field
   2. Record final locations of underground lines by depth from finished grade and by accurate horizontal offset distances to permanent surface improvements such as buildings, curbs, edges, or walks.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION

3.01 EXTENDED WARRANTIES

A. The entire project is warranted for a period of one (1) year from the date of substantial completion and several materials and systems require extended warranties. It is the responsibility of the General Contractor to review the Project Manual to determine the term of the extended warranties and provide the extended warranties required.

END OF SECTION

PART 1 – GENERAL

1.01 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.

B. Arkansas Special Inspections Guidelines (SEAoAR SI GL 02 - 01/01/2012) in accordance with 2012 Arkansas Fire Prevention Code (based on 2012 International Building Code).

1.02 SUMMARY

A. This Section includes administrative and procedural requirements required for compliance with the International Building Code, Chapter 17, Structural Tests and Special Inspections.

B. Structural testing and special inspection services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with other construction document requirements.
   1. Specific quality-assurance and -control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
   2. Specified tests, inspections, and related actions do not limit Contractor's other quality-assurance and -control procedures that facilitate compliance with the construction document requirements.
   3. Requirements for Contractor to provide quality-assurance and -control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions of this section.

C. The Owner will engage one or more qualified Special Inspectors and / or testing agencies to conduct structural tests and special inspections specified in this section and related sections and as maybe specified in other divisions of these specifications.

1.03 DEFINITIONS

A. Approved Agency: An established and recognized agency regularly engaged in conducting tests or furnishing inspection services, when such agency has been approved by the building official.

B. Construction Documents: Written, graphic and pictorial documents prepared or assembled for describing the design, location and physical characteristics of the elements of a project necessary for obtaining a building permit. Construction Documents include all supplemental instructions, sketches, addenda, and revisions to the drawings and specifications issued by the registered design professional beyond those issued for a building permit.

C. Shop Drawings/Submittal Data: Written, graphic and pictorial documents prepared and/or assembled by the Contractor based on the Construction Documents.

D. Structural Observation: Visual observation of the structural system by a representative of the registered design professional's office for general conformance to the approved construction documents. Structural observations are not considered part of the structural tests and special inspections and do not replace inspections and testing by the testing agency or Special Inspector.

E. Special Inspector: A qualified person who demonstrating competence, to the satisfaction of the code enforcement official and registered design professional in responsible charge, for inspection of the particular type of construction or operation requiring special inspection. The Special Inspector shall be a licensed Professional Engineer, Engineering Intern, or a qualified representative from the testing agency who is under supervision of a licensed Professional Engineer.

F. Special Inspection, Continuous: The full-time observation of work requiring special inspection by an approved Special Inspector who is present in the area where the work is being performed.

G. Special Inspection, Periodic: The part-time or intermittent observation of work requiring special inspection by an approved Special Inspector who is present in the area where the work has been or is being performed and at the completion of the work.

H. Testing Agency: A qualified materials testing laboratory under the responsible charge of a licensed Professional Engineer, approved by the code enforcement official and the registered design professional in responsible charge, to measure, examine, test, calibrate, or otherwise determine the characteristics or performance of construction materials and verify confirmation with construction documents.

1.04 QUALITY ASSURANCE

A. Testing Agency Qualifications:
   1. Minimum qualifications of inspection and testing agencies and their personnel shall comply with ASTM E329-03 Standard Specification for Agencies in the Testing and/or Inspection of Materials Used in Construction.
      a. Inspectors and individuals performing tests shall be certified for the work being performed as outlined in the appendix of the ASTM E329. Certification by organizations other than those listed must be submitted to the building official for consideration before proceeding with work.
   2. In addition to these requirements, local jurisdiction may have additional requirements. It is the responsibility of the testing and inspection agencies to meet local requirements and comply with local procedures.

1.05 CONFLICTING REQUIREMENTS, REPORTS, AND TEST RESULTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that

are different, but apparently equal, to the registered design professional in responsible charge for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to the registered design profession in responsible charge for a decision before proceeding.

C. The Special Inspector's reports and testing agencies results shall have precedence over reports and test results provided by the Contractor.

D. Where a conflict exists between the construction documents and approved shop drawings/submittal data, the construction documents shall govern unless the shop drawings/submittal data are more restrictive. All conflicts shall be brought to the attention of the registered design professional in responsible charge.

1.06 SUBMITTALS BY SPECIAL INSPECTOR AND/OR TESTING AGENCY

A. Special Inspectors shall keep and distribute records of inspections. The Special Inspector shall furnish inspection reports to the building official, and to the registered design professional in responsible charge, Contractor, Architect, and Owner. Reports shall indicate that work inspected was done in conformance to approved construction documents. Discrepancies shall be brought to the immediate attention of the Contractor for correction. If the discrepancies are not corrected, the discrepancies shall be brought to the attention of the building official and to the registered design professional in responsible charge prior to the completion of that phase of the work. A final report documenting required special inspections and correction of any discrepancies noted in the inspections shall be submitted at a point in time agreed upon by the permit applicant and the building official prior to the start of work.

1. Special inspection reports and test results shall include, but not be limited to, the following:
    a. Date of inspection.
    b. Description of inspections or tests performed including location (reference grid lines, floors, elevations, etc.).
    c. Statement noting that the work, material, and/or product conforms or does not conform to the construction document requirements.
        1) Name and signature of Contractor's representative who was notified of work, material, and/or products that do not meet the construction document requirements.
    d. Name and signature of Special Inspector and/or testing agency representative performing the work.

B. Schedule of Non-Compliant Work: Each agent shall maintain a log of work that does not meet the requirements of the construction documents. Include reference to original inspection/test report and subsequent dates of re-inspection/retesting.

C. Reports and tests shall be submitted within 1 week of inspection or test. Schedule of Non-Compliant Work shall be updated daily and submitted at monthly intervals.

D. Final Report of Special Inspections. Submitted by each agent listed in the schedule of Structural Testing and Special Inspections.

PART 2 - PRODUCTS (not used)

PART 3 – EXECUTION

3.1 CONTRACTOR'S RESPONSIBILITY

A. The Contractor shall coordinate the inspection and testing services with the progress of the work. The Contractor shall provide sufficient notice to allow proper scheduling of all personnel. The Contractor shall provide safe access for performing inspection and on site testing.

B. The Contractor shall submit schedules to the Owner, registered design professionals and testing and inspecting agencies. Schedules will note milestones and durations of time for materials requiring structural tests and special inspections.

C. Each Contractor responsible for the construction of a seismic-force-resisting system, designated seismic system, or component listed in the quality assurance plan shall submit a written Contractor's statement of responsibility to the building official and to the Owner prior to the commencement of work on the system or component. The Contractor's statement of responsibility shall contain the following:
1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.
2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.
3. Procedures for exercising control within the Contractor's organization, the method and frequency of reporting and the distribution of the reports.
4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.

D. Each Contractor responsible for the construction of a main wind force-resisting system or a wind-resisting component listed in the quality assurance plan shall submit a written statement of responsibility to the building official and the Owner prior to the commencement of work on the system or component. The Contractor's statement of responsibility shall contain the following:
1. Acknowledgment of awareness of the special requirements contained in the quality assurance plan.
2. Acknowledgment that control will be exercised to obtain conformance with the construction documents approved by the building official.
3. Procedures for exercising control within the Contractor's organization, the method and frequency of reporting and the distribution of the reports.
4. Identification and qualifications of the person(s) exercising such control and their position(s) in the organization.

E. The Contractor shall repair and/or replace work that does not meet the requirements of the construction documents.
   1. Contractor shall engage an Engineer/Architect to prepare repair and/or replacement procedures.
   2. Engineer/Architect shall be registered in the state in which the project is located. Engineer shall be acceptable to the registered design professional in responsible charge, code enforcement official, and Owner.
   3. Procedures shall be submitted for review and acceptance by the registered design professional in responsible charge, code enforcement official, and Owner before proceeding with corrective action.

F. The Contractor shall be responsible for costs of:
   1. Re-testing and re-inspection of materials, work, and/or products that do not meet the requirements of the construction documents and shop drawings/submittal data.
   2. Review of proposed repair and/or replacement procedures by the registered design professional in responsible charge and the inspectors and testing agencies.
   3. Repair or replacement of work that does not meet the requirements of the construction documents.

3.2 STRUCTURAL OBSERVATIONS

A. Structural observations may be made periodically as determined by the registered design professional in responsible charge.

3.3 TESTING AND INSPECTION

A. Reference related specifications for the minimum level of inspections and testing. Provide additional inspections and testing as necessary to determine compliance with the construction drawings.

END OF SECTION

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PART 1 - GENERAL

1.01 GENERAL SITE REQUIREMENTS

A. Do not close or obstruct streets, walks or other occupied or used facilities without permission from authorities having jurisdiction. Provide alternate routes around closed or obstructed traffic ways.

B. Ensure safe passage of persons around areas of construction. Conduct operations to prevent injury to adjacent buildings, structures, facilities and persons.

C. Erect temporary covered passageways as required by authorities having jurisdiction.

D. Provide dustproof partitions if required. If not indicated on the drawings, provide dustproof partitions as directed by the Architect to comply with applicable sections of the Life Safety Code.

E. Provide temporary enclosures at doors and other openings in walls as necessitated by weather conditions. Construct enclosures with fire retardant treated lumber. Tape joints and caulk to prevent dust and debris from migrating beyond construction areas. Maintain enclosures in good repair and remove when no longer needed.

F. Provide interior and exterior shoring, bracing or support as needed to prevent movement, settlement or collapse.

1.02 PROJECT SIGNS

A. General Contractor shall furnish and erect temporary construction sign at job site and remove sign at end of construction period. Paint and letter as directed by Architect to identify project, Owner, Architect and Contractor.

B. Additional signs will be provided by the Architect to be placed as directed. Signs shall be maintained throughout the project.

C. Subject to prior approval of Owner as to size, design, type, location and to local regulations, Contractor and his subcontractors may erect temporary signs for purposes of identification and controlling traffic.

1.03 JOB OFFICES AND STORAGE

A. Contractor and his subcontractors shall maintain office and storage facilities on site as may be necessary. Locate so as to cause no interference with work to be performed on the site by Owner or with Owner's operations. Consult with Architect regarding locations. Office shall have as a minimum the following items:

1. Complete set of Construction Documents including all addenda and supplemental information.
2. Layout and meeting space for Architects or Owners representative to use when visiting the site.
3. Complete job file with copies of all correspondence concerning the project.

B. Upon completion of project, or as directed by Architect, Contractor shall remove temporary structures and facilities from the site, same to become his property. Leave the premises in condition required by Contract.

1.04 SANITARY ARRANGEMENTS

A. Contractor, at beginning of Work, to provide on premises suitable temporary convenience and enclosure for use of workmen on job. Maintain in sanitary condition and remove at completion of Work or when directed by Architect.

1.05 TEMPORARY UTILITIES FOR CONSTRUCTION

A. The Owner will provide all water, gas and electric service required for construction purposes. Contractor to provide necessary conduit, pipe, fittings, etc.

1.06 TEMPORARY HEATING

A. Provide temporary heating, coverings and enclosures necessary to protect operations and materials against damage by dampness and cold, to dry out work, and facilitate completion of Work.

B. Maintain critical installation temperatures required in separate Sections of the Specifications. Repair or replace at no additional cost to Owner, any materials and work damaged by dampness, insufficient or abnormal heat.

1.07 CONSTRUCTION AIDS

A. Provide and maintain for the duration of construction temporary equipment and apparatus including scaffolds, elevators and hoists, canopies, tarpaulins, barricades, warning signs, steps, ladders, platforms, ramps, chutes, walkways, and other temporary construction aids and miscellaneous facilities as necessary for proper completion of the work; comply with pertinent safety regulations.

1.08 RUBBISH CONTAINERS

A. Provide suitable containers with covers for refuse from meals eaten on job site. Remove refuse from containers at least once in every 72 hour period. Place one container beside each drinking water facility to receive discarded paper cups. Pick up and place bottles, cans, paper and garbage of every description in covered rubbish containers continuously during day.

1.09 TEMPORARY FIRE PROTECTION

A. During construction period, provide and maintain types and forms of temporary fire protection needed to protect facilities against fire losses. Store combustible materials in recognized fire-safe locations and containers.

1.10 SECURITY

A. Provide sufficient control to prevent illegal entry or damage during nights, holidays, or other periods when work is not being executed, and such other controls as required during working hours.

1.11 REMOVAL

A. Maintain construction facilities and temporary controls as long as needed for safe and proper completion of work. Remove temporary facilities and controls as rapidly as progress of work will permit or as directed by Architect.

PART 2 - PRODUCTS (Not Applicable)

PART 3 - EXECUTION (Not Applicable)

END OF SECTION

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PART 1 - GENERAL

1.01 CLEANING AND WASTE REMOVAL

A. Progress Cleaning:
   1. The premises and the job site shall be maintained in a reasonable neat and orderly condition and kept free from accumulations of waste materials and rubbish during the entire construction period. Remove crates, cartons, and other flammable waste materials or trash from the work areas at the end of each working day. Do not allow debris to blow onto adjoining properties. Respond immediately to request from adjoining property owners to remove any debris that does manage to show up on adjoining properties. Collect and remove waste materials, debris, and rubbish from site weekly, daily if necessary and dispose off-site.
   2. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
   3. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

B. Final Cleaning:
   1. Use cleaning materials and agents recommended by manufacturer or fabricator of surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property, or that might damage finished surfaces.
   2. Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit of Work to condition expected from a commercial building cleaning and maintenance program. Comply with manufacturer's published instructions.
   3. Complete following cleaning operations before requesting inspection for Substantial Completion.
      a. Clean Project Site, yard and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste materials, litter and foreign substances. Sweep paved areas broom clean. Remove petro-chemical spills, stains and other foreign deposits. Rake grounds to a smooth even-textured surface.
      b. Remove tools, construction equipment, machinery and surplus material from Project Site.
      c. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
      d. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics and similar spaces.
      e. Broom clean concrete floors in unoccupied spaces.
      f. Vacuum clean carpet and similar soft surfaces, removing debris and excess nap. Shampoo if required.

g. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other substances that are noticeable vision-obscuring materials. Replace chipped, scratched or broken glass and other damaged transparent materials. Polish mirrors and glass, taking care not to scratch surfaces. Do not use razor blades to clean glass. Any scratches on the glass caused by the cleaning process will be cause for the removal and replacement of the damaged glass at the Contractor's expense.

h. Remove labels that are not permanent labels.

i. Touch-up and otherwise repair and restore marred exposed finishes and surfaces. Replace finishes and surfaces that can not be satisfactorily repaired or restored, or that show evidence of repair or restoration. Do not paint over "UL" and similar labels, including mechanical and electrical name plates.

j. Wipe surfaces of mechanical and electrical equipment, and other similar equipment. Remove excess lubrication, paint and mortar droppings and other foreign substances.

k. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

l. Replace all disposable filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills. Clean ducts, blowers, and coils if units were operated without filters during construction.

m. Clean light fixtures, lamps, globes and reflectors to function with full efficiency. Replace burned out bulbs, and defective and noisy starters in fluorescent and mercury vapor fixtures.

n. Leave Project clean and ready for occupancy.

4. Engage an experienced licensed exterminator to make a final inspection, and rid Project of rodents, insects, and other pests. Comply with regulations of local authorities having jurisdiction.

5. Remove temporary protection and facilities installed during construction to protect previously completed installations during remainder of construction.

6. Comply with governing regulations and safety standards for cleaning operations. Remove waste materials from Project Site and dispose of in accordance with requirements of local authorities having jurisdiction.

   a. Extra materials of value that remain after completion of construction and have become the Owner's property are to be stored as directed by Owner.

PART 2 - PRODUCTS - Not Used

PART 3 - EXECUTION - Not Used

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Interior demolition and removal work required for construction and connecting new Work to existing building and for remodeling existing building. Work also includes barricades, temporary protection, dust protection and removal from site trash and debris from demolition work.

B. Extent of selective demolition work is generally indicated on drawings. Selective demolition not shown on the drawings may be determined by examination of existing facilities and the proposed new and remodeled work. Existing items not shown on the plans of proposed work and preventing the execution of proposed work are in the scope of the selective demolition work.

C. Refer to the mechanical and electrical and plumbing drawings for extent of demolition work required in adjacent areas for accommodation of renovation work. If no drawings show the extent of demolition, the Contractor must determine the extent of work and include it in his scope of work.

D. Degree of patching to be performed in a given area will be determined by the proposed new finish of that area.

E. Disconnecting, removal and/or relocation and reconnecting of existing mechanical, electrical and fire protection work including equipment, piping and wiring are included in this Contract.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SCHEDULES

A. Before commencing any alteration work, submit for review and approval of the Architect, a schedule showing the commencement, the order, and the completion dates for the various parts of this work.

B. Before starting any work relating to existing utilities that will temporarily discontinue service to the existing building, notify the Owner 5 days in advance and obtain the Owner's approval before proceeding with this phase of work. Do not disconnect or disrupt service without Owner's prior approval.

PART 2 - PRODUCTS

2.01 BARRICADE AND SUPPORT MATERIALS

A. Before starting demolition and removal work, furnish and erect necessary barricades. Barricades shall provide for safe passage at all times. Provide temporary protection to keep existing building weathertight. Dust proof areas that are to be kept in use in manner to permit necessary passage for personnel and the protection of equipment. During process of demolition and removal, install temporary supports and bracing, to prevent building damage.

B. If approved by Architect, materials from demolition work may be used for construction of temporary protective barricades, temporary partitions, noise barriers and dust barriers and for temporary non-structural supports. Where suitable materials are not available from demolition work, furnish materials of proper type and construction to perform function specified above.

2.02 FIRESTOPPING IN EXISTING CONSTRUCTION

A. Demolition may uncover unsealed penetrations in fire rated floor, wall and ceiling assemblies. Examine the site for the location of these items and provide approved firestop sealant systems.

B. Any new penetration in fire rated floors, walls, ceilings and roof will be sealed with approved sealant to maintain fire rating.

2.03 FIREPROOFING

A. Any fireproofing removed during construction shall be replaced with similar material to maintain proper rating.

2.04 OTHER MATERIALS

A. Provide materials, not specifically described but required for proper completion of work of this Section, selected by Contractor subject to Architect's approval.

PART 3 - EXECUTION

3.01 PREPARATION

A. Make such explorations and probes as are necessary to ascertain required protection measures before proceeding with alteration work. Give particular attention to shoring and bracing requirements so as to prevent any damage to existing construction.

B. Provide, erect, and maintain catch platforms, lights, barriers, weather protection, warning signs, and other items as required for proper protection of the workmen engaged in alteration operations, and adjacent construction.

C. Provide and maintain weather protection at exterior openings so as to fully protect the interior premises against damage from the elements until such openings are closed by new construction.

D. Provide and maintain temporary protection of the existing building where demolition, removal, and new work is being done, connections made, materials handled, or equipment moved.

E. Take necessary precautions to prevent dust and dirt from rising by wetting demolished masonry, concrete, plaster, gypsum board, sprayed fireproofing and similar debris, or by other means. Protect unaltered portions of the existing building affected by the operations under this section by dustproof partitions and other adequate means.

F. Do not close or obstruct walkways or passageways without the authorization of the Owner. Do not store or place materials in passage-way or other means of egress. Conduct operations with minimum traffic interference.

G. Owner will be continuously occupying areas of the building immediately adjacent to areas of selective demolition. Conduct selective demolition work in manner that will minimize need for disruption of Owner's normal operations. Provide minimum of 72 hours advance notice to Owner of demolition activities which will severely impact Owner's normal operations.

3.02 TEMPORARY PARTITIONS

A. Provide floor-to-ceiling dustproof partitions to limit dust and dirt migration and to separate areas from fumes and noise.

B. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire-retardant-treated plywood on construction operations side.

C. Where fire-resistance-rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.

D. Insulate partitions to control noise transmission to occupied areas.

E. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.

F. Protect air-handling equipment.

G. Provide walk-off mats at each entrance through temporary partition.

3.03 UTILITY SERVICE

A. Maintain existing utilities indicated to remain, keep in service, and protect against damage during demolition operations.

B. Do not interrupt existing utilities serving occupied or used facilities, except when authorized in writing by authorities having jurisdiction. Provide temporary services such as emergency power, fire alarm, heating and air conditioning, during interruptions to existing utilities, as acceptable to Owner and governing authorities. Allow no interruption in service unless coordinated with Owner at least 24 hours in advance.

C. Disconnect and seal utilities serving interior area to be demolished, prior to start of demolished work.

D. Protect smoke and fire detectors from construction damage, dust and false alarms.

E. Request Owner to identify any data/communication wiring above the ceiling that should be removed. Remove this wiring.

F. Remove all abandoned conduit and wiring above ceiling.

3.04 INSTALLATION/APPLICATION/PERFORMANCE

A. Provide alteration work as indicated on the drawings or required for the work of this Contract. Be responsible for any damage that may be caused by such work to any part or parts of existing structures or items designated for reuse or salvage. Perform patching, restoration, and new work in accordance with applicable technical sections of the Specifications.

B. Where alterations occur, or new and old work join, cut, remove, patch, repair, or refinish the adjacent surfaces or as required by the involved conditions, and leave in as good a condition as existed prior to the commencing of the work. Refinish painted surfaces from intersection to intersection unless indicated otherwise. Materials and workmanship employed in the alterations, unless otherwise indicated or specified, shall conform to that of the original work. Materials not specifically described but required for a complete and proper installation of the work, shall be new, first quality of their respective kinds, as selected by Contractor subject to the approval of the Architect. Alteration work shall be performed by the various respective trades that normally perform the particular items of work.

C. Finish new and adjacent existing surfaces as specified for new work. Clean existing surfaces of dirt, grease and loose paint before refinishing.

D. Where alterations occur in areas to be completed during later phases of the work only prepare adjacent surfaces as necessary and complete finishing during proper phase of the work.

E. If it will be necessary to disrupt internal pedestrian traffic flow along means of egress from the building, the Contractor must consult the presiding code official in regards to temporary means of egress, temporary exit signage and other related items. Implementation of requirements made by the code official are the responsibility of the Contractor.

F. If unanticipated mechanical, electrical or structural elements which conflict with intended function or design are encountered, investigate and measure both nature and extent of the conflict. Submit report to Owner's Representative in written, accurate detail. Pending receipt of directive from Owner's Representative rearrange selective demolition schedule as necessary to continue overall job progress without delay.

G. At areas requiring demolition of finishes and items normally applied with adhesives (i.e. vinyl wall coverings, rubber/vinyl flooring, etc.) and where the original surface is to remain or receive a new finish, the Contractor shall assume the original surface will be damaged by the demolition and include in his base bid the cost for repair of these surfaces to a smooth surface, ready to receive new finish.

3.05 SALVAGE

A. Certain items and materials removed from existing building in demolition work are to be relocated or reused by Contractor in new construction work under this Contract. Items and materials for relocation or reuse and which are damaged by careless handling in removal may be rejected by Architect if considered unsuitable for re-use. Replace rejected items at Contractor's expense. Salvable materials, removed in demolition work and not for relocation or re-use or not turned over to the Owner for disposition, become property of Contractor and shall be hauled away from site as they are removed.

B. In all cases of interior demolition, door hardware, light fixtures, emergency lighting, art work, furniture, window treatments such as blinds, drapes, curtains and operating hardware, signage and graphics, doors and hardware and other interior decor items are to be carefully removed and turned over to Owner.
   1. Clean salvaged items.
   2. Pack or crate items after cleaning. Identify contents of containers.
   3. Store items in a secure area until delivery to Owner.
   4. Transport items to Owner's storage area
   5. Protect items from damage during transport and storage.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Form cast-in-place concrete required and subsequently remove forms except as otherwise specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Workmen: Provide foreman at all times during execution of this portion of the Work, thoroughly familiar with type materials being installed, referenced standards, and requirements of this work, and who shall direct work performed under this Section.

B. Codes and Standards:
   1. In addition to complying with pertinent codes and regulations, comply with pertinent recommendations contained in "Recommended Practice for Concrete Formwork", publication ACI 347 of the American Concrete Institute.
   2. Where provisions of pertinent codes and standards conflict with requirements of this Section more stringent provisions govern.

PART 2 - PRODUCTS

2.01 FORM MATERIALS - GENERAL

A. Smooth-Formed Finished Concrete: Form-facing panels that will provide continuous, true, and smooth concrete surfaces. Furnish in largest practicable sizes to minimize number of joints.
   1. Plywood, metal, or other approved panel materials.
   2. Exterior-grade plywood panels, suitable for concrete forms, complying with DOC PS 1, and as follows:
      a. High-density overlay, Class 1 or better.

b. Medium-density overlay, Class 1 or better; mill-release agent treated and edge sealed.
c. Structural 1, B-B or better; mill oiled and edge sealed.
d. B-B (Concrete Form), Class 1 or better; mill oiled and edge sealed.

B. Rough-Formed Finished Concrete: Plywood, lumber, metal, or another approved material. Provide lumber dressed on at least two edges and one side for tight fit.

C. Forms for Cylindrical Columns, Pedestals, and Supports: Metal, glass-fiber-reinforced plastic, paper, or fiber tubes that will produce surfaces with gradual or abrupt irregularities not exceeding specified formwork surface class. Provide units with sufficient wall thickness to resist plastic concrete loads without detrimental deformation.

D. Form Release: Provide Clean Strip J1A by Dayton Superior, Darragh Diamond-Kote Form Release, or approved equal.

2.02 TIES AND SPREADERS

A. Form Ties: Factory-fabricated, removable or snap-off metal or glass-fiber-reinforced plastic form ties designed to resist lateral pressure of fresh concrete on forms and to prevent spalling of concrete on removal.
1. Furnish units that will leave no corrodible metal closer than 1 inch (25 mm) to the plane of exposed concrete surface.
2. Furnish ties that, when removed, will leave holes no larger than 1 inch (25 mm) in diameter in concrete surface.
3. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

2.03 EXPANSION JOINTS

A. Non-extruding, pre-moulded filler strips conforming to ASTM D 1751 or D 1752 and compatible with sealant material used to seal joints.

2.04 FORMED JOINTS

A. Non-staining materials; of wood, plastic, or metals, formed to be removed without spalling concrete.

2.05 KEYED JOINTS

A. "Keyed Kold" joint form by Burke Concrete Accessories, Inc., or approved equal. Top of stakes set 3/8" below slab surface so when joint form is placed on stakes, painted portion of joint is finished elevation. Finish concrete to top of joint and burn in with hand trowel.

2.06 UNDER SLAB VAPOR BARRIER

A. Vapor Barrier must have the following qualities:
1. Permeance as tested after mandatory conditioning (ASTM E 1745, Paragraphs 7.1.2 - 7.1.5): not more than 0.01 Perms [grains/(ft^2 *hr * in.Hg)] per ASTM F 1249

or ASTM E 96.
2. ASTM E 1745 Class A (Plastics)

B. Vapor Barrier:
1. Stego Wrap 15 mil by Stego Industries, 877-464-7834.
2. Perminator 15 mil by W. R. Meadows, 800-342-5976.
3. Fortifiber Building Systems Group Moist Stop Ultra 15 mil

C. Accessories:
1. Seam Tape:
a. Water Vapor Transmission Rate: ASTM E 96, 0.3 perms or lower
b. Stego Tape by Stego Industries, 877-464-7834, or approved equal.
2. Mastic:
a. Water Vapor Transmission Rate: ASTM E 96, 0.3 perms or lower
b. Stego Mastic, or approved equal.
3. Pipe Boots: Construct pipe boots from vapor barrier material, pressure sensitive tape and/or mastic per manufacturer's instructions.
4. Perimeter/edge seal:
a. Stego Crete Claw
b. Stego Term Bar by Stego Industries LLC, (877) 464-7834
c. StegoTack Tape (double-sided sealant tape)

D. Penetration Prevention: Beast Foot

E. Vapor Barrier-Safe Screed System: Beast Screed

2.07 WATERSTOPS

A. Provide waterstops using extruded rubber, rubber compound or polyvinyl chloride. Furnish material with cross section of dumbbell, (bulbed), (ribbed), or otherwise deformed to prevent movement. Furnish material resistant to acid, alkali solution, and deterioration.

PART 3 - EXECUTION

3.01 CONSTRUCTION OF FORMS

A. General: Construct substantial, sufficiently tight forms to prevent fins and leakage of mortar, and able to withstand deflection when filled with wet concrete.

B. Layout:
1. Form cast-in-place concrete to shapes, sizes, lines, and dimensions required.
2. Exercise particular care in form layout to avoid necessity for cutting of concrete after placement.
3. Make proper provision for inserts, sleeves, pipes, openings, offsets, recesses, anchorage, blocking, and related features as required.

C. Forms for footings and related below grade concrete may be omitted when soil and workmanship permit accurate excavation to size and where omission is approved by Architect.

D. Removal of forms: Time for removing forms is subject to weather conditions after concrete is poured. Remove form work in manner to insure complete safety of structure. Do not place building materials on slabs until they are strong enough to carry the imposed load. Contractor shall decide when to remove forms and accept full responsibility for their removal.

3.02 JOINTS

A. If proposed layout of joints differs from layout shown on drawings, Contractor shall submit three (3) copies of alternate layout plan to Architect for review. Do not proceed with alternate layout of joints without written approval from Architect.

B. Provide mechanical "Keyed Kold" joint screed forms used in placing concrete slabs on grade installed to comply with manufacturer's specifications.

C. Construction Joints: Where joint is made, thoroughly clean concrete surface and remove all latence. In addition, thoroughly wet and slush vertical joints with a coat of neat cement grout immediately before placing new concrete.

D. Expansion Joints: Do not run reinforcement, corner protection angles, or related fixed metal items, embedded in or bonded into concrete continuous through expansion joints. Provide filler strips for expansion joints between slabs on grade and all joints between slabs on grade and vertical surfaces. Construct joints 1/2-inch thick and full depth of slab, unless otherwise noted.

E. Saw-cut Control Joints: In "Green" concrete the following tables will apply.
   1. Depth of cut:
      a. Soff-Cut Saw: 1" minimum
      b. Wet-Cut Saw: 1/4 slab thickness
   2. Joint spacing based upon slab thickness, UNLESS NOTED OTHERWISE:
      a. 4" slab equals 10'-0" o.c.
      b. 5" slab equals 13'-0" o.c.
      c. 6" or thicker slab equals 15'-0" o.c.

3.03 CHAMFERED CORNERS

A. Chamfer corners of rectangular concrete members formed with wood forms except where flush with adjacent concrete or masonry, or where covered with other materials.

3.04 INSTALLING VAPOR BARRIER

A. Provide vapor barrier under interior concrete floor slabs on grade.

B. Ensure that subsoil is approved by architect or geotechnical firm. Level, tamp or roll aggregate drainage fill.

C. Install vapor barrier in accordance with manufacturer's instructions and ASTM E 1643-98.
   1. Unroll Vapor Barrier/Retarder with the longest dimension parallel with the direction of the pour.

2. Lap Vapor Barrier/Retarder over footings and seal to foundation walls.
3. Overlap joints 6 inches and seal with manufacturer's tape.
4. Seal all penetrations (including pipes) per manufacturer's instructions.
5. No penetration of the vapor barrier is allowed except for reinforcing steel and permanent utilities.
6. Repair damaged areas by cutting patches of vapor barrier, overlapping damaged area 6 inches and taping all four sides.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install reinforcement and associated items required for cast-in-place concrete.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.
   1. Furnish Shop Drawings for review by Architect, on reinforcing steel including special details, bending diagrams, schedules, bar lists, placing diagrams, and accessories. In addition to provisions in General Conditions, submit reinforcing Shop Drawings prepared by or under supervision of registered professional engineer. Reproduction (in any form) of Contract Drawings are not to be used for Shop Drawings. Submit related shop drawings together. Partial submittals will not be accepted.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Workmen: Provide foreman at all times during execution of this portion of the Work, thoroughly familiar with type materials being installed, referenced standards, and requirements of this work, and who shall direct work performed under this Section.

B. Codes and Standards:
   1. In addition to complying with pertinent codes and regulations, comply with pertinent recommendations contained in "Manual of Standard Practice for Detailing Reinforced Concrete Structures", publication ACI 315 of the American Concrete Institute.
   2. Where provisions of pertinent codes and standards conflict with requirements of this Section more stringent provisions govern.

PART 2 - PRODUCTS

2.01 CONCRETE REINFORCEMENT

A. Concrete Reinforcement Materials: New, free from rust, and complying with following reference standards:
   1. Bars for Reinforcement: "Specifications for Deformed Billet-Steel Bars for Concrete Reinforcement", ASTM A-615, grade 60 unless otherwise shown.
   2. Wire Fabric: "Specifications for Wire Fabric for Concrete Reinforcement", ASTM A1064.
   3. Supports, Spacers, and Chairs: Types which will hold reinforcement in position shown in accordance with requirements of ACI 318 except as specified.

2.02 TENSION SPLICE DEVICES

A. ZAP Screwlok by Bar Splice Products, Inc.

B. Quick-Wedge by Erico Products, Inc.

C. Lenton Taper Rebar Splice by Erico Products, Inc.

2.03 OTHER MATERIALS

A. Provide metal accessories, including spacers, chairs, ties, and devices necessary for properly assembling, placing, spacing, and supporting reinforcement including welded wire fabric as shown on drawings. Provide materials, not specifically described but required for complete and proper installation of concrete reinforcement, as selected by Contractor subject to approval of Architect.

PART 3 - EXECUTION

3.01 SITE CONDITIONS

A. Inspection:
   1. Carefully inspect installed work of other trades and verify work is complete to point where this installation may properly commence.
   2. Verify that concrete reinforcement may be installed to comply with pertinent codes and regulations, reviewed Shop Drawings, and original design.

B. Discrepancies:
   1. In event of discrepancy, immediately notify Architect.
   2. Do not proceed with installation in areas of discrepancy until discrepancies have been fully resolved.

3.02 BENDING

A. General: Fabricate reinforcement to comply with reviewed Shop Drawings. Do not use bars with kinks and bends not shown on Drawings or on reviewed Shop Drawings. Do not bend and straighten steel in manner that will injure material.

B. Assembly: Tack-welding not acceptable for assembly of reinforcement without specific approval of the Structural Engineer. When permitted by Engineer all welding shall conform to reinforcing steel welding code (AWS D.12.1) of the American Welding Society.

3.03 PLACING OF REINFORCEMENT

A. Placing:
   1. Support and wire together reinforcing bars to prevent displacement by construction loads and placing of concrete. Provide metal or plastic coated bar chairs and spacers. Provide galvanized, stainless steel or plastic coated accessories where concrete surface will be exposed to weather in finished structure and where rust would impair architectural finishes. Do not support bars on concrete or masonry brick bats.
   2. Lap welded wire fabric minimum of 12". Support mesh in final position in all slabs. Lifting of mesh into final position is not permitted.
   3. Do not bend bars after embedded in concrete.

B. Cleaning Reinforcement: Remove loose, flaky rust, mill scale, mud, oil, and related coatings that will destroy and reduce bond during concrete placement.

C. Splices: Splice where shown on Drawings or reviewed Shop Drawings.

D. Concrete Reinforcement Protection: If not detailed otherwise, where concrete is deposited against ground, reinforcement shall have minimum of 3" concrete between it and the ground. If concrete surfaces after removal of forms are to be in contact with ground or exposed to weather, protect reinforcing with minimum of 2" of concrete for bars larger than No. 5 and 1-1/2" for No. 5 bars and smaller. Provide minimum 3/4" concrete covering for reinforcing in slabs and 1-1/2" minimum cover in beams at surfaces not exposed directly to ground or weather.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Cast-in-place, reinforced concrete required.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.
   1. Design Mix: Prior to placement of concrete, submit concrete mix designs proposed by the concrete supplier for class of concrete, including recent test results substantiating the quality of concrete produced by each mix.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Workmen:
   1. Provide foreman at all times during execution of this portion of the Work, thoroughly trained and experienced in placing type concrete specified and who shall direct work performed under this Section.
   2. Finishing of Exposed Surfaces of Concrete: Use thoroughly trained and experienced journeyman concrete finishers.

B. Codes and Standards:
   1. In addition to complying with pertinent codes and regulations, comply with pertinent recommendations of "Building Code Requirements for Reinforced Concrete", publication ACI 318 of latest issue of the American Concrete Institute.
   2. American Concrete Institute: ACI 302, ACI 305 and ACI 306
   3. Where provisions of pertinent codes and standards conflict with requirements of this Section more stringent provisions govern.

1.05 LABORATORY TESTING

A. All required testing will be performed by testing laboratory selected by Owner. Refer to Section 01 4510.

B. Contractor shall submit certified laboratory test reports to Architect for review.

C. Testing Procedures:
   1. Material Testing: Laboratory to re-check at plant materials as often as necessary to produce concrete of specified strength and consistency including:
      (a) Fine aggregate.
      (b) Coarse aggregate.
      (c) Cast-in-place concrete.
   2. Concrete Slump: As specified.
   3. Quality Control: As work progresses testing laboratory personnel shall conduct tests of concrete in accordance with following procedures:
      (a) Secure composite samples from the same batch complying with ASTM C 172.
      (b) Perform one (1) slump test for each set of strength test cylinders complying with ASTM C 143.
      (c) Make one (1) strength test (4 specimens) for each 50 cubic yards and at least one (1) set for each day's pour.
      (d) Mold four (4) strength test specimens from each sample complying with ASTM C 31 and protect and cure under standard moisture and temperature conditions in accordance with Section 7 of above ASTM method.
      (e) Test two (2) specimens at seven (7) days complying with ASTM C 39. Test (2) specimens at 28 days.
      (f) A compressive-strength test shall be the average compressive strength from a set of two specimens obtained from same composite sample and tested at age indicated.
      (g) If tested strength falls below strength specified at twenty-eight (28) days, Architect has the right to order the removal and replacement of defective concrete at Contractor's expense. If Contractor wishes to obtain test cores from in-place concrete, cost of coring, testing and patching will be paid by Contractor.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Portland Cement: Conform to ASTM "Standard Specifications for Portland Cement", C150, Type I. Use one brand of cement. Mix shall contain at least 470 lb. of Portland Cement per cubic yard of concrete.

B. Aggregates: Conform to ASTM "Standard Specifications for Concrete Aggregates", C33. Provide aggregate of natural sand and gravel or prepared from stone or gravel, free from adherent coatings. Maximum size of pieces 1", except for footings and foundation walls which may be 1-1/2" maximum size. Aggregate gradation size No.57.

C. Water: Clean and free from injurious amounts of oils, acids, alkalis, organic materials, and deleterious substances. **Nonpotable water will not be used in concrete mixing.**

D. Fly Ash: Type C. Not to exceed 20% of total mix. Do not use in cold weather conditions below 60 degrees F.

E. Air-Entraining Admixture: ASTM C260, certified by manufacturer to be compatible with other required admixtures.

F. Water-Reducing Admixture: ASTM C494, Type A.

G. High-Range Water-Reducing Admixture (Super Plasticizer): ASTM C494, Type F or Type G. The admixture shall not contain more than 0.05 percent Chloride ions.

2.02 CONCRETE MIXTURES FOR BUILDING ELEMENTS

A. Footings: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: as indicated at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.53.
   3. Slump Limit: 6 inches for concrete with verified slump of 2 to 4 inches before adding water-reducing admixture, plus or minus 1 inch.
   4. Air Content: 5 percent, plus or minus 1.5 percent at point of delivery.

B. Foundation Walls & Pedestals: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: as indicated at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.44.
   3. Slump Limit: 6 inches for concrete with verified slump of 2 to 4 inches before adding water-reducing admixture, plus or minus 1 inch.
   4. Air Content: 5-1/2 percent, plus or minus 1.5 percent at point of delivery.

C. Slabs-on-Grade: Proportion normal-weight concrete mixture as follows:
   1. Minimum Compressive Strength: As indicated at 28 days.
   2. Maximum Water-Cementitious Materials Ratio: 0.44.
   3. Slump Limit: 6 inches for concrete with verified slump of 2 to 4 inches before adding water-reducing admixture, plus or minus 1 inch.
   4. Air Content: Do not allow air content of troweled finished floors to exceed 3 percent.

D. Steel Pan Stairs: Provide concrete fill for steel pan stair treads, landings, and associated items. Cast-in inserts and accessories as shown on Drawings. Screed, tamp, and trowel finish concrete surfaces.

2.03 GROUT

A. Non-shrink, Non-metallic Grout: Darragh Company Non-Shrink Grout, or approved equal.

B. Grout shall be factory premixed and shall conform to ASTM C1107. In addition, the grout manufacturer shall furnish test data from an independent laboratory indication that the grout, when laced at a fluid consistency, shall achieve 95% bearing under a 4'x4' base plate.
   1. Where high fluidity and/or increased placing time are required, use high flow grout. In addition, the grout manufacturer shall furnish test data from an independent laboratory indicating that the grout, when placed at a fluid consistency, shall achieve 95% bearing under an 18"x36" base plate.

2.04 EPOXY FLOOR SEALER – Finish Key "C"

A. At Janitors Closet, Mechanical and Electrical Rooms, Unless otherwise noted: Furnish and apply to concrete surfaces shown on finish schedule as "Sealed Concrete" Tnemec Series 287 Enviro-Pox, or approved equal Low-VOC epoxy coating. VOC content not to exceed 6 g/L.

B. Apply per manufacturers recommendations to achieve minimum 6 mil thickness on horizontal surfaces and minimum 4 mil thickness on vertical surfaces.

PART 3 - EXECUTION

3.01 MIXING AND PLACING CONCRETE

A. Preparation: Clean equipment for transporting concrete. Remove debris, water, and ice from places to be occupied by concrete. Remove laitance and unsound material from hardened concrete before additional concrete is added.

B. Mixing: Ready-mixed concrete, mixed and delivered in accordance with following requirements only of ASTM C 94.
1. Tolerances in Slump,
2. Measuring Materials,
3. Batching Plant,
4. Mixers and Agitators,
5. Mixing and Delivery,
6. Use of Non-Agitating Equipment
7. Inspection.

C. Conveying: Convey concrete from mixer to place of deposit by methods that prevent separation and loss of materials.

D. Placing:
1. Deposit as nearly as practicable in final position to avoid segregation due to rehandling and flowing. Place at rate to assure concrete is plastic and flows readily into spaces between bars. Do not use concrete contaminated by foreign material or retempered concrete.
2. When placing is started, carry a continuous operation until placement of panel or section is completed.

E. Hot Weather Concreting: Place, handle, and cure concrete complying with ACI 305.

F. Cold Weather Concreting: Provide adequate equipment for handling concrete materials and protecting concrete during freezing and near freezing weather. Concrete materials, reinforcements, forms, and ground in contact with concrete to be free of frost, snow, and ice. Details of approved procedures are available in ACI 306. Contractor to keep accurate thermometer on job where the work is proceeding.

3.02 PROTECTION OF ADJACENT SURFACES

A. Contractor responsible for any work soiled and stained by dripping cement, water, or concrete. Protect same with tarpaulin or similar devices while pouring concrete.

3.03 CONSOLIDATION

A. Consolidate concrete by vibration, spading, rodding, or forking. Work around reinforcement, embedded items and into corner of forms. Over-vibrating and use of vibrators to transport concrete within forms not allowed. When consolidating by vibration, keep spare vibrator on job site during concrete placing. Use vibrators of length to extend within 6 inches of bottom of freshly poured concrete, vibrator being raised with each succeeding pour.

3.04 CONCRETE CURING

A. Curing Period: Cure concrete for minimum period of 7 days at a temperature above 50 Deg. F. by one of approved methods listed below. Protect fresh concrete from heavy rain, flowing water, mechanical injury and from injurious action of sun.

B. Water Curing: If cured with water, keep concrete wet by mechanical sprinklers or by any approved method which will keep surface continuously wet.

C. Saturated Sand Curing: Cover finished surfaces with minimum 1" thickness of sand, uniformly distributed and continuously water saturated during entire curing period.

D. Curing Compounds: No chemical curing compounds allowed.

E. Waterproofing Paper or Opaque Polyethylene Film: Conform to ASTM C 171. Cover concrete immediately following final finishing operation. Anchor securely, seal edges or apply in manner to prevent moisture escaping from concrete.

3.05 FINISHING FORMED SURFACES

A. Rough-Formed Finish: As-cast concrete texture imparted by form-facing material with tie holes and defects repaired and patched. Remove fins and other projections that exceed specified limits on formed-surface irregularities.
   1. Apply to concrete surfaces **not exposed to public view**.

B. Related Unformed Surfaces: At tops of walls, horizontal offsets, and similar unformed surfaces adjacent to formed surfaces, strike off smooth and finish with a texture matching adjacent formed surfaces. Continue final surface treatment of formed surfaces uniformly across adjacent unformed surfaces unless otherwise indicated.

3.06 SLAB FINISHES

A. General: Comply with recommendations in ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

B. Scratch Finish:
   1. While still plastic, texture surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4" in one direction.
   2. Apply scratch finish to surfaces indicated, and to receive mortar setting beds for bonded cementitious floor finishes.

C. Float Finish:
   1. After screeding, consolidating, and leveling concrete slabs, do not work surface until ready for floating. Begin floating when surface water has disappeared, or when concrete has stiffened sufficiently to permit operation of power-driven floats, or both. Consolidate surface with power-driven floats, or by hand-floating if area is small or inaccessible to power units. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture. Uniformly slope surfaces to drains.
   2. Apply float finish to slab surfaces indicated to receive trowel finish and surfaces to be covered with membrane or sheet waterproofing and membrane roofing.

D. Trowel Finish:
   1. After floating, begin first trowel finish operation using a power-driven trowel. Begin final troweling when surface produces a ringing sound as trowel is moved over surface. Consolidate concrete surface by final hand-troweling operation, free of trowel marks, uniform in texture and appearance. Grind smooth surface defects which would telegraph through applied floor covering.
   2. Apply to surfaces indicated and to floor and slab surfaces exposed-to-view or to received dyed and concrete finish, or to be covered resilient flooring, carpet, tile, paint or other thin film finish coating system.
   3. Finish surfaces to the following tolerances, according to ASTM E1155, for a randomly trafficked floor surface.
      a. For Carpeted Slabs: Specified overall values of flatness, F(F) 25; and of levelness, F(L) 20.
      b. For Thin-Floor Coverings: Specified overall values of flatness, F(F) 35; and of levelness, F(L) 25.

E. Trowel And Broom Finish: Apply a first trowel finish, stopping after second troweling, to surfaces indicated and where tile is to be installed by thin-set method. Immediately after second troweling, and when concrete is still plastic, slightly scarify surface with fine broom.

F. Non-Slip Broom Finish: Immediately after float finishing, slightly roughen trafficked surface by brooming with fiber-bristle broom perpendicular to main traffic route.
   1. Apply to cast-in-place concrete steps and concrete fill at steel pan stairs and walks and ramps, except where other finish is indicated.

3.07 CONCRETE SURFACE REPAIRS

A. Defective Concrete: Repair and patch defective areas when approved by Architect. Remove and replace concrete that cannot be repaired and patched to Architect's approval.

B. Patching Mortar: Mix dry-pack patching mortar, consisting of one part portland cement to two and one-half parts fine aggregate passing a No. 16 sieve, using only enough water for handling and placing.

C. Repairing Formed Surfaces: Surface defects include color and texture irregularities, cracks, spalls, air bubbles, honeycombs, rock pockets, fins and other projections on the surface, and stains and other discolorations that cannot be removed by cleaning.
   1. Immediately after form removal, cut out honeycombs, rock pockets, and voids more than 1/2 inch in any dimension in solid concrete, but not less than 1 inch in depth. Make edges of cuts perpendicular to concrete surface. Clean, dampen with water, and brush-coat holes and voids with bonding agent. Fill and compact with patching mortar before bonding agent has dried. Fill form-tie voids with patching mortar or cone plugs secured in place with bonding agent.
   2. Repair defects on surfaces exposed to view by blending white portland cement and standard portland cement so that, when dry, patching mortar will match surrounding color. Patch a test area at inconspicuous locations to verify mixture and color match before proceeding with patching. Compact mortar in place and strike off slightly higher than surrounding surface.
   3. Repair defects on concealed formed surfaces that affect concrete's durability and structural performance as determined by Architect.

D. Repairing Unformed Surfaces: Test unformed surfaces, such as floors and slabs, for finish and verify surface tolerances specified for each surface. Correct low and high areas. Test surfaces sloped to drain for trueness of slope and smoothness; use a sloped template.
   1. Repair finished surfaces containing defects. Surface defects include spalls, popouts, honeycombs, rock pockets, crazing and cracks in excess of 0.01 inch wide or that penetrate to reinforcement or completely through unreinforced sections regardless of width, and other objectionable conditions.
   2. After concrete has cured at least 14 days, correct high areas by grinding.
   3. Correct localized low areas during or immediately after completing surface finishing operations by cutting out low areas and replacing with patching mortar. Finish repaired areas to blend into adjacent concrete.
   4. Correct other low areas scheduled to receive floor coverings with a repair underlayment. Prepare, mix, and apply repair underlayment and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface. Feather edges to match adjacent floor elevations.
   5. Correct other low areas scheduled to remain exposed with a repair topping. Cut out low areas to ensure a minimum repair topping depth of 1/4 inch to match adjacent floor elevations. Prepare, mix, and apply repair topping and primer according to manufacturer's written instructions to produce a smooth, uniform, plane, and level surface.

6. Repair defective areas, except random cracks and single holes 1 inch or less in diameter, by cutting out and replacing with fresh concrete. Remove defective areas with clean, square cuts and expose steel reinforcement with at least a 3/4-inch clearance all around. Dampen concrete surfaces in contact with patching concrete and apply bonding agent. Mix patching concrete of same materials and mixture as original concrete except without coarse aggregate. Place, compact, and finish to blend with adjacent finished concrete. Cure in same manner as adjacent concrete.
7. Repair random cracks and single holes 1 inch or less in diameter with patching mortar. Groove top of cracks and cut out holes to sound concrete and clean off dust, dirt, and loose particles. Dampen cleaned concrete surfaces and apply bonding agent. Place patching mortar before bonding agent has dried. Compact patching mortar and finish to match adjacent concrete. Keep patched area continuously moist for at least 72 hours.

E. Perform structural repairs of concrete, subject to Architect's approval, using epoxy adhesive and patching mortar.

F. Repair materials and installation not specified above may be used, subject to Architect's approval.

3.08 FLOOR SLOPE TO DRAINS

A. Slope floors to drain outlets. Low spots where pools of water can stand on finished floors are not acceptable. Slope to drains 1/8" per lineal foot unless otherwise marked.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish labor, tools, scaffolding, and required equipment, and materials for masonry construction specified and required to provide high quality masonry workmanship.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Workmen:
   1. For actual cutting and placing of masonry units, use skilled journeyman masons thoroughly experienced with materials and methods specified and thoroughly familiar with design requirements.
   2. Have one skilled journeyman mason present at all times during execution of work of this Section who shall personally direct and execute this portion of the Work.

PART 2 - PRODUCTS

2.01 MORTAR MATERIALS

A. Acceptable Manufacturer: SPEC MIX, Inc., 1-888-773-2649, or approved equal.

B. Integral Water-Repellent Masonry Mortar: SPEC MIX Integral Water-Repellent (IWR) Masonry Mortar is a dry, preblended mortar mixture containing Portland cement and hydrated lime or masonry or mortar cement, dried masonry sand and dry SPEC MIX Integral Water-Repellent Mortar Admixture.
   1. Mortar Types: M, S and N
   2. Applicable Standards: C 91, C 144, C 150, C 207, C 270, C 476, C 595, C 780, C 979, C 1072, C 1329, C 1384, E 514, ACI 530.1, IMIAC.

C. Water: Clean and free from deleterious acids, alkalis, and organic matter.

D. Admixtures: Complying with ASTM 1384.

E. Mortar Schedule:

Building Segment	Mortar Type
Exterior, above grade	
load-bearing	M, S or N
non load-bearing	N

2.02 ANCHORS AND ACCESSORIES

A. Non-Loadbearing Partition Anchors: Unless otherwise called for on Structural Drawings, provide mesh wall ties, galvanized 16 gage wire 1/2" square mesh, by 20" long. Width to be 3" for 4" block partitions, and 2" less than the nominal width dimension for 6", 8", 10" and 12" block partitions. Install partition anchors where concrete block abuts other walls or partitions. Mesh anchors to occur in alternate joints to miss joint reinforcing.

B. C.M.U. Joint Reinforcement: Truss or Ladder type, high tensile strength, standard weight No.9 steel rods in 10 ft. lengths, in appropriate width. Vertical spacing not to exceed 16" o.c.

C. Reinforcing Bars: Where shown, Grade 60 conforming to ASTM A 615.

D. Control Joints In Concrete Masonry Units
1. In addition to locations shown on drawings, locate control joints so that spacing does not exceed 1.5 times height of wall or 30'-0" o.c. for reinforced CMU or 25'-0" o.c. for non-reinforced CMU.
2. Provide preformed gaskets placed in sash grooves of concrete masonry using Dur-O-Wal D/A 2001/2025, or approved equal. Factory extrude from solid section of natural or synthetic rubber conforming to ASTM D-2000 2AA-805, with minimum curometer hardness of not less than 80 when tested in accordance with ASTM D 2240.
3. At exposed face of CMU, provide backer rod and sealant in addition to extruded sash groove control joint.

2.03 MASONRY UNITS

A. Materials: Meet referenced ASTM Standards, with modifications specified herein.

B. Normal Weight Concrete Blocks (C33): Split Face and Smooth where shown.
1. Use nominal 8" x 16" face, thickness required. Conform to ASTM C90 (Latest Edition), Type II, for hollow loadbearing concrete masonry units and ASTM C129 (Latest Edition), Type II, for hollow non-loadbearing concrete masonry units. Cut blocks as required to form jambs, sills, and closers. Provide certification of ASTM C90 and C129 compliance from certified testing laboratory.

2. Provide standard "Sash Block" at locations where control and/or expansion joints are called for in CMU construction. Coordinate with control joint material specified in Section 04 1500.
3. Exposed, exterior concrete block must be manufactured with manufacturer's recommended amount of integral water repellant "Dry Block System Block Admix", as manufactured by Grace Construction Products.

C. Reinforced C.M.U. Construction: Conform to the provisions of ANSI A41.2 (NBS Handbook 74) and/or ACI/ASCE 530.

D. Concrete Fill: Fill voids in concrete block where required with 3,000 p.s.i. concrete (unless noted otherwise on structural drawings) using pea gravel for coarse aggregate. Do not use mortar for this purpose.

2.04 MASONRY CLEANERS

A. Provide products by ProSoCo, Inc., 913-281-2700, or approved equal.

B. Products approved for use are 600 Detergent, Vana Trol or 101 Lime solvent.

C. Consult masonry manufacturer and ProSoCo Technical Service prior to applying any cleaner. Some cleaners are not suited for use on certain masonry units and may cause damage that will be repaired or replaced at Contractor's expense.

PART 3 - EXECUTION

3.01 LAYING CONCRETE BLOCK

A. Lay blocks straight, plumb, and in perfect alignment. Protect concrete blocks from weather by covering during storage and after laying. Before using blocks, dry them to moisture content of approximately the average air-dry condition to which finished walls will be exposed. Take care to keep mortar off face surface of exposed blocks. At end of job, clean exposed block walls. Where necessary to fit around wall switches and openings, cut blocks to neat line with power saw. Refer to drawings for spacing and type of reinforcement and anchors required.

B. Lay block in 1/2 bond, with mortar finished using a round tool giving concave joints. Nominal thickness of all joints is 3/8" and uniform.

3.02 CONSTRUCTION TOLERANCES

A. Lay masonry units plumb, level and true to line within the tolerances specified.

B. Maximum variation from plumb:
1. In 10 feet: 1/4 inch
2. In 20 feet: 3/8 inch
3. In 40 feet or more: 1/2 inch

C. Maximum variation from level:
   1. In any bay or up to 20 feet: 1/4 inch
   2. In 40 feet or more: 1/2 inch

D. Maximum variation from linear building lines:
   1. In any bay or up to 20 feet: 1/2 inch
   2. In 40 feet or more: 3/4 inch

E. Maximum variation in cross-sectional dimensions of columns and thickness of walls from dimensions shown:
   1. Minus 1/4 inch
   2. Plus 1/2 inch

F. Maximum variation in prepared opening dimensions:
   1. Accurate to minus 0 inch
   2. Plus 1/4 inch

3.03 CLEANING PREMISES

A. Mason Contractor: Remove rubbish and building materials left over from operations under his charge, whenever directed by General Constructor. Premises must be left clear and clean. When buildings are completed, completely remove mortar droppings.

3.04 BOND BEAMS

A. Reinforce bond beams as required and fill with 3,000 p.s.i. minimum compressive 28-day strength concrete, unless shown otherwise on structural drawings. Do not use masonry mortar for this purpose.

3.05 POINTING AND CLEANING

A. Cut out defective mortar joints. Refill solidly with mortar and tool to match adjacent work.

B. On completion clean exposed masonry, removing foreign material, excess mortar and stains. Apply cleaning solution to sample area of approximately 20 square feet at an inconspicuous location approved by Architect. Use cleaning solution specially manufactured for this purpose, applying in accordance with manufacturer's directions. Drench masonry with clean water before applying solution, and after cleaning, rinse with clean water to remove all traces of solution. Protect materials adjacent to masonry from contact with cleaning solution.

C. High Pressure Water Cleaning: **This method of cleaning will not be allowed on masonry surfaces unless approved by architect and masonry manufacturer.** High pressure water is to be used to saturate the masonry before cleaning takes place and may be used to rinse away cleaning solution and foreign particles after cleaning is complete. Allow mortar to cure for a minimum of seven (7) days before subjecting it to high pressure cleaning. After consulting with Architect and manufacturer for cleaning recommendations, test clean a sample panel of all the materials selected for the work.

Apply water at a pressure ranging from 200-300 psi. Provide a flow rate of water between 3 and 6 gallons per minute through a "Fan" type, stainless steel tip dispersing a 25 deg to 50 deg fan spray. Do not use less than 15 deg fan spray tip. Application of acidic cleaning compounds through the high pressure system will not be allowed. Do not apply sealer until masonry is completely dry and cleaning has been reviewed by Architect.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and erect specified steel framing, column bases, lintels and related structural steel shapes and accessories.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.
   1. Furnish Shop Drawings, for review by Architect, on structural steel showing necessary fabrication details, fittings, fastenings, anchorage and erection details. In addition to provisions of the General Conditions, prepare structural steel Shop Drawings by or under the supervision of a registered professional engineer. Do not use reproductions, in any form, of the Contract Drawings for Shop Drawings. Submit related shop drawings together; partial submittals will not be accepted. Furnish mill certificates on foreign steel proposed for use and not produced within the continental USA. Include with mill certificates certified copies of mill test reports giving names and locations of mills and shops, and chemical analysis and physical properties of steel required for this project.
      a. Contract Document electronic files (including all drawings, specifications, addenda and supplemental information) will not be made available to Bidders or Sub-bidders before the award of a Contract. After the award of the Contract, the General Contractor may make request for release of electronic document files.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Codes and Standards: In addition to complying with pertinent codes and regulations, comply with:
   1. AISC "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings", Latest Edition.
   2. AISC "Code of Standard Practice", Latest Edition.
   3. AISC "Specification for Structural Steel Buildings - Allowable Stress Design and Plastic Design", Latest Edition.

4. AISC "Load and Resistance Factor Design Specification for Structural Steel Buildings", Latest Edition.
5. "Code for Welding in Building Construction" of the American Welding Society.
6. "Specifications for Architecturally Exposed Structural Steel" of the American Institute of Steel Construction.
7. Steel Structures Painting Council (SSPC): Painting Manual, Vol. 1, Good Painting Practice. Painting Manual, Vol. 2, Systems and Specifications.
8. Conform to ASTM A 6, "Specification for General Requirements for Rolled Steel Plates, Shapes, Sheet Piling and Bars for Structural Use".

B. Conflicting Requirements: In event of conflict between pertinent codes and regulations and requirements of referenced standards or these specifications, provisions of more stringent govern.

PART 2 - PRODUCTS

2.01 STRUCTURAL STEEL

A. Steel Shapes: Provide structural steel shapes, not otherwise indicated on Structural Drawings using high-strength steel, 50 ksi minimum yield strength, conforming to ASTM A992.

B. Pipe Columns: ASTM A501, Fy = 36 ksi. or A53, Type E, Fy = 35 ksi

C. Rectangular HSS: ASTM A500, Grade C (Fy=50ksi) or have equal yield, ultimate, and weldability properties.

D. Round HSS: ASTM A500, Grade C (Fy=46ksi) or have equal yield, ultimate, and weldability properties.

E. Steel Plates (See Drawings), Channels and Angles: ASTM A36, 36 ksi minimum yield strength, or as indicated.

F. Headed Stud Shear Connectors: ASTM A108, Grade 1015 or 1020, cold finished carbon steel with dimensions complying with AISC Specifications.

G. Furnish structural steel for this Project manufactured within continental limits of the United States of America unless mill certificates are submitted to and approved by Structural Engineer.

2.02 BOLTS AND NUTS

A. High Strength Bolts:
1. Meet ASTM F3125 Grade A325 or Grade F1852 for high strength bolts U.N.O..
2. Make bolt holes 1/16 inch larger than nominal bolt diameter.
3. Threads may be included in shear plane of bolts.

B. Machine Bolts: Meet ASTM A307 and A449.

C. Anchor Bolts: Meet ASTM F1554, Grade 55.

D. Bolted Truss Connections: Meet ASTM F3125 Grade A325, slip critical in oversize round holes.

2.03 SHOP PRIMER

A. Lead free, alkyd primer: Manufacturer's standard.

2.04 GALVANIZING

A. Hot-Dip Galvanized Finish: Apply zinc coating by the hot-dip process to structural steel according to ASTM A 123/A 123M.

B. Galvanize ALL EXTERIOR EXPOSED structural shapes, lintels, shelf angles and decorative steel components.

2.04 OTHER MATERIALS

A. For materials, not specifically described but required for complete and proper installation of structural steel, use new material, free from rust, first quality of their respective kinds, and subject to approval of Architect.

PART 3 - EXECUTION

3.01 MEASUREMENT AND DIMENSIONS

A. Contractor to verify measurements and dimensions at job site. Bring any conflict between actual measurements and dimensions shown on the Drawings and any existing condition which will prevent fabrication and erection of steel work as detailed to attention of Architect as soon as they are discovered. Contractor responsible for errors of Shop Drawings, fabrication, correct fitting, and alignment of the structural members. Shop or field splices in standard structural rolled shapes not acceptable unless shown on Contract Drawings.

3.02 WORKMANSHIP

A. Fabricate and erect to comply with the "Specifications for the Design, Fabrication and Erection of Structural Steel for Buildings" and the "Code of Standard Practice" as adopted by the American Institute of Steel Construction.

3.03 SHOP PRIMER

A. For surface preparation, shop painting and touch-up painting of structural steel shapes, conform to the "Steel Structures Painting Manual", Volumes 1 and 2, of the Steel Structures Painting Council.

3.04 WELDING

A. Shop and field welders continuously employed as welders are acceptable on basis of satisfactory reports dated not more than 2 years prior to award of this Contract. All others must have been requalified in past 6 months complying with AWS D 1.0, Appendix.

3.05 HIGH-STRENGTH BOLTING

A. Comply with the "Specification of Structural Joints" approved by the Research Council on Riveted and Bolted Structural Joints of the Engineering Foundation using calibrated-wrench tightening or turn-of-nut tightening methods. By either method, use a calibrating device to check tools and equipment and to provide means of reliable inspection. When turn-of-nut method tightening is used to provide bolt tension complying with ASTM F3125 Grade A325, match-mark outer face of nut with the protruding bolt point before final tightening for visual means of noting actual nut rotation. Above marks may be made by wrench operator with crayon or daub of paint, after bolts have been brought to "snug tight" condition.

3.06 ERECTION

A. Use Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings of AISC except as otherwise specified.

B. Sequence: Contractor responsible for erection method and sequence.

C. Progress: As erection progresses, secure the work to take care of dead loads, wind, and erection stresses. Where structural steel is being erected, completely connect the in-place work in the tier below.

D. Alignment: After erection, accurately align and adjust the various members forming parts of a completed frame and structure before being made secure.

E. Tolerances: AISC Code of Standard Practice apply except as otherwise specified.

F. Erection Shims: Sufficient shims may be installed to maintain structure within tolerances. Maximum shim thickness at any one joint no greater than 1/2-inch.

G. Field Assembly: Provide even bearing at field erected column splices and related compression joints which depend upon contact bearing upon completion with respect to the centroid of the contact area. Provide at least 65 percent of the entire contact area in full bearing and the separation of any remaining portion not to exceed 0.02 inches, except locally at toes of flanges where a 50 percent greater separation is permissible; otherwise perform corrective measures.

H. Anchors: Locate and install anchor bolts and anchors, preset by templates, into connecting work. Provide bearing plates under ends of primary structural members resting on masonry and set in full beds of non-shrink grout.

I. Base Plates: Support and align column base plates on steel leveling devices. After support members have been plumbed and properly positioned and anchor nuts tightened, pack solidly entire bearing area under plate with non-shrink grout specified in "Concrete" Division of these Specifications. Leave leveling devices in place and cut off flush with edge of column base plates.

J. All welds, cut edges and areas where primer is missing or damaged is to be cleaned and re-primed.

K. Shear Connectors: Prepare steel surfaces as recommended by Manufacturer of shear connectors. Weld shear connectors in field, spaced as shown, to beams and girders in composite construction. Use automatic end welding of headed stud shear connectors in accordance with manufacturer's printed instructions.

3.07 FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified independent testing and inspecting agency to inspect field welds and high-strength bolted connections.

B. Bolted Connections: Bolted connections will be inspected according to RCSC's "Specification for Structural Joints Using ASTM F3125 Grade A325 or A490 Bolts"

C. Welded Connections: Field welds will be visually inspected according to AWS D1.1/D1.1M.
   1. In addition to visual inspection, field welds will be tested and inspected according to AWS D1.1/D1.1M and the following inspection procedures, at testing agency's option:
      a. Liquid Penetrant Inspection: ASTM E 165.
      b. Magnetic Particle Inspection: ASTM E 709; performed on root pass and on finished weld. Cracks or zones of incomplete fusion or penetration will not be accepted.
      c. Ultrasonic Inspection: ASTM E 164.
      d. Radiographic Inspection: ASTM E 94.

D. In addition to visual inspection, test and inspect field-welded shear connectors according to requirements in AWS D1.1/D1.1M for stud welding and as follows:
   1. Perform bend tests if visual inspections reveal either a less-than-continuous 360-degree flash or welding repairs to any shear connector.
   2. Conduct tests on additional shear connectors if weld fracture occurs on shear connectors already tested, according to requirements in AWS D1.1/D1.1M.

E. Correct deficiencies in Work that test reports and inspections indicate does not comply with the Contract Documents.

3.08 REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780.

B. Touchup Painting: Immediately after erection, clean exposed areas where primer is damaged or missing and paint with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

1. Clean and prepare surfaces by SSPC-SP 2 hand-tool cleaning or SSPC-SP 3 power-tool cleaning.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and erect steel decking specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.
   1. Shop Drawings:
      a. Before metal decking is delivered to job site, submit Shop Drawings to Architect for review. Submit related shop drawings together; partial submittals will not be accepted. Do not use reproductions, in any form, of the Contract Drawings for Shop Drawings.
      b. Show sizes, locations, marking of decking units, sizes of holes to be cut in the shop, end closures types and fittings, and methods of securing, anchoring, and attaching to structural members.
      c. Show verification that members used are adequate to carry live and dead loads involved.
      d. Show welds, both shop and field, by currently recommended symbols of the American Welding Society.
      e. Furnish Shop Drawings for Architect review.
      f. Contract Document electronic files (including all drawings, specifications, addenda and supplemental information) will not be made available to Bidders or Sub-bidders before the award of a Contract. After the award of the Contract, the General Contractor may make request for release of electronic document files.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Following specifications and codes govern with modifications specified herein:
   1. American Iron and Steel Institute: Light Gauge Cold-Formed Steel Design Manual.
   2. Steel Deck Institute: Code of Recommended Standard Practice and Basic Design Specifications.
   3. American Welding Society: Code for Welding in Building Construction.

B. Conflicting Requirements: In event of conflict between pertinent codes and regulations, referenced standards requirements and these specifications, provisions of the more stringent govern.

PART 2 - PRODUCTS

2.01 STEEL ROOF DECK

A. Type "1.5B", 1.5 inch rib depth, 20 gage steel, painted by Vulcraft Division of Nucor Corporation, or approved equal manufactured by member of the Steel Deck Institute. Chemically clean steel deck of oil, grease and dirt.

B. Type "3PLN-32", 3 Inch rib depth, 22 gage steel, painted by Vulcraft Division of Nucor Corporation, or approved equal manufactured by member of the Steel Deck Institute. Chemically clean steel deck of oil, grease and dirt.

C. Lead free primer: Technical Coatings Co., #82706, Deckgard Gray, Acrylic Latex coating in 0.3 mil dry film thickness, or approved equal.

2.02 COMPOSITE STEEL FLOOR DECK

A. Composite Deck: Provide “2.0VL”, 2 inch deep, 18 gage, galvanized steel deck as manufactured by Epic Metals Corp., United Steel Deck, Inc., Vulcraft Div. of Nucor Corp., or approved equal.

B. Composite Floor Unit (combined steel and concrete sections): Capable of supporting concentrated load of 50 p.s.f. occurring anywhere on the slab plus 50% impact in addition to uniform live load of 100 p.s.f. Where more than one-foot width of composite section is required to carry this loading, lateral distribution characteristics must be demonstrated by full scale simple span load tests, or by rational analysis associated with subject tests.

C. Furnish steel floor units with slots, holes, or tabs available in every square foot of underside surface for attaching special adjustable devices or hanger wire size of #8 (.162) minimum for use of other trades.

D. Prepare erection drawings showing type floor and gauge steel being supplied, where it is to be located, necessary fabrication to fit floor into job, and how it coordinates with related parts of the construction. Also show and call for flashing to be supplied by this Contractor.

PART 3 - EXECUTION

3.01 FABRICATION

A. Fabricate metal decking to comply with final Shop Drawings and the referenced standards.

3.02 SHOP PRIMER

A. Paint steel deck and accessories with protective paint shop coat using type standard with manufacturer and conforming to requirements of the Steel Deck Institute. After erection, wire brush field connections and touch up welded, corroded or abraded areas with same paint as shop coat.

3.03 ERECTION

A. General: Erect metal decking to comply with the Drawings and final Shop Drawings, aligning straight, plumb, and level.

B. Provide sump plates or pans, cant strips, vent clips, and rubber closures required for complete and proper installation.

C. Cut decking to provide openings required by structural design Drawings and holes required for work of other trades. Form penetrations where decking is to receive concrete prior to concrete placement. Cut decking only after concrete has attained 75% of its design strength.

D. Attach decking by puddle welding to supporting structure. **MECHANICAL FASTENING OR POWDER ACTUATED FASTENING WILL NOT BE ALLOWED**.

E. Touch-up field welds and burned and abraded spots in shop finish using material equivalent to shop finish.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and erect steel framing and accessories.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.
   1. Shop Drawings:
      a. Submit shop drawings showing complete details for the fabrication and erection of members.
      b. Submit details, schedules, procedures, and diagrams showing the sequence of erection.
      c. Include all components required for a complete framing system
      d. Provide setting drawings, templates, instructions and directions for installation of anchorage devices.
      e. Submit shop drawings for review prior to starting any work. Work performed prior to shop drawing review is at contractors risk.
      f. Contract Document electronic files (including all drawings, specifications, addenda and supplemental information) will not be made available to Bidders or Sub-bidders before the award of a Contract. After the award of the Contract, the General Contractor may make request for release of electronic document files.
   2. All drawings and calculations shall bear the stamp of a structural engineer licensed in the state in which the project is located.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. American Iron and Steel Institute (AISI)
   1. "Specification for the Design of Cold-Formed Steel Structural Members" .
   2. "Cold-Formed Steel Design Manual" (Latest).

B. American Society of Civil Engineers (ASCE)
   1. ASCE 7-10, "Minimum Design Loads for Buildings and Other Structures"

C. American Society for Testing and Materials (ASTM):
   1. ASTM A446 - Steel Sheet, Zinc-coated (galvanized) by Hot-Dip Process, Structural (Physical) Quality.
   2. ASTM A570 Hot-Rolled Carbon Steel Sheet & Strip, Structural Quality.
   3. ASTM A525 - Sheet Steel, Zinc-Coated (Galvanized) by the Hot-Dip Process, General Requirements.
   4. ASTM A611 - "Standard Specification for Steel, Cold-Rolled Sheet, Carbon, Structural."
   5. ASTM C955 - "Standard Specification for Load Bearing Steel Studs, Runners (Track), Bracing, and Bridging."

D. American Welding Society (AWS):
   1. AWS D1.1 - "Structural Welding Code" and D1.3 - "Specifications for Welding Sheet Steel in Structures."
   2. AWS - Standard Qualification Procedure

E. Metal Lath/Steel Framing Association (ML/SFA) - "Lightweight Steel Framing Systems Manual," Latest Edition.

1.05 PERFORMANCE REQUIREMENTS

A. Contractor is responsible for design, fabrication and erection of steel stud framing to meet the requirements of the latest adopted Local Code.

B. Compute all structural properties in accordance with AISI "Specifications for the Design of Cold Formed Steel Structural Members."

C. Provide weldments as required in accordance with American Welding Society (AWS) AWSD1.3 "Structural Welding Code - Sheet Steel".

1.06 SYSTEM DESCRIPTION

A. Design Requirements: The supplier shall design and/or verify the size and strength of all light gauge cold-formed Metal Framing members and connections in accordance with the ML/SFA Lightweight Steel Framing Systems Manual.
   1. Design shall use the superimposed design loads specified .
   2. Design shall be based upon information shown on the drawings and specified herein.
   3. Maximum deflection of exterior wall systems shall not exceed L/600 for Masonry Veneer and L/360 for EIFS Veneer.
   4. 18 gage studs are the minimum allowed for exterior wall framing or any framing that supports masonry.

B. Design shall conform to: AISI Specification for the Design of Cold-Formed Steel Structural Members. Wall bridging shall be designed to provide resistance to minor axis bending and rotation of wall studs. Designated selected exterior and/or interior walls shall be designed to provide frame stability and lateral load resistance. All connections (member to member, and member to structure) shall be designed and detailed.

C. Qualification of Field Welding: Qualify welding process and welding operators in accordance with AWS AStandard Qualification Procedure.

1.07 DELIVERY AND STORAGE

A. Protect steel studs from rusting and damage.

B. Deliver to project site in manufacturer's unopened containers or bundles, fully identified with name, brand, type and grade.

C. Store off the ground in a dry, ventilated space.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Provide products by Steel Framing Industry Association Members in good standing (listing found at http://www.archtest.com/certification/SFIA_SteelFraming.aspx).

2.02 GENERAL REQUIREMENTS

A. Provide type, size, gauge and physical properties as described by the manufacturers load and height tables and in accordance with the current local building code. All section properties shall be calculated in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members (latest edition).

B. Structural calculations specifically related to this project and performed by the manufacturer's structural engineer will indicate depths, gages and spacings of studs required to meet deflection and load bearing requirements.

C. At all instances where radius steel stud and drywall construction is shown on drawings it is intended that the radius be smooth not faceted. Contractor is required to provide smooth face radius by whatever means necessary.

D. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.

2.03 MATERIALS

A. All structural members shall be formed from steel conforming to ASTM A653-94.

B. All structural members shall be zinc coated in accordance with ASTM A924, G-60 coating.

C. System Components: With each type of steel stud required, utilize runners (tracks), shoes, clips, angles, ties, fasteners, door jamb reinforcers, bridging and accessories for the applications indicated, as needed to product a complete metal stud system.

2.04 FABRICATION

A. General: Framing components may be prefabricated prior to erection. Fabricate components plumb, square, true to line and braced against racking with joints welded. Perform lifting of prefabricated components in a manner to prevent damage or distortion.

B. Fastenings: Attach similar components by welding. Attach dissimilar components by bolting, or screw fasteners, as standard with manufacturer.

C. Cutting of steel framing members may be accomplished with a saw or shear. Torch cutting of load carrying members is not permitted. Cut framing components squarely for attachment to perpendicular members, or as required for an angular fit against abutting members. Hold members positively in place until fastened.

D. Wire tying of framing components is not permitted.

PART 3 - EXECUTION

3.01 ERECTION

A. Anchor tracks securely to supporting structure to transfer imposed loads.

B. Provide complete, uniform and level bearing support for bottom track at each bearing stud location.

C. At intersection and abutting track joints, anchor abutting track pieces securely to a common structural element, or splice them together.

D. Splices in axial loaded studs not permitted.

E. Framed Wall Openings: Include properly designed header and multiple (or heavier) studs at each edge of opening, to compensate for those removed.

F. Diagonal Bracing: Install at wall locations used as "shear walls" for frame stability and to resist wind and lateral loads. Anchor bracing securely for uplift and horizontal shear. Position additional stud(s) as required to resist the vertical component.

G. General:
1. Install continuous tracks sized to match studs. Align tracks accurately to the lay-out at base and top of studs. Secure tracks as recommended by the stud manufacturer for the type of construction involved, except do not exceed 24" o.c. spacing for nail or power-driven fasteners, nor 16" o.c. for other types of attachment. Provide fasteners at corners and end of tracks.
2. Set studs plumb, except as needed for diagonal bracing or required for no-plumb walls or warped surfaces and similar requirements.
3. Where stud system abuts structural columns or walls anchor ends of stiffeners to support structure.

4. Install supplementary framing, blocking and bracing in the metal framing system wherever walls or partitions are indicated to support handrails, bumper guards, wall mounted door stops, fixtures, equipment, services, casework, heavy trim and furnishings, and similar work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the item supported.
5. Secure studs to top and bottom runner tracks by either welding or screw fastening at both inside and outside flanges.
6. Frame wall openings larger than 2'-0" square with double stud at each jamb of frame except where more than 2 are either shown or indicated in manufacturer's instructions. Install runner tracks and jamb studs with stud shoes or by welding, and space jack studs same as full-height studs of the wall. Secure stud system all around to wall opening frame in the manner indicated.
7. Frame both sides of expansion and control joints, as shown for the wall system, with a separate stud and do not bridge and joint with components of the stud system.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install miscellaneous metal items required and specified. Provide miscellaneous bolts, anchors, supports, braces, and connections necessary for completion of Work.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.
   1. Submit Shop Drawings on miscellaneous metal items for review by Architect, prior to fabrication. Include type, grade, class of metal and sizes, details of fabrication, methods of assembling, connections to supporting construction, reinforcement, and location of hardware.
      a. Contract Document electronic files (including all drawings, specifications, addenda and supplemental information) will not be made available to Bidders or Sub-bidders before the award of a Contract. After the award of the Contract, the General Contractor may make request for release of electronic document files.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. American Institute of Steel Construction (AISC):
   1. Specifications for the Design, Fabrication and Erection of Structural Steel for Building

B. American National Standards Institute (ANSI):
   1. ANSI A14.3, "Ladders, Fixed, Safety Requirements."

C. American Society for Testing and Materials (ASTM):
   1. ASTM A36, "Structural Steel."
   2. ASTM A53, "Hot-Dipped, Zinc-coated Welded and Seamless Steel Pipe."
   3. ASTM A123, "Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products."
   4. ASTM A153, "Zinc Coating (Hot-Dip) on Iron and Steel Hardware."
   5. ASTM A307, "Carbon Steel Bolts and Studs, 60,000 psi Tensile Strength."

6. ASTM A446, "Specification for Sheet Steel, Zinc-Coated by the Hot-Dip Process."
7. ASTM A500, "Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Round and Shapes."
8. ASTM A568, "Specification for General Requirements for Steel, Carbon and High-Strength Low Alloy Hot-Rolled Sheet and Cold Rolled Sheet."
9. ASTM A627, "Specification for Homogeneous Tool-Resisting Steel Bars for Security Applications.
10. ASTM A780, "Practice for Repair of Damaged Hot-Dipped Galvanized Coatings."
11. ASTM B221, "Aluminum-Alloy Extruded Bar, Rod, Wire, Shape, and Tube."

D. American Welding Society (AWS):
1. AWS D1.1 - Structural Welding Code.

E. Steel Structures Painting Council Specification (SSPC):
1. Steel Structures Painting Manual.

1.05 QUALITY ASSURANCE

A. Qualifications of Welders: Use certified welders and the shielded arc process for welding performed in connection with work of this Section.

B. Codes and Standards: In addition to complying with pertinent codes and regulations, comply with:
1. "Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings" of the American Institute of Steel Construction.
2. "Code for Welding in Building Construction" of the American Welding Society.

C. Conflicting Requirements: In event of conflict between pertinent codes and regulations, requirements of the referenced standards, and these specifications, provisions of more stringent govern.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel plates, angles, and other structural shapes shall conform to ASTM A572 Grade 50 ksi. Plates less or equal to ½" shall be ASTM A36.

B. Steel pipe shall conform to ASTM A53, Grade B, Schedule 40.

C. Galvanized steel pipe and tube shall conform to ASTM A53.

D. Steel Tubing shall conform to ASTM A500.

E. Sheet Steel, Galvanized: ASTM A446.

F. Sheet and Strip Steel, Hot Rolled: ASTM A568.

G. Welding Materials: AWS D1.1; type required for materials being welded.

H. Anchors
1. Threaded Type Concrete Inserts: Galvanized malleable iron or cast steel capable of receiving 3/4 inch diameter machine bolts.
2. Slotted Type Concrete Inserts: Welded box type fabricated with minimum 1/8 inch thick galvanized pressed steel plate with slot to receive 3/4 inch diameter square head bolt and knockout cover.
3. Expansion Shield for Masonry Anchorage: FS FF-2-325.
4. Toggle Bolts: FS FF-B-588.

I. Adhesive Anchors:
1. In Unreinforced Masonry Units ICC-ES AC60. Acceptable adhesives are Hilti HIT-HY70 (ICC-ESR-3342) Simpson SET (ICC-ES ESR-1772) Simpson AT (ICC-ES ESR-1958).
   a. Steel anchor element shall be Hilti HAS-E or ASTM F1554 Grade 36 continuously threaded rod.
2. In Hollow Concrete Masonry Units: ICGES AC58. Acceptable adhesives are Hilti HIT-HY 70 (ICC-ESR-2682), Simpson SET, Simpson AT, or approved equal.
   a. Plastic mesh screen tube per manufacturer recommendations required.
3. In Solid Grouted Masonry Units: ICC-ES AC58. Acceptable adhesives are Hilti HIT-HY 70 (ICC-ESR-3342), Simpson SET-XP (IAPMO UES-ER-265), or Simpson AT-XP (IAPMO UES-ER-281).
   a. Steel anchor element shall be Hilti HASE, ASTM F1554 Grade 36, or ASTM A193, Grade B6, B8 or B8M continuously threaded rods.
4. In Concrete: ICC-ES AC308. Acceptable anchors are Hilti HIT-HY 200 SAFESet fast cure (ICC-ESR-3187), Hilti HIT-RE 500-SD slow cure (ICC-ESR-2322), Simpson SET-XP (ICC-ESR-2508), Simpson AT-XP (IAPMO UES-ER-263), or approved equal.
   a. Steel anchor element shall be Hilti HASE, STM F1554 Grade 36, or ASTM A193, Grade B6, B8, or B8M continuously threaded rod.

J. Fasteners General:
1. Provide **Type 304** stainless-steel fasteners at stainless steel and aluminum fabrications.
2. Bolts, Nuts and Washers for Exterior Locations: ASTM A307, galvanized in accordance with ASTM A153.
3. Bolts, Nuts and Washers for Interior Locations: ASTM A307, Grade A, regular hexagon head.
4. Bolts, Round Head: ANSI B-18.5
5. Wood Screws, Flat Head Carbon Steel: ANSI B-18.6.1.
6. Plain Washers, Helical Spring Type Carbon Steel: FS FF-W-84.

K. Column Anchor Rods: ASTM F1554, Grade 55 minimum, but See Schedule on drawings for other specified Grades.

2.02 FABRICATION

A. Fabricate steel items according to approved shop drawings and to applicable portions of AISC Specifications. Conceal welds where possible; grind exposed welds smooth and flush with adjacent finished surface. Ease exposed edges to small uniform radius.

B. Pre-assemble products in shop to greatest extent possible. Disassemble units to extent necessary for shipping and handling. Clearly mark units for re-assemble and installation.

C. For exposed to view fabrications, use materials which are smooth and free of surface blemishes including pitting, seams marks, roller marks, roller trade names and roughness. Remove blemishes by grinding or by welding and grinding, prior to cleaning, treating and application of surface finishes including zinc coating.

D. Fabricate items with joints tightly fitted and secured.

E. Fit and shop assemble in largest practical sections for delivery to Project site.

F. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of structure, except where specifically noted otherwise.

G. Make exposed joints butt tight, flush and hairline.

H. Fabricate anchorage and related components of same material and finish as metal fabrication, unless indicated otherwise.

2.03 ROUGH HARDWARE

A. Furnish bent or otherwise custom fabricated bolts, plates, anchors, hangers, dowels, and other miscellaneous steel and iron shapes as required for framing and supporting woodwork, and for anchoring or securing woodwork to concrete or other structures. Straight bolts and other stock rough hardware items are specified in Division 6 sections.

B. Fabricate items to sizes, shapes, and dimensions required. Furnish malleable-iron washers for heads and nuts which bear on wood structural connections; elsewhere, furnish steel washers.

2.04 MISCELLANEOUS FRAMING AND SUPPORTS

A. General: Provide steel framing and supports for applications indicated or which are not a part of structural steel framework, as required to complete work.

B. Fabricate units to sizes, shapes, and profiles indicated and required to receive adjacent other construction retained by framing and supports. Fabricate from structural steel shapes, plates, and steel bars of welded construction using mitered joints for field connection. Cut, drill, and tap units to receive hardware, hangers, and similar items.

1. Equip units with integrally welded anchors for casting into concrete. Furnish inserts if units must be installed after concrete is placed.

a. Except as otherwise indicated, space anchors 24 inches o.c. and provide minimum anchor units in the form of steel straps 1-1/4 inch x 8 inches long.

2.05 FINISHES, GENERAL

A. Comply with NAAMM Metal Finishes Manual for recommendations relative to application and designations of finishes.

B. Finish metal fabrications after assembly.

C. Galvanizing: Galvanize ALL EXTERIOR EXPOSED structural shapes, and decorative steel components.
1. For those items indicated for galvanizing, apply zinc-coating by the hot-dip process compliance with the following requirements:
a. ASTM A153 for galvanizing iron and steel hardware.
b. ASTM A123 for galvanizing both fabricated and unfabricated iron and steel products made of uncoated rolled, pressed, and forged shapes, plates, bars, and strip 0.0299 inch thick and heavier.

D. Preparation for Shop Priming: Prepare uncoated ferrous metal surfaces to comply with minimum requirements indicated below for SSPC surface preparation specifications and environmental exposure conditions of installed metal fabrications:
1. Interiors (SSPC Zone 1A): SSPC-SP3 Power Tool Cleaning:
2. Apply shop primer to uncoated surfaces of metal fabrications, except those with galvanized finish or to be embedded in concrete, sprayed-on fireproofing, or masonry, unless otherwise indicated. Comply with requirements of SSPC-PA1 Paint Application Specification No. 1 for shop painting.
3. Lead free, alkyd primer: Manufacturer's standard.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Fastening to In-Place Construction: Provide anchorage devices and fasteners where necessary for securing miscellaneous metal fabrications to in-place construction; include threaded fasteners for concrete and masonry inserts, toggle bolts, through-bolts, lag bolts, wood screws, and other connectors as required.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installation of miscellaneous metal fabrications. Set metal fabrication accurately in location, alignment, and elevation; with edges and surfaces level, plumb, true, and free of rack; and measured from established lines and levels.

C. Provide temporary bracing or anchors in formwork for items that are to be built into concrete masonry or similar construction.

D. Fit exposed connections accurately together to form hairline joints. Weld connections that are not to be left as exposed joints, but cannot be shop welded because of shipping size limitations. Do not weld, cut or abrade the surfaces of exterior units which have been hot-dip galvanized after fabrication, and are intended for bolted or screwed field connections.

E. Field Welding: Comply with AWS Code for procedures of manual shielded metal-arc welding, appearance and quality of welds made, methods used in correcting welding work, and the following:
   1. Use materials and methods that minimize distortion and develop strength and corrosion resistance of base metals.
   2. Obtain fusion without undercut or overlap.
   3. Remove welding flux immediately.
   4. At exposed connections, finish exposed welds and surfaces smooth and blended so that no roughness shows after finishing and contour of welded surface matches those adjacent.

3.02 CLEANING

A. Touch-Up Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas of shop paint, and paint exposed areas with same material as used for shop painting to comply with SSPC-PA 1 requirements for touch-up of field painted surfaces.
   1. Apply by brush or spray to provide a minimum dry film thickness of 2.0 mils.

B. For galvanized surfaces clean welds, bolted connections and abraded areas and apply galvanizing repair paint to comply with ASTM A780.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Worked covered by this Section includes furnishing of and paying for all materials, labor, services, equipment, licenses, taxes, other items, and appliances for execution, installation and completion of all work specified herein and/or shown on the drawings.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1.04 QUALITY ASSURANCE

A. Design, engineer, fabricate and install handrails and railing systems to comply with requirements of ASTM E985 for structural performance based on testing performed in accordance with ASTM E 894 and E 935.

B. Structural design, fabrication and assembly shall be in accordance with requirements of NAAMM Metal Stairs Manual, except as otherwise specified or shown.

C. Design stairs to support a live load of 100 pounds per square foot.

D. Structural Performance: Railings, including attachment to building construction, shall withstand the effects of gravity loads and the following loads and stresses within limits and under conditions indicated:
   1. Handrails and Top Rails of Guards:
      a. Uniform load of 50 lbf/ ft. applied in any direction.
      b. Concentrated load of 200 lbf applied in any direction.
      c. Uniform and concentrated loads need not be assumed to act concurrently.
   2. Infill of Guards:
      a. Concentrated load of 50 lbf applied horizontally on an area of 1 sq. ft.
      b. Infill load and other loads need not be assumed to act concurrently.

E. ASTM E 985 - For railing - related definitions and structural performance criteria.

F. Shop Drawings and Calculations must be stamped by a professional engineer licensed in the State where the work is located.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Steel Pipe: ASTM A53, Standard Weight.
   1. Shop primed for interior applications
   2. G90 hot dipped galvanized for exterior applications.

2.02 FASTENERS

A. Provide Type 304 or 316 stainless steel fasteners for exterior use and zinc-plated fasteners with coating complying with ASTM B 633, Class Fe/Zn 5, where built into exterior walls. Select fasteners for type, grade and class required for conditions indicated and as specified.
   1. At steel railings, use Type 304 stainless steel or hot-dip zinc-coated steel fasteners complying with ASTM A 153.
   2. At aluminum and stainless steel railings, use Type 304 or 316 stainless steel fasteners.

B. Bolts And Nuts: ASTM A 307, Grade A. High strength bolts; ASTM A 325. Hot-dip galvanize all items in accordance with ASTM A 153.

C. Expansion Bolts Wedge Anchors: Ramset "Trubolt" or Hilti "Kwik Bolt".

D. Expansion Shields: F.S. FF-S-325.

E. Anchor Bolts: Furnish and deliver to site, anchor bolts and other items to be embedded in concrete. Provide necessary shop details and diagrams for concrete forms and, if required, provide templates to insure proper and accurate locations and setting of anchor bolts.

F. Toggle Bolts: Tumble-wing type F.S. FF-B-588 type, class and style as required.

G. Lock Washers: F.S. FF-W-84, helical spring type carbon steel.

2.03 FABRICATION GENERAL

A. Verify dimensions on site prior to shop fabrication.

B. Fit and shop assemble components in largest practical sizes, for delivery to site and installation.

C. Supply components required for secure anchorage of stairs, handrails and railings.

D. Fully weld joints. Grind exposed welds smooth and flush with adjacent surfaces.

E. Make exposed butt joints tight, flush, and hairline.

F. Accurately form components required for anchorage of members to each other and to building structure.

G. Welding:
   1. Structural steel, AWS D1.1 and sheet steel, AWS D1.3.
   2. Where possible, locate welds on unexposed side.
   3. Grind exposed welds smooth and true to contour of welded member. Remove welding splatter.

2.04 STEEL FINISH

A. Lead free, alkyd primer: Manufacturer's standard.

2.05 STEEL RAILING SYSTEM

A. Rails and Posts: Sizes and shapes as indicated.

B. Mounting on Concrete Floor: Steel sleeves, sized to receive railing post with 1/4 inch clearance.

C. Mounting on Masonry or Concrete Walls: Provide brackets with anchors.

D. Mounting on Stud Walls: Provide brackets and anchor plates, predrilled to receive bolts.

E. Splice Connectors: Steel threaded collars.

PART 3 - EXECUTION

3.01 PREPARATION

A. Supply items to be embedded in masonry or concrete or placed in partitions with setting templates and erection drawings to approximate sections.

3.02 RAILING INSTALLATION

A. Provide standard terminal fittings at ends of posts and rails.

B. Secure brackets, posts and rails to steel by welds, and to masonry or concrete with expansion sleeves and bolts, except secure posts at concrete by setting in sleeves filled with commercial non-shrink grout.

C. Set rails horizontal or parallel to rake of stairs to within 1/8-inch in 12 feet.

D. Set posts plumb and aligned to within 1/8-inch in 12 feet.

3.04 FIELD PRIME PAINTING

A. When installation is complete, clean field welds and surrounding areas to bright metal, and coat with same primer paint used for shop priming.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Includes: Provide rough carpentry, and installation of items specified in other Sections, normally installed by carpenters.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Material Grading: Identify hardboard, particleboard, lumber, and plywood by affixing grademark, stamp, or related identifying marks indicating material grades, rules or standards under which they are produced, and complying with rule or standard under which the material is produced. Use certified inspection agency certified by the Board of Review, American Lumber Standards Committee, to grade lumber species. In lieu of piece grademarking, a certificate of inspection from an agency certified by the Board of Review, American Lumber Standards Committee may be furnished for precut lumber. Applicable grading rules are as follows:

1. Douglas Fir, White Fir, and Cedar: "Standard Grading and Dressing Rules for West Coast Lumber" as published by the West Coast Lumber Inspection Bureau.
2. Ponderosa and Western White Pine: "Grading Rules for Western Lumber", published by the Western Wood Products Association.
3. Southern Yellow Pine: "Standard Grading Rules for Southern Pine Lumber" as published by the Southern Pine Inspection Bureau.

B. Plywood: Conform to U. S. Product Standard PS 1 issued by the National Bureau of Standards. Stamp or brand each standard size panel to show type and grade of panel. When used structurally, plywood to meet performance standards for its type as described in Product Standard PS 1 for Douglas Fir plywood. Furnish material identified as to species, grade, and glue type by an approved agency or independent testing laboratory with appropriate affixed grade-marks on each panel. Provide in addition to above requirements, exterior type plywood for permanently exposed plywood in outdoor applications.

C. Qualifications of Workmen: Provide sufficient skilled workmen and carpenter foreman present at all times during execution of this portion of the Work, thoroughly familiar with type construction involved, materials and techniques specified.

1.05 PRODUCT HANDLING

A. Protection:
1. Store materials to ensure proper ventilation and drainage. Protect against damage and weather.
2. Deliver materials to job site and store, in safe area, out of the way of traffic, and shored off ground surface.
3. Identify framing lumber as to grades and store grades separately.
4. Protect metal products with adequate weatherproof outer wrappings.
5. Use extreme care in off-loading lumber to prevent damage, splitting, and breaking materials.

B. Replacements: In event of damage, immediately make repairs and replacements necessary to approval of Architect at Contractor's expense.

PART 2 - PRODUCTS

2.01 LUMBER

A. Provide lumber for structural carpentry using following species provided grade for each is not lower than minimum shown:
1. Pine, Southern Yellow - SPIB Rules (KD) No. 2 Common
2. Fir, Douglas - WCLIB Rules Standard
3. Fir, White - WCLIB Rules Standard
4. Pine, Western White - WWPA Rules Standard

B. Lumber (except where otherwise noted): Surfaced 4 sides unless, in addition to being dressed, it has been notched, shiplapped, or patterned.

C. Lumber Dimensions: Are nominal.

2.02 PLYWOOD

A. Plywood (not otherwise specified or noted on the Drawings): Comply with DOC PS-1, Exposure 1 (exterior glue), Group 1, Southern pine, C-D grade for concealed applications and B-C grade for exposed “utility” applications.
1. Refer to 06 4000 for exposed “Architectural” applications.

B. Wall Panels at Data/Electrical Rooms: ¾” B-C, Painted Flat White.

2.03 FIRE-RETARDANT AND PRESERVATIVE TREATMENT

A. Wood-Preservative-Treated Lumber And Plywood
   1. Preservative Treatment by Pressure Process: AWPA U1; Use Category UC2 for interior construction not in contact with the ground, Use Category UC3b for exterior construction not in contact with the ground, and Use Category UC4a for items in contact with the ground
   2. Preservative Chemicals: Acceptable to authorities having jurisdiction and containing no arsenic or chromium. Do not use inorganic boron (SBX) for sill plates.
   3. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Do not use material that is warped or that does not comply with requirements for untreated material.
   4. Mark lumber with treatment quality mark of an inspection agency approved by the ALSC Board of Review.
   5. Application: Treat items indicated on Drawings, and the following:
      a. Wood cants, nailers, curbs, equipment support bases, blocking, stripping, and similar members in connection with roofing, flashing, vapor barriers, and waterproofing.
      b. Wood sills, sleepers, blocking, and similar concealed members in contact with masonry or concrete.
      c. Wood framing and furring attached directly to the interior of below-grade exterior masonry or concrete walls.
      d. Wood framing members that are less than 18 inches above the ground in crawlspaces or unexcavated areas.
      e. Wood floor plates that are installed over concrete slabs-on-grade.

B. Fire-Retardant Treated Lumber And Plywood
   1. General: Where fire-retardant-treated materials are indicated, use materials complying with requirements in this article, that are acceptable to authorities having jurisdiction, and with fire-test-response characteristics specified as determined by testing identical products per test method indicated by a qualified testing agency.
   2. Fire-Retardant-Treated Lumber and Plywood by Pressure Process: Products with a flame spread index of 25 or less when tested according to ASTM E 84, and with no evidence of significant progressive combustion when the test is extended an additional 20 minutes, and with the flame front not extending more than 10.5 feet beyond the centerline of the burners at any time during the test.
   3. Exterior Type: Treated materials shall comply with requirements specified above for fire-retardant-treated lumber and plywood by pressure process after being subjected to accelerated weathering according to ASTM D 2898. Use for exterior locations and where indicated.
   4. Interior Type: Treated materials shall have a moisture content of 28 percent or less when tested according to ASTM D 3201 at 92 percent relative humidity. Use where exterior type is not indicated.
   5. Kiln-dry lumber after treatment to a maximum moisture content of 19 percent. Kiln-dry plywood after treatment to a maximum moisture content of 15 percent.

6. Identify fire-retardant-treated wood with appropriate classification marking of qualified testing agency.
7. Application: Treat items indicated on Drawings

2.04 HARDWARE

A. Provide rough hardware required for proper installation of carpentry work. Furnish hot-dipped galvanized, nails, spikes, screws, bolts, and similar items using proper types and ample sizes to fasten and hold the various members securely in place.

B. Where rough carpentry is exposed to weather, in ground contact, pressure-preservative treated, fire retardant treated, or in area of high relative humidity, provide fasteners **with hot-dip zinc coating complying with ASTM A 153/A 153M or Type 304 stainless steel**.

PART 3 - EXECUTION

3.01 WORKMANSHIP

A. Carpentry: Produce joints true, tight, and well nailed. Lay out, install and fit wood framing, furring, stripping, and blocking as required by conditions encountered.

B. All Work: Plumb, level, and brace with sufficient nails, spikes, and bolts required to ensure secure attachment and rigidity.

C. Any piece of work or carpentry material with defects that prevent it from serving its intended purpose satisfactorily, including crooked, warped, bowed, or otherwise defective material, even if within the limits of grade specified, will be rejected. Replace with an acceptable piece.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. Extent of gypsum sheathing is shown on the drawings and described in this section.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Gypsum Board Terminology Standard: GA-505 by Gypsum Association.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver gypsum sheathing with factory identification of brand and grade. Protect from damage and direct exposure to severe weather. Store on leveled supports off the ground.

PART 2-PRODUCTS

2.01 MATERIALS

A. Gypsum Sheathing:
   1. Manufacturer:
      a. "Dens-Glass Gold" by Georgia Pacific Corporation.
      b. "GlasRoc" by Certainteed
      c. "Green Glass" by Temple-Inland
      d. "Secur Rock" by USG
   2. Provide 4'-0" x 8'-0" x thickness shown. Fabricate sheathing with fiberglass mat facing on both sides and conforming to ASTM C-1177 for core requirements. Provide sheathing classed as noncombustible when tested by ASTM E136 with Flame Spread and Smoke Developed rating of 0 when tested by ASTM E84.
   3. Seal all joints by applying 3M Venture Tape Polypropylene Sheathing Tape 1585CW.

PART 3 - EXECUTION

3.01 INSTALLATION

A. General: Except as otherwise indicated, comply with manufacturer's instructions and industry standards for the installation of gypsum sheathing.

B. Horizontal Installation: Install wide panels horizontally with end joints on supports and staggered 2 support spacings where possible, but not less than one support spacing or 12". Fasten at each support with screws (spaced approximately 8" o.c.) set back 3/8" minimum from edges.

C. Cut boards at penetrations, edges and other obstructions of the work; fit tight against abutting work, except provide 3/8" setback where non-loadbearing work abuts structural elements at head and jambs.

D. Do not bridge building expansion joints with gypsum sheathing; cut and space edges to match spacing of structural support elements.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install millwork, shelving, ornamental wood items, hardware and accessories specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.
   1. Shop Drawings: Submit newly prepared architectural woodwork Shop Drawings for review by Architect prior to start of fabrication. Do not duplicate Architect's construction drawings. Indicate on shop drawings, dimensions, species, matching of panels, profiles of moldings, assembly details, applied finish, surfacing, built-in hardware, and necessary connections to other trades.
      a. Contract Document electronic files (including all drawings, specifications, addenda and supplemental information) will not be made available to Bidders or Sub-bidders before the award of a Contract. After the award of the Contract, the General Contractor may make request for release of electronic document files.
   2. Brochures: Submit manufacturer's descriptive literature on specialty items not manufactured by the architectural woodworker, as requested by Architect.
   3. Samples to be Submitted:
      a. Each plastic laminate and melamine laminate.
      b. Each type of edge band material.
      c. Each solid surface material.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Standards:
   1. Architectural Woodwork Standards of the Architectural Woodwork Institute (AWI) are referenced in this specification, however, where more stringent requirements are specified, the more stringent shall govern. Any reference to Premium, Custom or Economy in this specification is as defined in latest edition of the AWI "Architectural Woodwork Standards " and as modified in this specification.

2. Provide Custom grade for any item not given a specific quality grade as defined in latest edition of the AWI "Architectural Woodwork Standards"

B. Competence: Approved woodwork manufacturer, regularly engaged and well experienced in manufacture of fixtures and wood trim and finish of monumental building type, having reputation for doing satisfactory work on time and successfully completing comparable work. Architect reserves the right to approve woodwork manufacturer selected to furnish woodwork.

1.05 FIELD DIMENSIONS

A. Woodwork manufacturer is responsible for details and dimensions not controlled by job conditions. Show on Shop Drawings all required field measurements beyond his control. General Contractor and the woodwork manufacturer shall cooperate to establish and maintain these field dimensions.

1.06 PRODUCT HANDLING

A. Protection: Protect architectural woodwork before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary to approval of Architect and at Contractor's expense.

PART 2 - PRODUCTS

2.01 MATERIALS FOR ARCHITECTURAL WOODWORK

A. Substrate for High Pressure Laminated Plastic Finish:
1. Typical: ANSI A208 Grade 155 Medium Density Fiberboard (MDF).
2. At Sinks and Lavatories: All Hardwood veneer core plywood with each veneer layer bonded with exterior glue.

B. Substrate for Thermally Fused "Melamine" Laminate Finish:
1. ANSI A208 Grade 155 Medium Density Fiberboard (MDF) with factory laminated "Melamine" finish on both sides.
2. Melamine at Cabinet Interiors to be White.

C. Refer to Finish Legend on Sheet A801 for Material List.

2.02 MILLWORK

A. Fabricate according to AWI Architectural Woodwork Standards for "Custom" Grade, Flush Overlay type.

B. Hardware: Install cabinet hardware furnished under this Section of these Specifications.

C. Edge Banding: Provide 3mm PVC at cabinet top edges and 1mm PVC at door and drawer edges in color to be selected by Architect.

D. Drawer Construction: Drawers are to be four sided, drawer box type. Head screw from the inside of the drawer box and install pulls through the drawer box.
   1. ANSI A208 Grade 155 Medium Density Fiberboard (MDF) with factory laminated "Melamine" finish on both sides at HPL or melamine finish millwork.

2.03 HARDWARE

A. Cabinet Doors:
   1. 1 Pair Hinges: Blum # 71T5550, 120 Degree Clip Top Hinge, Straight-Arm Style, US26D.
   2. 1 Pull: Mockett DP128-17S, Kombi Pull, 170mm O.A., Satin Nickle
   3. 1 Camlock C8053 Cylinder Cam Lock by Compx National, where required, masterkeyed and keyed alike in groups as directed by Architect.
   4. Provide self-adhesive rubber silencers at each corner of the leading edge of cabinet doors.
   5. Provide Stanley #35 catch on all doors to comply with seismic requirements.

B. Cabinet Drawers:
   1. 1 Pair Drawer Slides: KV1805 (Length as required), roller bearing, 3/4 extension lift-out, hold in/out, lock open, self closing.
      a. Provide medium duty model 8417, full extension drawer slides at file drawers and all drawers over 7" deep.
   2. 1 Pull: Mockett DP128-17S, Kombi Pull, 170mm O.A., Satin Nickle
   3. 1 Camlock C8053 Cylinder Cam Lock By Compx National, where required, masterkeyed and keyed alike in groups as directed by Architect.

C. Adjustable Shelf Support:
   1. Wood Shelves: Millwork subcontractor to install recessed standards and clips.

D. Counter Support Bracket: A&M Hardware Inc., Hybrid Surface Mount countertop / workstation support bracket in length required. Finish color to be selected by Architect.

E. Grommets: Doug Mockett & Co., 1-800-523-1269 “XG” 3” plastic where shown on mill-work drawings. Color to be White. Exact locations to be verified with Architect before

PART 3 - EXECUTION

3.01 FABRICATION

A. Fabricate millwork, ornamental wood, and countertops to comply with reviewed Shop Drawings and referenced standards.

3.02 UNDER-COUNTER AND BUILT-IN ITEMS COORDINATION

A. Prior to fabrication, verify exact location of specified and Owner Furnished under-counter and built-in items. Verify dimensions of appliances and equipment to be installed within the millwork. Notify Architect immediately of any dimensional discrepancies that would interfere with installation of under-counter or built-in items.

3.03 CABINET INSTALLATION

A. Grade: Install cabinets to comply with same grade as item to be installed.

B. Assemble cabinets and complete fabrication at Project site to the extent that it was not completed in the shop.

C. Install cabinets level, plumb, true, and straight. Shim as required with concealed shims. Install level and plumb to a tolerance of 1/8 inch in 96 inches.

D. Scribe and cut cabinets to fit adjoining work, refinish cut surfaces, and repair damaged finish at cuts.

E. Anchor cabinets to anchors or blocking built in or directly attached to substrates. Secure with countersunk, concealed fasteners and blind nailing. Use fine finishing nails or finishing screws for exposed fastening, countersunk and filled flush with woodwork.
   1. For shop finished items use filler matching finish of items being installed.

F. Cabinets: Install without distortion so doors and drawers fit openings properly and are accurately aligned. Adjust hardware to center doors and drawers in openings and to provide unencumbered operation. Complete installation of hardware and accessory items as indicated.
   1. Install cabinets with no more than 1/8 inch in 96-inch sag, bow, or other variation from a straight line.
   2. Maintain veneer sequence matching of cabinets with transparent finish.
   3. Fasten wall cabinets through back, near top and bottom, and at ends not more than 16 inches o.c. with No. 10 wafer-head screws sized for not less than 1-1/2-inch penetration into wood framing, blocking, or hanging strips

G. Touch up finishing work specified in this Section after installation of woodwork. Fill nail holes with matching filler where exposed.

3.04 FINAL INSPECTION

A. General: Prior to final inspection and acceptance by Architect, completely check each installed item and adjust for proper operation.

B. Compliance:
   1. Owner reserves right to request and pay for inspection by representative of the Architectural Woodwork Institute to determine that work of this Section has been performed to comply with referenced standards.
   2. In event above inspection determines architectural woodwork, or any part of it does not comply with referenced standards, contractor pays all costs for initial inspection and all subsequently required reinspections. Immediately remove non-complying items, and immediately replace them with items complying to referenced standards of these specifications, at Contractor's expense.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Surface preparation and application of liquid applied asphalt emulsion weather barrier.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 REFERENCES

A. ASTM D146-97 - Standard Test Methods for Sampling and Testing Bitumen-Saturated Felts and Fabrics Used in Roofing and Waterproofing.

B. ASTM D412-98a(2002)e1 - Standard Test Methods for Vulcanized Rubber and Thermoplastic Elastomers-Tension.

C. ASTM E96-00e1 (Method B) - Standard Test Methods for Water Vapor Transmission of Materials.

D. ASTM E283-91 (1999) - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.

E. ASTM E783 - Standard Test Method for Field Measurement of Air Leakage Through Installed Exterior Windows and Doors.

F. 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.

G. ASTM E2178-01 - Standard Test Method for Air Permeance of Building Materials.

H. ASTM E2357 - 05 Standard Test Method for Determining Air Leakage of Air Barrier Assemblies

1.05 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Use an experienced installer and adequate number of skilled personnel who are thoroughly trained and experienced in the application of the air barrier.
   2. Air Barrier Installer performing Work shall be approved by air barrier membrane manufacturer.

B. Obtain air/vapor barrier materials from a single manufacturer regularly engaged in manufacturing the product.

C. Provide products which comply with all state and local regulations controlling use of volatile organic compounds (VOCs).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver materials to site in manufacturer's original, unopened containers and packaging, with labels clearly identifying product name and manufacturer.

B. Store materials in a clean dry area in accordance with manufacturer's instructions at temperatures above 32ºF (0ºC), free from contact with cold or frozen surfaces.

C. Protect materials during handling and application to prevent damage or contamination.

1.07 ENVIRONMENTAL REQUIREMENTS

A. Product not intended for uses subject to abuse or permanent exposure to the elements.

B. Do not proceed with product application during rain or inclement weather.

C. Do not apply membrane when air or surface temperatures are below 30ºF (-1ºC).

D. Do not apply to frozen substrate.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. W.R. Meadows Air-Shield, W.R. Grace Perm-A-Barrier VP; or approved equal from Prosoco, Tremco or Carlisle.
   1. Coordinate with thru-wall membrane flashing product in 04 2000 for compatibility.

2.02 MATERIALS

A. Liquid Barrier System: Air-Shield™ LMP, One component, polymer modified, cold applied liquid vapor permeable membrane.
   1. Performance Based Specification: Air barrier membrane shall be water-based, that cures to form a tough, seamless, elastomeric membrane having the following characteristics:

a. Air Leakage ASTM E2357: < 0.04 cfm / ft.^{2} @ 75 Pa (1.57 lb./ft.^{2}).
b. Air Permeability ASTM E2178: < 0.004 cfm/ft.^{2} @ 75 Pa (1.57 lb./ft.^{2}).
c. Water Vapor Permeance ASTM E96 Method B: > 10 perms.
d. Elongation ASTM D412: 1300%.
e. Flexibility at -20° C ASTM C836 2" mandrel: Pass.
f. Flame Spread and Smoke Development, ASTM E84: Class A.
g. Installed Thickness: 45 mils dry, 60 mils wet.

2.03 ACCESSORIES

A. Flashing and Transition Membrane: Self-adhesive polymeric sheet membrane having a thickness of 40 mils (1 mm).
1. AIR-SHIELD THRU-WALL FLASHING by W. R. MEADOWS.

B. Joint Sealant: Single component, polyurethane joint sealant for exterior sheathing panels.
1. POURTHANE® NS by W. R. MEADOWS.

C. Liquid Flashing: Fluid applied, single component, flashing membrane for rough openings and detailing.
1. AIR-SHIELD LIQUID FLASHING by W. R. MEADOWS.

D. Membrane Adhesive:
1. Solvent-Based Primer: MEL-PRIME VOC Compliant Solvent-Base Adhesive or Standard Solvent-Base Adhesive by W. R. MEADOWS.

E. Pointing Mastic: mastic for sealing penetrations and terminations of membrane.
1. POINTING MASTIC by W. R. MEADOWS.

F. Detailing Membrane: non-slump waterproofing material for joint detailing.
1. BEM by W. R. MEADOWS.

G. Concrete Repair Materials: general purpose patching materials.
1. MEADOW-PATCH™ 5 and MEADOW-PATCH 20 Concrete Repair Mortars by W. R. MEADOWS.

H. Sealant: Dow Corning 758 Silicone Weather Barrier Sealant.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine surfaces to receive membrane. Notify Architect if surfaces are not acceptable. Do not begin surface preparation or application until unacceptable conditions have been corrected.

3.02 SURFACE PREPARATION

A. Protect adjacent surfaces not designated to receive air/vapor barrier.

B. Clean and prepare surfaces to receive air/vapor barrier membrane in accordance with manufacturer's instructions.

C. Do not apply membrane to surfaces unacceptable to manufacturer.

D. Concrete surfaces must be clean, free of standing water, ice, snow, frost, dust, dirt, oil, curing compounds or any other foreign material that could prevent proper adhesion of the membrane.

E. Patch all holes and voids and smooth out any surface misalignments.

F. Patch all cracks, protrusions, small voids, offsets, details, irregularities and small deformities with cementitious patching mortar at least two hours before application.

G. Ensure joints between dissimilar building materials are sealed with a strip of self-adhesive membrane 6" (150 mm) wide, centered over the joint.

H. Exterior Sheathing Panels:
1. Panels are to be fastened according to sheathing panel manufacturer.
2. Fill all panel joint with detailing compound prior to full application.
3. Joints greater than 1/4" (6.3 mm) in exterior sheathing panels (drywall and glass-faced) should be filled with detailing compound and then taped with 4@ wide mesh tape as recommended by manufacturer.

3.03 APPLICATION OF SYSTEM

A. TRANSITION MEMBRANE
1. Prime surfaces to be covered in one working day with applicable primer.
2. Apply transition membrane with a minimum overlap of 75mm (3 in.) onto primed surface at all joints, columns, and beams as indicated in drawings.
3. Tie in to window and door openings, roofing systems, floor intersections, and dissimilar materials.
4. Roll membrane firmly into place.
5. Ensure membrane is fully adhered and remove all wrinkles and fish mouths.
6. Overlap subsequent courses of membrane a minimum of 2" (50mm) and ensure joints are fully adhered.
7. Seal all edges of transition membrane with detailing sealant.

B. BARRIER MEMBRANE
1. Apply membrane in accordance with manufacturer's instructions.
2. Thoroughly mechanically mix membrane prior to application.
3. Apply membrane by spray or roller at a minimum coverage rate of 20-25 ft^2/gal. (60 mils wet, 45 mils dry). Two coats (30 mils wet) may be necessary.
4. Frequently inspect surface area with a wet mil gauge to ensure consistent thickness.
5. Work material into any fluted rib forming indentations.
6. Cured thickness of membrane should be 45 mils dry.
7. Avoid use of products which contain tars, solvents, pitches, polysulfide polymers, or PVC materials that may come into contact with air/vapor barrier system.

3.04 PROTECTION

A. Cover membrane as soon as possible, since it is not designed for permanent exposure.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install insulation and related items specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 PRODUCT HANDLING

A. Protection:
   1. Deliver materials to job site and store in safe dry place with labels intact and legible at time of installation.
   2. Protect building insulation materials before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary to approval of Architect and at Contractor's expense.

1.05 REFERENCES

A. Concealed Installations: Flame Spread rating of not more than 75 and a smoke developed rating of not more than 450 when tested in accordance with ASTM E84.

B. Exposed Installations: Flame Spread rating of not more than 25 and a smoke developed rating of not more than 450 when tested in accordance with ASTM E84.

PART 2 - PRODUCTS

2.01 PERIMETER INSULATION BOARD

A. Provide extruded polystyrene insulation board Owens-Corning Foamular 250, or approved equal.

2.02 CONTINUOUS INSULATION (XPS)

A. Provide extruded polystyrene insulation board by Dow Chemical, Owens-Corning, or approved equal.

B. Provide Owens Corning® FOAMULAR® 250 Extruded Polystyrene (XPS) Insulation:
:
1. Rigid closed cell extruded polystyrene foam insulation.
2. Compressive Strength, minimum psi (kPa) ASTM D1621 25 (172)
3. Flexural Strength, minimum psi (kPa) ASTM C203 50 (345)
4. Water Absorption, maximum % by volume ASTM C272 0.3
5. Water Vapor Permeance, maximum perm (ng/Pa•s•m2) ASTM E96 1.5 (86)
6. Dimensional Stability, maximum % linear change ASTM D2126 2.0
7. Flame Spread ASTM E84 10
8. Smoke Developed ASTM E84 175
9. Oxygen Index, minimum % by volume ASTM D2863 24
10. Service Temperature, maximum °F (°C) 165 (74)
11. Linear Coefficient of Thermal Expansion, in/in/ºF (m/m°C) ASTM E228 3.5 x 10-5 (6.3 x 10-5)

C. Joint Flashing Tape: Provide insulation manufacturer's recommended board joint tape for sealing joints, seams and veneer tie penetrations through the insulation layer.
1. Owens Corning Joint SealR

D. Sealant: One-part, flexible polyurethane-based elastomeric sealant; moisture curing and non-sagging; to ASTM C920, Type S, Grade NS, Class 25.

E. Accessories:
1. Insulation Board Attachment:
    a. Fasteners at Steel Studs: Provide insulated sheathing manufacturer's recommended polymer or other corrosion protective coated steel screw fasteners for securing the rigid foam sheathing to back-up wall. Fastener length and size based on wall thickness and fastening requirements. Wall Anchors and/or Fasteners should not exceed a maximum distance of 8" from any insulation board edge when used as part of the fastening pattern installation.
        1) Acceptable Products: Rodenhouse Inc. w/ 1-3/4 inch diameter high-grade plastic washers.
    b. Adhesive:
        1) ChemRex, Inc. "Contech Brands PL300 Foam Board Adhesive".
        2) ChemRex, Inc. "Contech Brands Premium Foam Board Adhesive".
        3) Dacar products, Inc. "Foamgrab PS".
2. Wall Opening Flashing: Provide insulated sheathing manufacturer's recommended flashing sealing window and door wall openings.
    a. Straight Flashing Tape, with butyl rubber adhesive, at straight opening heads, jambs and sills.
3. Penetration Filler: Provide insulated sheathing manufacturer's recommended polyurethane foam for sealing penetrations of insulated sheathing.

a. Acceptable Products: Single component polyurethane insulating foam sealant.

4. Gap Air Infiltration Filler: Two Component, Quick Cure Polyurethane Foam:
   a. NFPA 286 Approval for Exposed use to the interior of the building without the need for a 15-min thermal barrier.
   b. ASTM E-84 Class A

2.03 BATT INSULATION

A. Manufacturers: Johns Manville Thermal-SHIELD™ Free, Owens Corning EcoTouch™, Certainteed Sustainable Insulation™ , Knauf EcoBatt™ or approved equal formaldehyde-free fiberglass insulation manufacturers.

B. Material: Glass fiber type bearing the U.L. Classification marking as to fire resistance conforming ASTM C-665:
   1. Unfaced, Type I

2.04 SPRAY FOAM INSULATION AT VOIDS

A. Dow Chemical FROTH-PAK™ Spray Polyurethane Foam Sealant, or approved equal.

B. Provide a two-component, quick-cure spray polyurethane foam to fill voids where typical building insulation cannot easily be installed.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Carefully inspect installed work of other trades and verify that work is complete to point where this installation may properly commence.

B. Discrepancies: Do not proceed with installation in areas of discrepancy until discrepancies are fully resolved.

3.02 INSTALLING CONTINUOUS INSULATION BOARD

A. Install rigid foam board insulation system in accordance with manufacturer's installation guidelines.

B. Install boards with long axis perpendicular to supports. Ensure end joints are fully supported.

C. Install insulation boards to ensure board width spans not less than 3 framing supports.

D. Cut and fit boards to suit project requirements.

E. Fit insulation between wall ties and other obstructions with joints staggered providing ¼' to ½" spacing at end joints.
   1. Press units firmly against inside wythe of masonry or other construction.
   2. Make insulation continuous.

F. Fill all voids between insulation boards with single component insulating foam sealant to provide continuous vapor barrier.

G. Comply with insulation manufacturer's written instructions applicable to products and applications indicated.

H. Install insulation that is undamaged, dry, and unsoiled and that has not been left exposed to ice, rain, or snow at any time.

I. Extend insulation to envelop entire area to be insulated. Cut and fit tightly around obstructions and fill voids with insulation. Remove projections that interfere with placement.

J. Apply joint tape over exposed board joints using a squeegee or bristle brush.

K. Seal all voids and joints that cannot be taped.

L. Apply Flashing at all wall openings.

3.03 INSTALLING BATT AND BLANKET INSULATION

A. After piping and wiring is in place, install and support blanket and batt insulation in position required, and coordinate with framing.

B. Remove insulation torn, displaced, water soaked, and damaged. Replace with new material.

END OF SECTION

PART 1 - GENERAL

1.01 SUMMARY

A. This Section specifies factory-formed metal wall panels.

1.02 REFERENCES

A. ASTM International:
   1. ASTM A653/A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.
   2. ASTM A792/A792M Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot Dip Process.
   3. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate.
   4. ASTM E283 Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen.
   5. ASTM E331 Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference.
   6. ASTM E1592 Standard Test Method for Structural Performance of Sheet Metal Roof and Siding Systems by Uniform Static Air Pressure Difference.

1.03 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.04 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Shop Drawings:
   1. Provide elevations showing seam layout and pattern.
   2. Show manner of forming, joining, and securing panels to Project substrate.
   3. Show expansion joint details and waterproof connections to adjoining work and at obstructions and penetrations.
   4. Panel and fastener calculations to be submitted along with the panel drawings.

D. Samples consisting of 6-inch square specimens of material.

1.05 QUALITY ASSURANCE

A. Qualifications:
   1. Installer experienced in performing work of this section who has specialized in installation of work similar to that required for this project.
   2. Manufacturer Qualifications: Manufacturer capable of providing field service representation during construction and approving erection method.

B. Pre-installation Meetings: Conduct pre-installation meeting to verify project requirements, manufacturer's installation instructions and manufacturer's warranty requirements.

C. Performance Requirements:
   1. Static air infiltration of 0.06 cfm/sf (0.028 liters/second) with 6.24 psi (43 kPa) air pressure differential as tested in accordance with ASTM E283.
   2. No water infiltration at inward static air pressure differential of not less than 6.24 psi (43 kPa) and not more than 12 psi (83 kPa) as tested in accordance with ASTM E331.

D. Manufacturer's Qualifications: Manufacturer has a minimum of five years experience in manufacturing metal roof systems of this nature. Panels specified in this section shall be produced in a factory environment (not with a portable roll former) with fixed-base roll forming equipment and in line leveling, assuring the highest level of quality control. A letter from the manufacturer certifying compliance will accompany the product material submittals.

E. Installation Contractor's Qualifications:
   1. Installation contractor shall be an approved installer, certified by the manufacturer before the beginning of installation of the metal roof system.
   2. Project foreman is the person having received certification by the manufacturer specific training in the proper installation of the selected metal roof system and will be present to supervise whenever material is being installed.
   3. Provide certification letter that installation contractor has a minimum of three years' of metal product installation experience immediately preceding the date upon which work is to commence.

1.06 DELIVERY, STORAGE & HANDLING

A. Deliver materials in manufacturer's original packaging with identification labels intact.

B. Store materials protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.
   1. Stack prefinished material to prevent twisting, bending, abrasion, scratching and denting.
   2. Elevate one end of each skid to allow for moisture runoff.
   3. Prevent contact with material that may cause corrosion, discoloration or staining.
   4. Provide factory installed strippable vinyl film protective coating to panels.

1.07 PRE-INSTALLATION CONFERENCE

A. Prior to installation of roofing system, conduct a pre-installation conference at the project site.

B. Attendance: Owner, Architect, Contractor, Project Superintendent, and Certified Installer

1.08 WARRANTY

A. Provide manufacturer's guarantee for exterior color finish for a period of 20 years against blistering, peeling, cracking, flaking, checking, chipping and excessive color change and chalking. Color change not to exceed 5 N.B.S. units (per ASTM D-2244.64T) and chalking not less than rating of 8 per ASTM D-659.

B. Installer:
   1. Submit manufacturer's written two (2) year limited warranty providing panels to be free from defects in materials and workmanship, beginning from the date of substantial completion.
   2. The installation contractor shall issue a separate two (2) year warranty against defects in installed materials and workmanship, beginning from the date of substantial completion of the installation.

PART 2 - PRODUCTS

2.01 WALL PANELS

A. Manufacturer: McElroy Metal, Inc.

B. Multi-Cor Panel; Roll formed in factory; Exposed fastener wall panel, tape sealant required at side-lap seams.
   1. 32” coverage, 7/8” overall thickness
   2. 24 gage ASTM A 792 (50 ksi steel) AZ50 Painted
   3. Lap Seam Fasteners: 1/4-14 x 7/8” LAP TEK ZAC fastener (1’-8” o.c.)
   4. Provide all accessory metal trim, j-mold and closure strips as required.
   5. Color: To be selected from manufacturer’s standard line

2.02 FINISH

A. Finish to be Kynar 500 based polyvinylidene fluoride (PVDF) coating, 70% resin formulation.
   1. Primer is applied to 0.20 - 0.30 mils DFT (Dry Film Thickness) and the topcoat at 0.7 - 0.9 mils DFT (0.90 – 1.2 total DFT)

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's written data, including product technical bulletins, product catalog installation instructions, product carton installation instructions

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that substrate conditions, which have been previously installed under other sections or contracts, are acceptable for product installation in accordance with manufacturer's instructions prior to installation of panels.

3.03 PREPARATION

A. Ensure surfaces are clean and free of dirt and other foreign matter

B. Remove manufacturerís protective film from panel surfaces.

C. Coordinate panel installation with work of other trades to provide a noncorrosive and leakproof installation.

D. Prevent galvanic action of dissimilar metals in proximity to one another.

3.04 INSTALLATION

A. Seams: Provide uniform, neat seams.

B. Fasteners: Conceal fasteners where possible in exposed work. Cover and seal fasteners and anchors for watertight and leakproof installation.

C. Sealant-Type Joints: Provide sealant-type joint where indicated. Form joints to conceal sealant.

3.05 FINAL CLEANING

A. Upon completion, remove surplus and excess materials, rubbish, tools and equipment.

END OF SECTION

PART 1 GENERAL

1.01 SUMMARY

A. Furnish and install elastomeric sheet roofing system, including:
   1. Roofing manufacturer's requirements for the specified warranty.
   2. Preparation of roofing substrates.
   3. Wood nailers for roofing attachment.
   4. Insulation.
   5. Cover boards.
   6. Elastomeric membrane roofing.
   7. Flashings.
   8. Other roofing-related items specified or indicated on the drawings or otherwise necessary to provide a complete weatherproof roofing system.

1.02 REFERENCES

A. Referenced Standards: These standards form part of this specification only to the extent they are referenced as specification requirements.

B. ASTM C 1177/C 1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2004.

C. ASTM C 1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2004.

D. ASTM C 1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer; 2004.

E. ASTM D 638 - Standard Test Method for Tensile Properties of Plastics; 2003.

F. ASTM D 1004 - Standard Test Method for Initial Tear Resistance of Plastic Film and Sheeting; 2003.

G. ASTM D 3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2000.

H. ASTM D 6878 - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2003.

I. ASTM E 84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2005.

J. ASTM E 136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2004.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

C. Product Data:
   1. Provide membrane manufacturer's printed data sufficient to show that all components of roofing system, including insulation and fasteners, comply with the specified requirements and with the membrane manufacturer's requirements and recommendations for the system type specified; include data for each product used in conjunction with roofing membrane.

D. Samples: Submit samples of each product to be used.

E. Specimen Warranty: Submit prior to starting work.

F. Installer Qualifications: Letter from manufacturer attesting that the roofing installer meets the specified qualifications.

G. Pre-Installation Notice: Copy to show that manufacturer's required Pre Installation Notice (PIN) has been accepted and approved by the manufacturer.

1.04 QUALITY ASSURANCE

A. Pre-Installation Conference: Before start of roofing work, shall hold a meeting to discuss the proper installation of materials and requirements to achieve the warranty.
   1. Require attendance with all parties directly influencing the quality of roofing work or affected by the performance of roofing work.
   2. Notify Architect well in advance of meeting.

1.05 DELIVERY, STORAGE AND HANDLING

A. Deliver products in manufacturer's original containers, dry and undamaged, with seals and labels intact and legible.

B. Store materials clear of ground and moisture with weather protective covering.

C. Keep combustible materials away from ignition sources.

1.06 WARRANTY

A. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.

B. Manufacturer Warranty: Firestone 20 year Red Shield Limited Warranty covering membrane, roof insulation, and membrane accessories.
   1. Limit of Liability: No dollar limitation.

2. Scope of Coverage: Repair leaks in the roofing system caused by:
   a. Ordinary wear and tear of the elements.
   b. Manufacturing defect in Firestone brand materials.
   c. Defective workmanship used to install these materials.
   d. Damage due to winds up to 55 mph (88 km/h).
3. Not Covered:
   a. Damage due to winds in excess of 55 mph (88 km/h).
   b. Damage due hurricanes or tornadoes.
   c. Hail.
   d. Intentional damage.
   e. Unintentional damage due to normal rooftop inspections, maintenance, or service.

C. General Contractor and Roofing Subcontractor: Required to jointly and separately provide written guarantee that the roofing and flashing will be weathertight and free from defects in materials and workmanship for a period of 2 years from Final Acceptance Date.
1. Leaks and defects include blistering, fishmouths, ridging, splits, open laps, buckles, wrinkles and slippage. Make corrections at Contractor's expense during guarantee period.
2. Roofing inspection and written acceptance by manufacturer, Architect, and Owner will be required. In addition, roofing subcontractor is to schedule a joint inspection by above named parties 60 days prior to expiration of 2 year guarantee and correct defects complying with original specifications.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Manufacturer: Firestone Building Products Co., Carmel, IN. www.firestonebpco.com, or approved equal system by
1. GAF
2. Manville
3. Carlisle

2.02 ROOFING SYSTEM DESCRIPTION

A. Roofing System:
1. Membrane: Thermoplastic olefin (TPO).
2. Thickness: As specified elsewhere.
3. Membrane Attachment: MECHANICALLY FASTENED with battens in seams.
4. Comply with applicable local building code requirements.
5. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.
6. Provide assembly complying with UL Design Criteria for 1-90 wind uplift rating.

B. Insulation:
   1. Thickness Shown or as requried to achieve R-20 minimum.
   2. Base Layer: Polyisocyanurate foam board, non-composite. Firestone 95+ or approved equal.
      a. Attachment: Loose laid

C. Insulation Cover Board:
   1. Type: Gypsum-based board, 1/4 inch Dens Deck Prime.
   2. Attachment: Mechanical fastening thru insulation board into steel deck.

2.03 TPO MEMBRANE MATERIALS

A. Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D 6878, with polyester weft inserted reinforcement and the following additional characteristics:
   1. Thickness: 0.060 inch plus/minus 10 percent, with coating thickness over reinforcement of 0.024 inch (0.61 mm) plus/minus 10 percent.
   2. Sheet Width: Provide sheets of width necessary to accommodate batten spacing required by manufacturer for project conditions.
   3. Puncture Resistance: 265 lbf (1174 N), minimum, when tested in accordance FTM 101C Method 2031.
   4. Solar Reflectance: 0.79, minimum, when tested in accordance with ASTM C 1549.
   5. Solar Reflectance Index: (SRI) 98 initial, 81 3-year.
   6. Color: White.
   7. Acceptable Product: ULTRAPLY TPO by Firestone.

B. Membrane Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

C. Curb and Parapet Flashing: Same material as membrane, with encapsulated edge which eliminates need for seam sealing the flashing-to-roof splice; precut to 18 inches (457 mm) wide.

D. Formable Flashing: Non-reinforced, flexible, heat weldable sheet, composed of thermoplastic polyolefin polymer and ethylene propylene rubber.
   1. Thickness: 0.060 inch plus/minus 10 percent.
   2. Tensile Strength: 1550 psi (10.7 MPa), minimum, when tested in accordance with ASTM D 638 after heat aging.
   3. Elongation at Break: 650 percent, minimum, when tested in accordance with ASTM D 638 after heat aging.
   4. Tearing Strength: 12 lbf (53 N), minimum, when tested in accordance with ASTM D 1004 after heat aging.
   5. Color: White.
   6. Acceptable Product: ULTRAPLY TPO Flashing by Firestone.

E. Tape Flashing: 5-1/2 inch (140 mm) nominal wide TPO membrane laminated to cured rubber polymer seaming tape, overall thickness 0.065 inch (1.6 mm) nominal; TPO QuickSeam Flashing by Firestone.

F. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing; Pourable Sealer by Firestone.

G. Seam Plates: Steel with barbs and Galvalume coating; corrosion-resistance complying with FM 4470.

H. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches (33 mm) wide by 0.10 inch (2.5 mm) thick; Firestone Termination Bar by Firestone.

I. Cut Edge Sealant: Synthetic rubber-based, for use where membrane reinforcement is exposed; UltraPly TPO Cut Edge Sealant by Firestone.

J. General Purpose Sealant: EPDM-based, one part, white general purpose sealant; UltraPly TPO General Purpose Sealant by Firestone.

K. Molded Flashing Accessories: Unreinforced TPO membrane pre-molded to suit a variety of flashing details, including pipe boots, inside corners, outside corners, etc.; UltraPly TPO Small and Large Pipe Flashing by Firestone.

L. Roof Walkway Pads: Non-reinforced TPO walkway pads, 0.130 inch by 30 inches x length shown on drawings with patterned traffic bearing surface; UltraPly TPO Walkway Pads by Firestone.

2.04 ROOF INSULATION AND COVER BOARDS

A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with glass reinforced mat laminated to faces, complying with ASTM C 1289 Type II Class 1, with the following additional characteristics:
   1. Thickness: As Shown.
   2. Size: 48 inches by 96 inches, nominal.
   3. Compressive Strength: 20 psi (138 kPa) when tested in accordance with ASTM C 1289.
   4. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
   5. Recycled Content: 19 percent post-consumer and 15 percent post-industrial, average.

B. Gypsum-Based Cover Board: Non-combustible, water resistant gypsum core with embedded glass mat facers, complying with ASTM C 1177/C 1177M, and with the following additional characteristics:
   1. Size: 48 inches by 96 inches, nominal.
      a. Exception: Board to be attached using adhesive or asphalt may be no larger than 48 inches by 48 inches, nominal.
   2. Thickness: 1/4"
   3. Surface Water Absorption: 2.5 g, maximum, when tested in accordance with ASTM C 473.

4. Spanning Capability: Recommended by manufacturer
5. Surface Burning Characteristics: Flame spread of 0, smoke developed of 0, when tested in accordance with ASTM E 84.
6. Combustibility: Non-combustible, when tested in accordance with ASTM E 136.
7. Mold Growth Resistance: Zero growth, when tested in accordance with ASTM D 3273 for minimum of 4 weeks.

C. Insulation Fasteners: Type and size as required by roof membrane manufacturer for roofing system and warranty to be provided; use only fasteners furnished by roof membrane manufacturer.

2.05 ACCESSORY MATERIALS

A. Wood Nailers: PS 20 dimension lumber, Structural Grade No. 2 or better Southern Pine, Douglas Fir; or PS 1, APA Exterior Grade plywood
1. Width: 3-1/2 inches nominal minimum, or as wide as the nailing flange of the roof accessory to be attached to it.
2. Thickness: Same as thickness of roof insulation.

PART 3 - INSTALLATION

3.01 GENERAL

A. Install roofing, insulation, flashings, and accessories in accordance with roofing manufacturer's published instructions and recommendations for the specified roofing system. Where manufacturer provides no instructions or recommendations, follow good roofing practices and industry standards. Comply with federal, state, and local regulations.

B. Obtain all relevant instructions and maintain copies at project site for duration of installation period.

C. Do not start work until Pre-Installation Notice has been submitted to manufacturer as notification that this project requires a manufacturer's warranty.

D. Perform work using competent and properly equipped personnel.

E. Temporary closures, which ensure that moisture does not damage any completed section of the new roofing system, are the responsibility of the applicator. Completion of flashings, terminations, and temporary closures shall be completed as required to provide a watertight condition.

F. Install roofing membrane only when surfaces are clean, dry, smooth and free of snow or ice; do not apply roofing membrane during inclement weather or when ambient conditions will not allow proper application; consult manufacturer for recommended procedures during cold weather. Do not work with sealants and adhesives when material temperature is outside the range of 60 to 80 degrees F (15 to 25 degrees C).

G. Protect adjacent construction, property, vehicles, and persons from damage related to roofing work; repair or restore damage caused by roofing work.
   1. Protect from spills and overspray from bitumen, adhesives, sealants and coatings.
   2. Particularly protect metal, glass, plastic, and painted surfaces from bitumen, adhesives, and sealants within the range of wind-borne overspray.
   3. Protect finished areas of the roofing system from roofing related work traffic and traffic by other trades.

H. Until ready for use, keep materials in their original containers as labeled by the manufacturer.

I. Consult membrane manufacturer's instructions, container labels, and Material Safety Data Sheets (MSDS) for specific safety instructions. Keep all adhesives, sealants, primers and cleaning materials away from all sources of ignition.

3.02 EXAMINATION

A. Examine roof deck to determine that it is sufficiently rigid to support installers and their mechanical equipment and that deflection will not strain or rupture roof components or deform deck.

B. Verify that surfaces and site conditions are ready to receive work. Correct defects in the substrate before commencing with roofing work.

C. Examine roof substrate to verify that it is properly sloped to drains.

D. Verify that the specifications and drawing details are workable and not in conflict with the roofing manufacturer's recommendations and instructions; start of work constitutes acceptable of project conditions and requirements.

3.03 PREPARATION

A. Take appropriate measures to ensure that fumes from adhesive solvents are not drawn into the building through air intakes.

B. Prior to proceeding, prepare roof surface so that it is clean, dry, and smooth, and free of sharp edges, fins, roughened surfaces, loose or foreign materials, oil, grease and other materials that may damage the membrane.

C. Fill all surface voids in the immediate substrate that are greater than 1/4 inch (6 mm) wide with fill material acceptable to membrane manufacturer.

D. Seal, grout, or tape deck joints, where needed, to prevent bitumen seepage into building.

3.04 INSULATION AND COVER BOARD INSTALLATION

A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.

B. Install only as much insulation as can be covered with the completed roofing system before the end of the day's work or before the onset of inclement weather.

C. Lay roof insulation in courses parallel to roof edges.

D. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch (6 mm). Fill gaps greater than 1/4 inch (6 mm) with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch (6 mm).

F. Mechanical Fastening: Using specified fasteners and insulation plates engage fasteners through insulation into deck to depth and in pattern required by Factory Mutual for FM Class specified in PART 2 and membrane manufacturer, whichever is more stringent.

3.05 ELASTOMERIC MEMBRANE INSTALLATION

A. Beginning at low point of roof, place membrane without stretching over substrate and allow to relax at least 30 minutes before attachment or splicing; in colder weather allow for longer relax time.

B. Lay out the membrane pieces so that field and flashing splices are installed to shed water.

C. Install membrane without wrinkles and without gaps or fishmouths in seams; bond and test seams and laps in accordance with membrane manufacturer's instructions and details.

D. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches (1:6) using mechanically fastened reinforced perimeter fastening strips, plates, or metal edging as indicated or as recommended by roofing manufacturer.
   1. Exceptions: Round pipe penetrations less than 18 inches (460 mm) in diameter and square penetrations less than 4 inches (200 mm) square.

3.06 FLASHING AND ACCESSORIES INSTALLATION

A. Install flashings, including laps, splices, joints, bonding, adhesion, and attachment, as required by membrane manufacturer's recommendations and details.

B. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.

C. Roofing Expansion Joints: Install as shown on drawings and as recommended by roofing manufacturer.

D. Flashing at Walls, Curbs, and Other Vertical and Sloped Surfaces: Install weathertight flashing at all walls, curbs, parapets, curbs, skylights, and other vertical and sloped surfaces that the roofing membrane abuts to; extend flashing at least 8 inches (200 mm) high above membrane surface.
   1. Use the longest practical flashing pieces.
   2. Evaluate the substrate and overlay and adjust installation procedure in accordance with membrane manufacturer's recommendations.

3. Complete the splice between flashing and the main roof sheet with specified splice adhesive before adhering flashing to the vertical surface.
4. Provide termination directly to the vertical substrate as shown on roof drawings.

E. Roof Drains:
1. Taper insulation around drain to provide smooth transition from roof surface to drain. Use specified pre-manufactured tapered insulation with facer or suitable bonding surface to achieve slope; slope not to exceed manufacturer's recommendations.
2. Position membrane, then cut a hole for roof drain to allow 1/2 to 3/4 inch (12 to 19 mm) of membrane to extend inside clamping ring past drain bolts.
3. Make round holes in membrane to align with clamping bolts; do not cut membrane back to bolt holes.
4. Apply sealant on top of drain bowl where clamping ring seats below the membrane
5. Install roof drain clamping ring and clamping bolts; tighten clamping bolts to achieve constant compression.

F. Flashing at Penetrations: Flash all penetrations passing through the membrane; make flashing seals directly to the penetration.
1. Pipes, Round Supports, and Similar Items: Flash with specified pre-molded pipe flashings wherever practical; otherwise use specified self-curing elastomeric flashing.
2. Pipe Clusters and Unusual Shaped Penetrations: Provide penetration pocket at least 2 inches (50 mm) deep, with at least 1 inch (25 mm) clearance from penetration, sloped to shed water.
3. Structural Steel Tubing: If corner radii are greater than 1/4 inch (6 mm) and longest side of tube does not exceed 12 inches (305 mm), flash as for pipes; otherwise, provide a standard curb with flashing.
4. Flexible and Moving Penetrations: Provide weathertight gooseneck set in sealant and secured to deck, flashed as recommended by manufacturer.
5. High Temperature Surfaces: Where the in-service temperature is, or is expected to be, in excess of 180 degrees F (82 degrees C), protect the elastomeric components from direct contact with the hot surfaces using an intermediate insulated sleeve as flashing substrate as recommended by membrane manufacturer.

3.07 FINISHING AND WALKWAY INSTALLATION

A. Install walkways at access points to the roof, around rooftop equipment that may require maintenance, and where indicated on the drawings.

3.08 FIELD QUALITY CONTROL

A. Inspection by Manufacturer: Provide final inspection of the roofing system by a Technical Representative employed by roofing system manufacturer specifically to inspect installation for warranty purposes (i.e. not a sales person).

B. Perform all corrections necessary for issuance of warranty.

3.09 CLEANING

A. Clean all contaminants generated by roofing work from building and surrounding areas, including bitumen, adhesives, sealants, and coatings.

B. Repair or replace building components and finished surfaces damaged or defaced due to the work of this section; comply with recommendations of manufacturers of components and surfaces.

C. Remove leftover materials, trash, debris, equipment from project site and surrounding areas.

3.10 PROTECTION

A. Where construction traffic must continue over finished roof membrane, provide durable protection and replace or repair damaged roofing to original condition.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install metal flashing and sheet metal work specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Job Supervision: Applicator of work in this Section to furnish competent, qualified foreman present and in charge at all times work is performed.

B. Applicable Standard: Refer to the latest edition of the "Architectural Sheet Metal Manual" of the Sheet Metal and Air Conditioning Contractors National Association, Inc. Use as applicable standard for method and quality of work under this Section where not specifically otherwise shown on Contract Drawings. Manufacturer to provide trained metal craftsmen to supervise installation.

1.05 WARRANTY

A. Provide manufacturer's guarantee for exterior color finish for a period of 20 years against blistering, peeling, cracking, flaking, checking, chipping and excessive color change and chalking. Color change not to exceed 5 N.B.S. units (per ASTM D-2244.64T) and chalking not less than rating of 8 per ASTM D-659.

B. Guaranty: Guaranty sheet metal work installed under this Section against leakage or defects for 2 years after substantial completion date. Make good at Contractor expense leakage or defects occurring within this period.

PART 2 - PRODUCTS

2.01 SHEET METAL

A. Galvalume Sheet Steel: Aluminum-zinc alloy coating AZ50, meeting ASTM A792. Keep Galvalume dry during transit, in storage, and at work site.
   1. Finish to be Kynar 500 based polyvinylidene fluoride (PVDF) coating, 70% resin formulation in color to be selected by Architect from manufacturer's standard line.
      a. Primer is applied to 0.20 - 0.30 mils D.F.T. (Dry Film Thickness) and the topcoat at 1.0 - 1.2 mils D.F.T

B. Gauge of Metal:
   1. Metal components of a roof assembly: 24 gauge (USS .025") minimum
   2. Scuppers, guttering, downspouts and splash pans: 22 gauge (USS .0312") minimum. Gutter straps to be 18 gage.
   3. Miscellaneous Flashing: 26 gauge minimum

2.02 PREFINISHED METAL COPING SYSTEM

A. Manufacturer:
   1. OMG EdgeSystems, "Permasnap 2"
   2. Pac-Clad "Pac Anchor-Tite"
   3. Approved equal.

B. Metal coping cap with galvanized steel anchor cleats and gutter support chairs for capping any parapet wall. The system shall be watertight, maintenance free, and not require exposed fasteners or sealant. Joints shall be butt type with concealed splice plates.

C. Performance characteristics:
   1. Coping sections shall expand and contract freely while mechanically locked in place on anchor cleats.
   2. Coping sections shall lock to anchor cleats by mechanical pressure from support chairs.
   3. All coping cover joints shall be underlayed with gutter/support chairs capable of draining water.

D. Metal: 24 gauge galvanized steel

E. Coping vertical face and back leg: standard 4” nominal; custom size by request.

F. Internal splice plates: Shall be concealed with matching finish to maintain outside face continuity.

G. Coping Cleat: 20 gauge galvanized steel anchor cleat normally 12” wide @ 5'-0” on center to be mechanically fastened as indicated and detailed.

H. Fasteners: Shall be stainless steel screw type with a minimum pull-out resistance of 240 # as supplied by the manufacturer per substrate application. No exposed fasteners shall be permitted.

I. Finishes: Kynar-500 in color to be selected by Architect

J. ACCESSORIES
1. Corners, end caps, pier caps, etc. shall be fabricated by the coping manufacturer.

2.03 ACCESSORIES

A. Fasteners: All metal counter flashing and parapet cap flashing shall be attached with galvanized or cadmium plated screws with neoprene washers. Nails, screws and rivets used at other locations are to be the appropriate type for the purpose as described in the latest edition of the SMACNA Design Manual.

B. Solder for Lead: ASTM B 32, 50% tin and 50% lead used with rosin flux.

C. Roofing Cement: F.S. SS-C-153, Type I, Class A (summer grade) or Class B (winter grade) as applicable.

D. Bitumastic Coating: F.S. TT-C-494, MIL-C-18480, or SSPC - Paint 12, cold applied solvent type bitumastic coating for application in dry film thickness of 15 mils per coat.

2.04 FABRICATION

A. Fabricate metal flashings, counterflashings, trim and related items to comply with profiles and sizes required. Fabricate to comply with the latest edition of the SMACNA "Architectural Sheet Metal Manual", metal manufacturer's recommendations, and recognized industry practices.

B. For continuous running work, fabricate with expansion joints in flashings, spaced sufficiently close to prevent flashing damage and failure in resistance to water penetration. Form flashing to fit substrate in each application.

C. Where sheet metal is required and no material or gauge is indicated on the Drawings, furnish and install highest quality and gauge commensurate with the referenced applicable standard, (SMACNA Manual, latest edition).

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Prior to work of this Section, carefully inspect installed work of other trades and verify work is complete to point where this installation may properly commence.

B. Discrepancies: Do not proceed with sheet metal installation in areas of discrepancy until discrepancies are resolved.

3.02 WORKMANSHIP

A. General: Form sheet metal accurately to dimensions and shapes required, watertight and weathertight, with angles and broken surfaces true, sharp, and in straight lines. Where

intercepting other members, cope to an accurate fit and solder securely. Produce flat surfaces free from waves and buckles.

B. Expansion: Allow a 3/8"-1/2" gap in coping caps between each section. Use 3-1/2" wide prefinished 24 gage cover plate over joints.
   1. Set cover plates in visible bead of polyurethane sealant between the cap and cover plate. Wipe joints of excessive sealant.
   2. Attach cover plate at the front and back with hex head cadmium screws with neoprene washers, installed in the gap between the metal cap sections.
   3. Do not exceed maximum length of 10'-0" for cap, fascia and flashing sections. Furnish with factory formed slots or enlarged holes for fasteners.

C. Paint metal in contact with mortar, concrete, and masonry materials with an alkali-resistant coating. Use heavy-bodied bituminous paint or approved equal.

3.03 MISCELLANEOUS FLASHING

A. General:
   1. Where exposed portions are used as a counter-flashings, lap base flashings at least four inches and use thickness of metal as specified for exposed locations.
   2. Exposed edge of flashing may be formed as a receiver for two piece counter flashing.
   3. Terminate exterior edge beyond face of wall approximately 1/4-inch with drip edge where not part of counter flashing.
   4. Turn back edge up 1/4-inch unless noted otherwise where flashing terminates in mortar joint or hollow masonry unit joint.
   5. Terminate interior raised edge in masonry backup unit approximately 2 inches into unit unless shown otherwise.
   6. Under copings terminate both edges beyond face of wall approximately 1/4-inch with drip edge.
   7. Lap end joints not less than four inches. Seal laps with sealant.
   8. Where dowels, reinforcing bars and fastening devices penetrate flashing, seal penetration with sealing compound.
   9. Coordinate with other work to set in a bed of mortar above and below flashing so that total thickness of the two layers of mortar and flashing are same as regular mortar joint.
   10. Where ends of flashing terminate turn ends up 1 inch and fold corners to form dam extending to wall face in vertical mortar or veneer joint.
   11. Turn flashing up not less than 8 inches between masonry wythes or behind exterior veneer.

3.04 SOLDERING

A. General:
   1. Thoroughly clean and tin joint materials prior to soldering.
   2. Perform soldering slowly with well heated copper in order to heat seams thoroughly and to completely fill them with solder.
   3. Make exposed soldering neat, full flowing, and smooth. Do not use solder where dependence upon its strength is a factor.

B. Cleaning: After soldering, thoroughly wash acid flux with soda solution.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install roof accessories specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

PART 2 - PRODUCTS

2.01 ROOF ACCESS LADDER

A. Manufacturer: ALACO Ladder Co., 5167 G Street, Chino, CA 91710-5143, 888-310-7040, or approved equal.

B. Roof Ladder Type 1: Fixed Wall Ladders- Model 564PRPC- Parapet return w/ crossover platform
   1. Fabricated from 6061-T6 aluminum alloy
   2. Model 564 fixed wall ladders include side rails with 1-1/8" (29 mm) round rungs that are serrated and secured with cast aluminum connectors, 4 solid rivets and 3/8" (9.5 mm) thick brackets mounted to the walls. Crossover Platform - The platform consists of GripStrut® floors and 4" (102 mm) high toe boards.
   3. Rest Platform - These platforms consist of GripStrut® floors, 4" (102 mm) high toe boards, 1-1/4" (32 mm) round serrated tube guard railings and cast aluminum railing fittings.
   4. Security Doors - These doors are fabricated from 0.188"(4.8 mm) thick aluminum sheets, with securing piano hinges and hasps.

C. Roof Ladder Type 2: Fixed Wall Ladders- Model 563PR- Parapet return
   1. Model 563 fixed wall ladders include side rails with 1-1/8" (29 mm) round rungs that are serrated and secured with cast aluminum connectors, 4 solid rivets and 3/8" (9.5 mm) thick brackets mounted to the walls.

D. FINISHES & COATINGS: Factory primed for field paint.

2.02 ROOF SCUTTLE AND CURB & SHIP'S LADDER

A. Provide Bilco Co. Type Type NB-20 roof hatch, 30" x 54" with Bil-Guard hatch rail system Model RL-NB, or approved equal by Precision Ladders LLC., factory assembled unit with standard 12" high insulated curb.
   1. Steel: Cover and frame are 14 gauge G-90 paint bond galvanized steel.
   2. Cover: Brakeformed, hollow-metal design with 1" concealed fiberglass insulation, 3" beaded, overlapping flange, fully welded at corners, and internally reinforced for 40 psf live load.
   3. Curb: 12" in height with integral capflashing, 1" fiberboard insulation, fully welded at corners, and 3-1/2" mounting flange with 7/16" holes provided for securing frame to the roof deck.
   4. Gasket: Extruded EPDM rubber gasket permanently adhered to cover.
   5. Hinges: Heavy-duty pintle hinges with 3/8" Type 316 stainless steel hinge pins.
   6. Latch: Slam latch with interior and exterior turn handles and padlock hasps.
   7. Lift Assistance: Compression spring operators enclosed in telescopic tubes. Automatic hold-open arm with grip handle release.
   8. Performance Ratings: Complies with UL 790 Class A (burning brand test).
   9. Finish: Steel: Alkyd base red oxide primer.
   10. Hardware: Engineered composite compression spring tubes and steel compression springs packed in grease. All other hardware is zinc plated/chromate sealed.

B. Aluminum Ships Ladder:
   1. Provide Precision Model SL Aluminum Ships Ladder as manufactured by Precision Ladders, LLC., 1-800-225-7814, or approved equal
      a. Capacity: Unit shall support a 500 lb total load without failure.
      b. Ladder Stringer: 5 inch by 2 inch by 3/16 inch extruded 6005-T5 aluminum channel. Pitch: 60 to 75 degrees.
      c. Ladder Mounting Brackets:
         1) Floor Bracket: 2 inch by 3 inch by 1/4 inch aluminum angle.
         2) Top Bracket: 4-3/4 inch by 5 inch by 1/4 inch aluminum angle.
      d. Handrails: 1-1/4 inches Schedule 40, 6005-T5 aluminum pipe provided with internal aluminum fittings.

PART 3 - EXECUTION

3.01 INSTALLATION OF ROOF ACCESSORIES

A. Install roof accessories complying with manufacturer's installation specifications, accepted shop drawings, and with projection through roof watertight and weathertight.

B. Separate roof accessories metal surfaces from dissimilar metals and from wood substrates, using thick coating of bituminous compound or separation recommended by metal manufacturer to prevent corrosive action.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish labor, materials, tools, and equipment required to completely close (with caulking compound or sealant) all joints to give a finished appearance. Items to be caulked or sealed include but are not limited to the following:
   1. Hollow metal frames.
   2. Exterior doors, louvers, windows and any other openings in exterior walls.
   3. Plumbing fixtures.
   4. Flooring, paving and sidewalk joints.
   5. Joints shown on drawings or specified to be caulked or sealed.
   6. All joints or gaps between similar or dissimilar materials that do not receive closure trim are to be caulked/sealed with the appropriate material as listed in Part 2 of this Section.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Applicators: Use workmen thoroughly skilled and specially trained in techniques of caulking, and completely familiar with manufacturer's published recommendations for caulking material used.

B. Rejection of Installed Caulking: Lack of skill by caulking installers is sufficient ground for Architect to reject installed caulking and to require its removal and complete recaulking at Contractor's expense.

C. Guarantee: Guarantee caulking materials and workmanship, in writing for 2 years after substantial completion date. Repair at Contractors expense any defects developing within guarantee period.

D. Submit manufacturer's product data sheets and color selection information for every brand and type of sealant, caulk and accessory item proposed for use on this project.

1.05 PRODUCT HANDLING

A. Protection: Protect caulking materials before, during, and after installation. Protect installed work and materials of other trades. In event of damage, immediately make repairs and replacements necessary at Contractor's expense.

B. Storage: Store caulking materials and equipment under conditions recommended by manufacturer. Do not use materials stored for period of time exceeding maximum recommended material shelf-life.

1.06 JOB CONDITIONS

A. Inspection: Carefully inspect installed work of trades and verify work is complete to point where this installation may properly commence.

B. Discrepancies: Do not proceed with installation in areas of discrepancy until discrepancies are fully resolved.

C. Do not install sealants under adverse weather conditions, or when temperatures are not within manufacturer's recommended limitations for installation. Install sealants only when forecasted weather conditions are favorable for proper care and development of high early bond strength.

PART 2 - PRODUCTS

2.01 MATERIALS FOR CAULKING AND SEALING

A. Select caulking materials for specific locations complying with manufacturers recommendations. Provide caulking, sealant and accessory items in color(s) selected to match adjacent materials or as selected by Architect from manufacturer's complete line.

B. VOC Content Of Interior Sealants: Sealants and sealant primers used inside the weatherproofing system shall comply with the following limits for VOC content when calculated according to 40 CFR 59, Subpart D (EPA Method 24):
   1. Architectural Sealants: 250 g/L.
   2. Sealant primers for Nonporous Substrates: 250 g/L.
   3. Sealant primers for Porous Substrates: 775 g/L.

C. Silicone Sealant: Single component, non-sag, gun grade product meeting ASTM C920, Type S, Grade NS, Class 25.
   1. Silicone Sealant 790/791/795 by Dow-Corning Corp.
   2. Sonolastic-OmniPlus by BASF.
   3. Silpruf SCS2000 by GE

D. Silicone Sealant for Weather Barrier Membranes: Refer to Weather Barrier specification and provide Dow Corning 758 Silicone Weather Barrier Sealant.

E. Mildew-Resistant Silicone Sealant: Single component, non-sag, gun grade product meeting ASTM C920, Type S, Grade NS, Class 25.
   1. Silicone Sealant 786 by Dow-Corning Corp.
   2. Sanitary 1700 by GE
   3. Tremsil 200 Sanitary by Tremco

F. Acrylic Latex Caulk (interior only): General purpose, gun grade, nonsag, paintable, nonstaining latex sealant complying with ASTM C834.
   1. Sonolac by Sonnoborn.
   2. AC-20 + Silicone by Pecora.
   3. Tremflex 834 by Tremco.

G. Acoustical Sealant: General purpose, gun grade, nonsag, paintable, nonstaining latex sealant complying with ASTM C834.
   1. SHEETROCK Acoustical Sealant by U.S. Gypsum
   2. AC-20 FTR by Pecora
   3. Acoustical Sealant GSC by Grabber Construction Products
   4. Acoustical Sealant by Tremco

H. Polyurethane Sealant (for vertical surfaces): Single component, non-sag, gun grade product meeting ASTM C920, Type S, Grade NS, Class 25.
   1. NP-1 by BASF.
   2. Vulkem Dymonic FC by Tremco
   3. Dynatrol I by Pecora.
   4. QSC-102 by Carlisle.

I. Polyurethane Sealant (for horizontal surfaces): Single component, non-priming, self leveling, pourable grade product meeting ASTM C920, Type S, Grade P, Class 25.
   1. SL-1 by BASF.
   2. Vulkem 45SSL by Tremco
   3. NR-201 by Pecora.
   4. QSC-131 by Carlisle.

2.02 SEALANT BACKER RODS

A. Sealant Backer Rod for general use except at floor and deck joints: Open cell type as recommended by sealant manufacturer for compatibility with sealant.

B. Sealant Backer Rod for use at floor and deck joints: Closed cell type as recommended by sealant manufacturer for compatibility with sealant.

C. Provide rod sized and shaped to control joint depth for sealant placement, break bond of sealant at bottom of joint, form optimum shape of sealant bead on back side, and provide a highly compressible backer to minimize possibility of sealant extrusion when joint is compressed.

2.03 MISCELLANEOUS MATERIALS

A. Joint Cleaner Compound: Use type recommended by sealant and caulking compound manufacturer for joint surfaces to be cleaned.

B. Joint Primer/Sealer: Use type recommended by sealant manufacturer for joint surfaces to be primed or sealed.

C. Bond Breaker Tape: Use self adhesive polyethylene tape or plastic tape recommended by sealant manufacturer. Apply to sealant-contact surfaces where bond to substrate or joint filler must be avoided for proper performance of sealant.

D. Joint Filler: W.R. Meadows, Sealtight Standard Cork, Expansion Joint Filler produced from clean, selected, granulated cork bonded with a phenolic resin, or approved equal meeting ASTM D 1752, Type II.

2.04 GENERAL APPLICATION GUIDE

A. Interior caulking, except joints with ceramic tile, metal, glass and aluminum: Acrylic Latex Caulk.

B. Sound rated walls, partitions and ceilings: Acoustical Sealant.

C. Interior and Exterior joints with metal, glass and aluminum: Silicone sealant.

D. Joints with ceramic tile and plumbing fixtures: Mildew resistant Silicone sealant.

E. Horizontal and Vertical building joints: Polyurethane sealant.

F. Paving Joints: Refer to Division 32

PART 3 - EXECUTION

3.01 CHOICE OF CAULKING MATERIAL

A. Use sealant and caulking materials best suited to the installation and recommended by caulking material manufacturer.

3.02 INSPECTION

A. Installer must examine substrates, (joint surfaces) and conditions under which joint sealer work is to be performed. Do not proceed with joint sealer work until unsatisfactory conditions are corrected.

3.03 JOINT PREPARATION

A. Clean joint surfaces immediately before installation of gaskets, sealants and caulking compounds. Remove dirt, insecure coatings, moisture and substrates which could interfere with gasket seal and bond of sealant or caulking compound. Etch concrete and

masonry joint surfaces when recommended by sealant manufacturer. Roughen vitreous and glazed joint surfaces recommended by sealant manufacturer.

B. Prime or seal joint surfaces where required, and when recommended by sealant manufacturer. Confine primer/sealer to areas of sealant bond. Do not allow spillage and migration onto adjoining surfaces.

3.04 INSTALLATION

A. Comply with manufacturer's printed instructions except when more stringent requirements are specified, and except when manufacturer's technical representative directs otherwise.

B. Set joint filler units at depth and position in joint as required to coordinate with other work, including installation of bond breakers, backer rods and sealants. Do not leave voids or gaps between ends of joint filler units.

C. Install sealant backer rod except when required to be omitted or recommended to be omitted by sealant manufacturer for application required.

D. Install bond breaker tape when required by manufacturer's recommendations to ensure liquid-applied sealants will perform as intended.

E. Employ proven installation techniques, which ensure sealants are deposited in uniform, continuous ribbon without gaps or air pockets, and with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise required, fill sealant rabbet to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints occur between a horizontal surface and vertical surface, fill joint to form a slight cove, so joint will not trap moisture and dirt.

F. Install liquid-applied sealant to depths required and as recommended by sealant manufacturer.

G. Spillage: Do not allow sealants and compounds to overflow from joint confines or to spill onto adjoining work, or to migrate into voids of exposed finished. Clean adjoining surfaces to eliminate evidence of spillage without damaging adjoining surfaces.

H. Recess edges of exposed joint fillers slightly behind adjoining surfaces, unless otherwise required, so compressed units will not protrude from joints.

I. Acoustical Sealant Application: Comply with recommendations of ASTM C 919 for use of joint sealants in acoustical applications as applicable to materials, applications, and conditions indicated.

1. Where sound rated walls and partitions are penetrated by pipe, conduit, duct, etc.; pack annular space with acoustical fiberglass insulation until flush with both faces of wall. Seal both sides and the entire annular space between the penetrating item and the wall board with acoustical sealant. Also, seal at top and bottom edges of acoustical walls and partitions where wall board abuts a horizontal surface. Joint is to be full and continuous from slab to gypsum board edge at bottom of gypsum board walls.

2. Do not allow any rigid material or connection to bridge the separation between the acoustical construction and the penetrating item. Upon inspection, if bridging is found to exist, all sealed penetrations may be ordered removed and resealed at Contractor's expense.

3.05 CURE AND PROTECTION

A. Cure sealants and caulking compounds in compliance with manufacturer's instructions and recommendations, to obtain high early bond strength, internal cohesive strength and surface durability. Cure and protect sealants in manner which will minimize increases in modules of elasticity and accelerated aging effects.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Provide hollow metal doors and frames required.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Use skilled workmen thoroughly trained and experienced and completely familiar with specified requirements and methods needed for proper performance of work of this Section.

B. Codes and Standards:
1. Manufacture labeled units in strict accordance with specifications and procedures of Underwriters' Laboratories, Inc. Labels must be affixed to rated assemblies.
2. In guarantee and Shop Drawings, apply and use definitions and nomenclature established in American National Standards Institute publication A 123.1 "Nomenclature for Steel Doors and Steel Door Frames."
3. Fire-Rated Units: **Affix metal plates to jamb side or top of door and/or frame stating the appropriate fire rating. Paper labels will not be accepted. Do not apply paint or stain over metal labels. Mask off the label before applying finish and remove masking after finish is dry.**

1.05 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Protection:
1. Deliver, store, and handle hollow metal units to prevent damage and deterioration.
2. Provide packaging of cardboard or containers, separators, banding, spreaders, and paper wrappings to completely protect hollow metal units during transportation and storage.

3. Store units upright, in protected dry area, at least one inch off ground and with at least 1/4" air space between individual pieces. Protect primed and hardware surfaces.
4. Protect installed work and materials of other trades.
5. Avoid use of non-vented plastic or canvas shelters which could create humidity chamber. If cardboard wrapper on door becomes wet, remove carton immediately. Provide 1/4" spaces between stacked units to promote air circulation.

B. Replacements: Inspect hollow metal work upon delivery for damage. Minor damages may be repaired provided finish items are equal in all respects to new work, otherwise, remove and replace damaged items as directed at Contractor's expense.

PART 2 - PRODUCTS

2.01 GENERAL

A. Fabricate hollow metal items rigid, neat in appearance, and free from defects, warp, or buckle.

B. Provide clean cut, straight and true molded members with well-formed and aligned miters.

C. Dress exposed weld joints smooth.

D. Door Clearances: Maximum 1/8" at jambs and heads, 1/8" at meeting edges of pairs of doors, and 3/4" at bottom from finished floorline.

E. Close top and bottom edges of exterior doors flush. Seal against water penetration with flush steel channel fillers.

2.02 ACCEPTABLE MANUFACTURERS

A. Provide hollow metal units by Amweld Building Products, Inc., The Ceco Corp., Curries Mfg. Co., Mesker Industries, Inc., Republic Builders Prod. Corp., Steelcraft, Trussbilt, Inc., or approved equal.

2.03 FACTORY PREPARATION

A. Prepare units to receive hardware scheduled in "Hardware" Section of these specifications and in accordance with ANSI Standards A 115-1 through A 115-17.

B. Cut, mortise, reinforce, drill, and tap units at factory, except drill and tap for surface applied hardware at job when hardware is applied.

C. Prepare door frames for rubber silencers to be provided with frames.

2.04 SHOP PRIME COAT FOR FIELD FINISHED DOORS AND FRAMES

A. Clean, treat, and prime exposed surfaces of hollow metal units, including galvanized surfaces.

B. Clean steel surfaces free of mill scale, rust, oil, grease, dirt, and foreign materials before applying paint.

C. Apply shop coat of rust-inhibiting prime paint of even consistency to provide uniformly finished surface ready to receive finish paint.

2.05 FLUSH TYPE DOORS

A. Form flush type hollow metal doors with outer sheets of minimum 16 gauge, Galvanized, cold rolled steel at exterior doors and with no exposed face seams. Conform to ASTM Designation A 1008.

B. Core material at exterior doors is to be either rigid insulation core glued in place or rigid insulation core foamed in place.
   1. Rigid Insulation Core (Glued): Polystyrene slab, density not less than 1.0 pounds per cubic foot.
   2. Rigid Insulation Core (Foamed-in-Place): Nonburning type having compressive strength and shear strength of not less than 20 p.s.i., an insulation to steel bonding strength at least equal to the strength of the insulation, be dimensionally stable within plus or minus 5% volume after 24-hour exposure to temperatures ranging from minus 15E F. to 200E F., have no voids exceeding 1/2" in any direction, and have density of not less than 1.8 pounds per cubic foot.

2.06 WELDED DOOR FRAMES

A. Form pressed steel frames using cold rolled steel conforming to ASTM Designation A 1008.
   1. Form exterior frames using minimum 14 gauge Galvanized steel.
   2. Form interior frames using minimum 16 gauge Galvanized steel.

B. Secure headers and jambs at corners by external welding of faces. Grind smooth to provide invisible joints.
   1. Knock-Down frames are not acceptable.

C. Provide frames with minimum of 3 anchors per jamb for adjoining wall construction and floor anchors for attachment at floor. Construct anchors using minimum 18 gauge steel.

D. For frames that are to receive concealed closers mounted in the head; provide a cover box to attach to the inside of the frame that will completely cover and protect the closer.

F. Provide lead lined door frames required. Refer to Section 13 0900.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Examine areas and conditions for work of this Section. Correct conditions detrimental to timely and proper completion of the Work. Do not proceed until unsatisfactory conditions are corrected.

3.02 INSTALLATION

A. Install hollow metal units in strict accordance with approved Shop Drawings and manufacturer's recommendations.

B. Set frames accurately, plumbed, aligned, and securely anchored.

C. Install finish hardware in strict accordance with manufacturers' recommendations. Eliminate hinge-bound conditions, making items operate smoothly with secure locking and latching.

3.03 ADJUST AND CLEAN

A. Immediately after installation, sand smooth rusted and damaged prime coat. Apply compatible touch-up air-drying primer.

B. Check and adjust operating finish hardware items, leaving hollow metal units undamaged and in proper operating condition.

C. Excessive filing or grinding of strike plate will not be accepted. Filing and grinding not to exceed 1/8" in any direction.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Provide plastic laminate faced wood doors, complete. Refer to Door Schedule for types and sizes.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Comply with NWMA Industry Standard I.S.1 and Architectural Woodwork Institute Specifications for type doors specified.

B. Markings: Furnish door with stamp, brand, or identifying mark indicating door quality and construction. Identifying mark or separate certification to include inspection organization name, identification of standard for door construction, and identity of plant to which stamp was issued.

1.05 REFERENCE STANDARDS

A. American Society for Testing and Materials: (ASTM) E 152, "Fire Tests of Door Assemblies".

B. National Woodwork Manufacturers Association, Inc.: "Industry Standard 1-Wood Doors", latest revision, and Commercial Standard CS17.

C. Rated doors and frames must meet NFiPA 80 (AFPC V2 703.4.1).

1.06 WARRANTY

A. Warranty: Submit written agreement using door manufacturer's standard form, signed by manufacturer, contractor, and installer, agreeing to repair or replace defective doors which have warped (bow, cup or twist) or which show photographing of construction below in

face veneers, or do not conform to NWMA and AWI tolerance limitations. Warranty period is for lifetime of installation.

B. Limitation and Exclusions:
   1. Improper finishing is considered a defect.
   2. Warp not considered a defect unless it exceeds 1/4 inch in the plane of the door itself. Warp is distortion in the door itself and does not refer to relationship of door to frame. Term "warp" includes bow, cup and twist. Amount of warp in door is measured by placing a straight-edge on the suspected concave face of door at any angle (horizontally, vertically, diagonally), with door in installed position. Measurement of bow, cup, and twist is made at point of maximum distance between bottom of straight-edge and face of door.

1.07 PRODUCT HANDLING

A. Protect doors during transit, storage and installation to prevent damage, soiling and deterioration. Comply with the "On-Site Care" recommendations of NWMA and with manufacturer's instructions.

B. Protection: Store doors in fully covered, well ventilated area. Protect from extreme changes in temperature and humidity.

C. Replace damaged doors at Contractor's expense.

PART 2 - PRODUCTS

2.01 SWINGING DOORS

A. Provide "Perma-Clad" doors by V.T. Industries or "Aspiro" doors by Marsfield-Algoma.

B. Types of Doors:
   1. 404H, PC-HPDL-5: Nonrated and 20 minute rated
   2. 1345H, mineral core, FD-45-HPDL-5, 45-minute rated
   3. 1111H, mineral core, FD-60-HPDL-5 and FD-90-HPDL-5, 60- and 90-minute rated.
   4. 1P15H, particleboard core, LL-20PP-HPDL-7 and LL-45PP-HPDL-7, 20- and 45-minute rated, positive pressure.

C. Compliance: WDMA I.S.1-A.
   1. Aesthetic Grade: Premium.
   2. Duty Level: Extra heavy duty.

D. Door Thickness: 1-3/4 inches.

E. Stiles:
   1. 1-3/8 inches wide, before prefitting.
   2. Structural composite lumber (SCL).
   3. Edged with high-pressure decorative laminate before face laminates.

F. Rails:
1. Structural composite lumber (SCL).
2. Minimum Width Before Prefitting: 1-3/8 inches.

G. Door Assembly:
1. Stiles and rails bonded to core.
2. Monolithically sand core assembly to ensure minimum telegraphing of core components.

H. Laminates:
1. Apply to core in hot press using Type I, exterior, water-resistant adhesive.
2. HPDL to be .050 inch general purpose HPDL as selected by Architect.

I. Stile Edges: Apply laminate edges before application of face laminates.

J. Prefit Doors:
1. Prefit and bevel doors at factory to fit openings.
2. Prefit Tolerances: WDMA I.S.1-A.

K. Factory-machine doors for mortised hardware, including pilot holes for hinge screws and lock fronts required.

L. Top and Bottom Rails: Factory sealed.

M. Install factory vision panels with frame finish as selected by Architect.

2.04 SIDE SLIDING PLASTIC LAMINATED FACED WOOD DOOR

A. Manufacturer: Serenity Door
https://serenityslidingdoor.com/healthcare-sliding-barn-door-systems/

B. Model: 'Medical Slide' MODEL (SM-201 with Serenity Sound Seal system.

C. Door Finish : Plastic Laminate ; Wilsonart Columbian Walnut 7943

D. Door Panel Lite : Glass size Per drawings. Provide wood stop vision lite kid (WVL) stained to match laminate.

E. Hardware: 12" Ladder style pulls. Non-locking , Non-Latching.

F. Door Frame Finish : Anodized Aluminum

PART 3 - EXECUTION

3.01 FABRICATION

A. Fabricate doors complying with Contract Drawings, with this Section and with the referenced standards for types specified.

B. Prefit doors at factory with following clearances:
   1. 1/8" on top and hinge side
   2. 1/8" on lock edge of single doors
   3. 1/16" per leaf on pair meeting edges
   4. Bevel both edges of door (1/8" in 2"). Specific clearances to be shown on door schedule. Field trimming of fire doors will not be allowed.

C. Pre-machine doors for hardware as required by Hardware Schedule in Bid Documents. Hardware Schedule by hardware supplier to be furnished complete with templates for all hardware requiring door preparation. Hollow metal frame schedule to be furnished and to include exact location and size of hardware preparation. No door machining to be required for any totally surface-mounted hardware.

3.02 INSPECTION

A. Examine door frames and verify frames are correct type and have been installed for proper hanging of corresponding doors.

B. Do not proceed with installation until unsatisfactory conditions have been corrected in manner acceptable to Architect.

C. Install doors only after completion of other work which would raise moisture content of doors or damage surface of doors.

3.03 INSTALLATION

A. Fit, hang, and trim doors by openings.

B. Bevel lock edge of doors at rate of 1/8" in 2".

END OF SECTION

PART 1 - GENERAL

1.01 SCOPE

A. Provide aluminum framing specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Fabricate exterior door and frame units to withstand the wind pressure loading shown or, or if not shown, 20 lbs. per sq. ft. on the gross area of the frames, doors, panels and glass, acting inward and also outward.

1.05 WARRANTY

A. Submit a warranty signed by the manufacturer, contractor, installer, agreeing to replace aluminum doors, windows, framing and glazing which fall in materials and workmanship within 2 years of the date of acceptance. Failure of materials or workmanship shall include, but not be limited to, failure in operation of doors, windows, and hardware, excessive leakage of air infiltration, excessive deflections, delamination of panels, deterioration of finish or metal in excess of normal weathering, and defect in accessories, weatherstripping, and other components of the work.
   1. Submit 10 year warranty by manufacturer of polyvinylidene fluoride (PVDF) coating.

1.06 ADJUSTMENT

A. After installation, make adjustments as necessary to insure proper operation of all hardware items.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Manufacturers who produce products that may be submitted to Architect for review are:
   1. Kawneer
   2. Oldcastle BE
   3. EFCO
   4. Tubelite

2.02 FRAMING

A. Provide standard shapes and moldings of Kawneer glazed framing system, or approved equal.
   1. Trifab VG 451T at exterior
   2. Trifab VG 450 at interior

B. Subsill: Manufacturer's standard High-Performance (HP) subsill with sealed end-dams.

C. Storefront System Performance Requirements:
   1. Air Infiltration: The test specimen shall be tested in accordance with ASTM E 283. Air infiltration rate shall not exceed 0.06 cfm/ft^2 at a static air pressure differential of 6.24 psf (300 Pa).), with interior perimeter seal installed.
   2. Water Resistance: The test specimen shall be tested in accordance with ASTM E 331. There shall be no leakage at a minimum static air pressure differential of 10 psf (383 Pa) as defined in AAMA 501.
   3. Uniform Load: A static air design load of 20 psf shall be applied in the positive and negative direction in accordance with ASTM E 330. There shall be no deflection in excess of L/175 of the span of any framing member. At a structural test load equal to 1.5 times the specified design load, no glass breakage or permanent set in the framing members in excess of 0.2% of their clear spans shall occur.
   4. Thermal Transmittance (U-factor): When tested to AAMA Specification 1503, the thermal transmittance (U-factor) shall not be more than: 0.44 (low-e) or 0.61 (clear), as determined by AAMA 507 or NFRC 100.

2.04 ALUMINUM FLASHING AND BREAKMETAL

A. Provide 0.040 thick material for flashing and 0.090 material for breakmetal.

2.05 SEALANTS

A. Shop Applied: Provide GE Silpruf or Dow Corning 795 shop applied silicone sealant, or approved equal.

B. Field Applied:
   1. Structural sealant for glazing perimeter shall be GE SSG Ultra Glaze, Dow Corning 995, or approved equal.
   2. For other joints, select an appropriate sealant for the type of joint, movement and substrates involved. Acceptable products include Tremco Dymeric, GE 1200,

Dow Corning 999, GE Silpruf, Dow Corning 795, Tremco Curtainwall Sealant, Dow Corning 790, PTI 606 Butyl Tape, Tremco Polyshim Tape, or approved equal.

2.06 FINISH

A. Factory finish with oven cured Kynar 500 based polyvinylidene fluoride (PVDF) coating, AAMA 2605 70% resin formulation in color to be selected by Architect from manufacturer's standard line.
   1. Dry Film Thickness, ASTM D1400: 0.20 mil primer coat plus 1.0 mil color coat, 1.20 mil total, minimum thickness.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in compliance with manufacturer's recommendations and accepted shop drawings. Set units plumb, level and true to line, without warp or rack of framing, windows, and doors. Anchor securely in place. Secure to structure with non-staining, non-corrosive shims, anchors, fasteners, spacers, and fillers. Use care in erection so as not to mar, abrade, or stain finished surfaces. Where aluminum is to be placed in contact with steel, concrete and other dissimilar surface, back paint the aluminum before erection with an acceptable bituminous paint.

B. Seal frames with a Silicone approved sealant in color to match frames, making a neat fully weatherproof job. Refer to Section 07 9000, and comply with requirements of that section.

C. Protection: After erection, adequately protect by masking, light motor oil, vaseline or other acceptable covering all exposed parts of the work and the finish from damage by grinding and polishing machines and/or by plaster, lime, cement, acid or other harmful substances.

D. Cleaning: After completion of all other work in the vicinity of the aluminum doors, windows, and framing, remove all masking, vaseline and/or other covering used to protect the work, and thoroughly clean the aluminum surfaces with soap and plain water or a petroleum product such as white gasoline, kerosene, or distillate. Do not use abrasive cleaning agents.

END OF SECTION

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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 commercial door hardware for the following:

1. Swinging doors.

B. Door hardware includes, but is not necessarily limited to, the following:

1. Mechanical door hardware.
2. Electromechanical door hardware.
3. Automatic operators.

C. Related Sections:

1. Division 08 Section “Hollow Metal Doors and Frames”.
2. Division 08 Section “Flush Wood Doors”.
3. Division 08 Section “Radiation Shielding Doors and Frames”.
4. Division 28 Section “Access Control Hardware Devices”.

D. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI A117.1 - Accessible and Usable Buildings and Facilities.
2. ICC/IBC - International Building Code.
3. NFPA 70 - National Electrical Code.
4. NFPA 80 - Fire Doors and Windows.
5. NFPA 101 - Life Safety Code.
6. NFPA 105 - Installation of Smoke Door Assemblies.
7. UL/ULC and CSA C22.2 - Standards for Automatic Door Operators Used on Fire and Smoke Barrier Doors and Systems of Doors.
8. State Building Codes, Local Amendments.

E. Standards: All hardware specified herein shall comply with the following industry standards as applicable. Any undated reference to a standard shall be interpreted as referring to the latest edition of that standard:

1. ANSI/BHMA Certified Product Standards - A156 Series.
2. UL10C - Positive Pressure Fire Tests of Door Assemblies.
3. ANSI/UL 294 - Access Control System Units.

4. UL 305 - Panic Hardware.
5. ANSI/UL 437- Key Locks.

1.3 SUBMITTALS

A. Product Data: Manufacturer's product data sheets including installation details, material descriptions, dimensions of individual components and profiles, operational descriptions and finishes.

B. Door Hardware Schedule: Prepared by or under the supervision of supplier, detailing fabrication and assembly of door hardware, as well as procedures and diagrams. Coordinate the final Door Hardware Schedule with doors, frames, and related work to ensure proper size, thickness, hand, function, and finish of door hardware.

1. Format: Comply with scheduling sequence and vertical format in DHI's "Sequence and Format for the Hardware Schedule."

2. Organization: Organize the Door Hardware Schedule into door hardware sets indicating complete designations of every item required for each door or opening. Organize door hardware sets in same order as in the Door Hardware Sets at the end of Part 3. Submittals that do not follow the same format and order as the Door Hardware Sets will be rejected and subject to resubmission.

3. Content: Include the following information:

   a. Type, style, function, size, label, hand, and finish of each door hardware item.
   b. Manufacturer of each item.
   c. Fastenings and other pertinent information.
   d. Location of door hardware set, cross-referenced to Drawings, both on floor plans and in door and frame schedule.
   e. Explanation of abbreviations, symbols, and codes contained in schedule.
   f. Mounting locations for door hardware.
   g. Door and frame sizes and materials.
   h. Warranty information for each product.

4. Submittal Sequence: Submit the final Door Hardware Schedule at earliest possible date, particularly where approval of the Door Hardware Schedule must precede fabrication of other work that is critical in the Project construction schedule. Include Product Data, Samples, Shop Drawings of other work affected by door hardware, and other information essential to the coordinated review of the Door Hardware Schedule.

C. Shop Drawings: Details of electrified access control hardware indicating the following:

1. Wiring Diagrams: Upon receipt of approved schedules, submit detailed system wiring diagrams for power, signaling, monitoring, communication, and control of the access control system electrified hardware. Differentiate between manufacturer-installed and field-installed wiring. Include the following:

a. Elevation diagram of each unique access controlled opening showing location and interconnection of major system components with respect to their placement in the respective door openings.
b. Complete (risers, point-to-point) access control system block wiring diagrams.
c. Wiring instructions for each electronic component scheduled herein.

2. Electrical Coordination: Coordinate with related sections the voltages and wiring details required at electrically controlled and operated hardware openings.

D. Keying Schedule: After a keying meeting with the owner has taken place prepare a separate keying schedule detailing final instructions. Submit the keying schedule in electronic format. Include keying system explanation, door numbers, key set symbols, hardware set numbers and special instructions. Owner must approve submitted keying schedule prior to the ordering of permanent cylinders/cores.

E. Informational Submittals:

1. Product Test Reports: Indicating compliance with cycle testing requirements, based on evaluation of comprehensive tests performed by manufacturer and witnessed by a qualified independent testing agency.

F. Operating and Maintenance Manuals: Provide manufacturers operating and maintenance manuals for each item comprising the complete door hardware installation in quantity as required in Division 01, Closeout Procedures.

1.4 QUALITY ASSURANCE

A. Manufacturers Qualifications: Engage qualified manufacturers with a minimum 5 years of documented experience in producing hardware and equipment similar to that indicated for this Project and that have a proven record of successful in-service performance.

B. Certified Products: Where specified, products must maintain a current listing in the Builders Hardware Manufacturers Association (BHMA) Certified Products Directory (CPD).

C. Installer Qualifications: A minimum 3 years documented experience installing both standard and electrified door hardware similar in material, design, and extent to that indicated for this Project and whose work has resulted in construction with a record of successful in-service performance.

D. Door Hardware Supplier Qualifications: Experienced commercial door hardware distributors with a minimum 5 years documented experience supplying both mechanical and electromechanical hardware installations comparable in material, design, and extent to that indicated for this Project. Supplier recognized as a factory direct distributor by the manufacturers of the primary materials with a warehousing facility in Project's vicinity. Supplier to have on staff a certified Architectural Hardware Consultant (AHC) available during the course of the Work to consult with Contractor, Architect, and Owner concerning both standard and electromechanical door hardware and keying.

E. Automatic Operator Supplier Qualifications: Power operator products and accessories are required to be supplied and installed through the Norton Preferred Installer (NPI) program.

Suppliers are to be factory trained, certified, and a direct purchaser of the specified power operators and be responsible for the installation and maintenance of the units and accessories indicated for the Project.

F. Source Limitations: Obtain each type and variety of door hardware specified in this section from a single source unless otherwise indicated.

1. Electrified modifications or enhancements made to a source manufacturer's product line by a secondary or third party source will not be accepted.

2. Provide electromechanical door hardware from the same manufacturer as mechanical door hardware, unless otherwise indicated.

G. Each unit to bear third party permanent label demonstrating compliance with the referenced standards.

H. Keying Conference: Conduct conference to comply with requirements in Division 01 Section "Project Meetings." Keying conference to incorporate the following criteria into the final keying schedule document:

1. Function of building, purpose of each area and degree of security required.
2. Plans for existing and future key system expansion.
3. Requirements for key control storage and software.
4. Installation of permanent keys, cylinder cores and software.
5. Address and requirements for delivery of keys.

I. Pre-Submittal Conference: Conduct coordination conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier(s), Installer(s), and Contractor(s) to review proper methods and the procedures for receiving, handling, and installing door hardware.

1. Prior to installation of door hardware, conduct a project specific training meeting to instruct the installing contractors' personnel on the proper installation and adjustment of their respective products. Product training to be attended by installers of door hardware (including electromechanical hardware) for aluminum, hollow metal and wood doors. Training will include the use of installation manuals, hardware schedules, templates and physical product samples as required.
2. Inspect and discuss electrical roughing-in, power supply connections, and other preparatory work performed by other trades.
3. Review sequence of operation narratives for each unique access controlled opening.
4. Review and finalize construction schedule and verify availability of materials.
5. Review the required inspecting, testing, commissioning, and demonstration procedures

J. At completion of installation, provide written documentation that components were applied to manufacturer's instructions and recommendations and according to approved schedule.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Inventory door hardware on receipt and provide secure lock-up and shelving for door hardware delivered to Project site. Do not store electronic access control hardware, software or accessories at Project site without prior authorization.

B. Tag each item or package separately with identification related to the final Door Hardware Schedule, and include basic installation instructions with each item or package.

C. Deliver, as applicable, permanent keys, cylinders, cores, access control credentials, software and related accessories directly to Owner via registered mail or overnight package service. Instructions for delivery to the Owner shall be established at the "Keying Conference".

1.6 COORDINATION

A. Templates: Obtain and distribute to the parties involved templates for doors, frames, and other work specified to be factory prepared for installing standard and electrified hardware. Check Shop Drawings of other work to confirm that adequate provisions are made for locating and installing hardware to comply with indicated requirements.

B. Door Hardware and Electrical Connections: Coordinate the layout and installation of scheduled electrified door hardware and related access control equipment with required connections to source power junction boxes, low voltage power supplies, detection and monitoring hardware, and fire and detection alarm systems.

C. Door and Frame Preparation: Doors and corresponding frames are to be prepared, reinforced and pre-wired (if applicable) to receive the installation of the specified electrified, monitoring, signaling and access control system hardware without additional in-field modifications.

1.7 WARRANTY

A. General Warranty: Reference Division 01, General Requirements. Special warranties specified in this Article shall not deprive Owner of other rights Owner may have under other provisions of the Contract Documents and shall be in addition to, and run concurrent with, other warranties made by Contractor under requirements of the Contract Documents.

B. Warranty Period: Written warranty, executed by manufacturer(s), agreeing to repair or replace components of standard and electrified door hardware that fails in materials or workmanship within specified warranty period after final acceptance by the Owner. Failures include, but are not limited to, the following:

1. Structural failures including excessive deflection, cracking, or breakage.
2. Faulty operation of the hardware.
3. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
4. Electrical component defects and failures within the systems operation.

C. Standard Warranty Period: One year from date of Substantial Completion, unless otherwise indicated.

D. Special Warranty Periods:

1. Ten years for mortise locks and latches.
2. Five years for exit hardware.
3. Twenty five years for manual overhead door closer bodies.
4. Five years for motorized electric latch retraction exit devices.
5. Two years for electromechanical door hardware, unless noted otherwise.

1.8 MAINTENANCE SERVICE

A. Maintenance Tools and Instructions: Furnish a complete set of specialized tools and maintenance instructions as needed for Owner's continued adjustment, maintenance, and removal and replacement of door hardware.

PART 2 - PRODUCTS

2.1 SCHEDULED DOOR HARDWARE

A. General: Provide door hardware for each door to comply with requirements in Door Hardware Sets and each referenced section that products are to be supplied under.

B. Designations: Requirements for quantity, item, size, finish or color, grade, function, and other distinctive qualities of each type of door hardware are indicated in the Door Hardware Sets at the end of Part 3. Products are identified by using door hardware designations, as follows:

1. Named Manufacturer's Products: Product designation and manufacturer are listed for each door hardware type required for the purpose of establishing requirements. Manufacturers' names are abbreviated in the Door Hardware Schedule.

C. Substitutions: Requests for substitution and product approval for inclusive mechanical and electromechanical door hardware in compliance with the specifications must be submitted in writing and in accordance with the procedures and time frames outlined in Division 01, Substitution Procedures. Approval of requests is at the discretion of the architect, owner, and their designated consultants.

2.2 HANGING DEVICES

A. Continuous Geared Hinges: ANSI/BHMA A156.26 Grade 1-600 certified continuous geared hinge. with minimum 0.120-inch thick extruded 6063-T6 aluminum alloy hinge leaves and a minimum overall width of 4 inches. Hinges are non-handed, reversible and fabricated to template screw locations. Factory trim hinges to suit door height and prepare for electrical cut-outs.

1. Manufacturers:

a. Bommer Industries (BO).
b. Pemko (PE).

B. Pivots: ANSI/BHMA A156.4, Grade 1, certified. Space intermediate pivots equally not less than 25 inches on center apart or not more than 35 inches on center for doors over 121 inches

high. Pivot hinges to have oil impregnated bronze bearing in the top pivot and a radial roller and thrust bearing in the bottom pivot with the bottom pivot designed to carry the full weight of the door. Pivots to be UL listed for windstorm where applicable.

1. Manufacturers:

    a. Norton Rixson (RF).

2.3 POWER TRANSFER DEVICES

A. Electrified Quick Connect Continuous Geared Transfer Hinges: Provide electrified transfer continuous geared hinges with a removable service panel cutout accessible without de-mounting door from the frame. Furnish with Molex™ standardized plug connectors with sufficient number of concealed wires (up to 12) to accommodate the electrified functions specified in the Door Hardware Sets. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Wire nut connections are not acceptable.

1. Manufacturers:

    a. Bommer Industries (BO) - SER-QC (# of wires) Option.
    b. Pemko (PE) - SER-QC (# wires) Option.

B. Electric Door Wire Harnesses: Provide electric/data transfer wiring harnesses with standardized plug connectors to accommodate up to twelve (12) wires. Connectors plug directly to through-door wiring harnesses for connection to electric locking devices and power supplies. Provide sufficient number and type of concealed wires to accommodate electric function of specified hardware. Provide a connector for through-door electronic locking devices and from hinge to junction box above the opening. Wire nut connections are not acceptable. Determine the length required for each electrified hardware component for the door type, size and construction, minimum of two per electrified opening.

1. Provide one each of the following tools as part of the base bid contract:

    a. McKinney (MK) - Electrical Connecting Kit: QC-R001.
    b. McKinney (MK) - Connector Hand Tool: QC-R003.

2. Manufacturers:

    a. McKinney (MK) - QC-C Series.

2.4 DOOR OPERATING TRIM

A. Flush Bolts and Surface Bolts: ANSI/BHMA A156.3 and A156.16, Grade 1, certified.

1. Flush bolts to be furnished with top rod of sufficient length to allow bolt retraction device location approximately six feet from the floor.
2. Furnish dust proof strikes for bottom bolts.
3. Surface bolts to be minimum 8” in length and U.L. listed for labeled fire doors and U.L. listed for windstorm components where applicable.

4. Provide related accessories (mounting brackets, strikes, coordinators, etc.) as required for appropriate installation and operation.

5. Manufacturers:

    a. Rockwood (RO).
    b. Trimco (TC).

B. Coordinators: ANSI/BHMA A156.3 certified door coordinators consisting of active-leaf, hold-open lever and inactive-leaf release trigger. Model as indicated in hardware sets.

1. Manufacturers:

    a. Rockwood (RO).
    b. Trimco (TC).

C. Door Push Plates and Pulls: ANSI/BHMA A156.6 certified door pushes and pulls of type and design specified in the Hardware Sets. Coordinate and provide proper width and height as required where conflicting hardware dictates.

1. Push/Pull Plates: Minimum .050 inch thick, size as indicated in hardware sets, with beveled edges, secured with exposed screws unless otherwise indicated.
2. Door Pull and Push Bar Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door unless otherwise indicated.
3. Offset Pull Design: Size, shape, and material as indicated in the hardware sets. Minimum clearance of 2 1/2-inches from face of door and offset of 90 degrees unless otherwise indicated.
4. Fasteners: Provide manufacturer's designated fastener type as indicated in Hardware Sets.

5. Manufacturers:

    a. Rockwood (RO).
    b. Trimco (TC).

2.5 CYLINDERS AND KEYING

A. General: Cylinder manufacturer to have minimum (10) years experience designing secured master key systems and have on record a published security keying system policy.

B. Source Limitations: Obtain each type of keyed cylinder and keys from the same source manufacturer as locksets and exit devices, unless otherwise indicated.

1. Manufacturers:

    a. Sargent Manufacturing (SA).
    b. Match Existing.

C. Cylinder Types: Original manufacturer cylinders able to supply the following cylinder formats and types:

1. Threaded mortise cylinders with rings and cams to suit hardware application.

2. Rim cylinders with back plate, flat-type vertical or horizontal tailpiece, and raised trim ring.
3. Bored or cylindrical lock cylinders with tailpieces as required to suit locks.
4. Tubular deadlocks and other auxiliary locks.
5. Mortise and rim cylinder collars to be solid and recessed to allow the cylinder face to be flush and be free spinning with matching finishes.
6. Keyway: Match Facility Standard.

D. Keying System: Each type of lock and cylinders to be factory keyed.

1. Supplier shall conduct a "Keying Conference" to define and document keying system instructions and requirements.
2. Furnish factory cut, nickel-silver large bow permanently inscribed with a visual key control number as directed by Owner.
3. Existing System: Field verify and key cylinders to match Owner's existing system.

E. Key Quantity: Provide the following minimum number of keys:

1. Change Keys per Cylinder: Three (3).
2. Master Keys (per Master Key Level/Group): Five (5).
3. Construction Keys (where required): Ten (10).

F. Construction Keying: Provide construction master keyed cylinders.

G. Key Registration List (Bitting List):

1. Provide keying transcript list to Owner's representative in the proper format for importing into key control software.
2. Provide transcript list in writing or electronic file as directed by the Owner.

2.6 MECHANICAL LOCKS AND LATCHING DEVICES

A. Mortise Locksets, Grade 1 (Heavy Duty): ANSI/BHMA A156.13, Series 1000, Operational Grade 1 Certified Products Directory (CPD) listed. Locksets are to be manufactured with a corrosion resistant steel case and be field-reversible for handing without disassembly of the lock body.

1. Extended cycle test: Locks to have been cycle tested in ordinance with ANSI/BHMA 156.13 requirements to 14 million cycles or greater.

2. Where specified, provide status indicators with highly reflective color and wording for “locked/unlocked” or “vacant/occupied” with custom wording options if required. Indicator to be located above the cylinder with the inside thumb-turn not blocking the visibility of the indicator status. Indicator window size to be a minimum of 2.1” x 0.6” with a curved design allowing a 180 degree viewing angle with protective covering to prevent tampering.

3. Manufacturers:

a. Sargent Manufacturing (SA) - 8200 Series.
b. No Substitution.

2.7 LOCK AND LATCH STRIKES

A. Strikes: Provide manufacturer's standard strike with strike box for each latch or lock bolt, with curved lip extended to protect frame, finished to match door hardware set, unless otherwise indicated, and as follows:

1. Flat-Lip Strikes: For locks with three-piece antifriction latchbolts, as recommended by manufacturer.
2. Extra-Long-Lip Strikes: For locks used on frames with applied wood casing trim.
3. Aluminum-Frame Strike Box: Provide manufacturer's special strike box fabricated for aluminum framing.
4. Double-lipped strikes: For locks at double acting doors. Furnish with retractable stop for rescue hardware applications.

B. Standards: Comply with the following:

1. Strikes for Mortise Locks and Latches: BHMA A156.13.
2. Strikes for Bored Locks and Latches: BHMA A156.2.
3. Strikes for Auxiliary Deadlocks: BHMA A156.36.
4. Dustproof Strikes: BHMA A156.16.

2.8 ELECTROMAGNETIC LOCKING DEVICES

A. Surface Electromagnetic Locks (Heavy Duty): Electromagnetic locks to be surface mounted type tested to ANSI A156.23, Grade 2 with minimum holding force strength of 1,200 pounds. Locks to be capable of accepting between 12 to 24 volts direct current and be UL listed for use on fire rated door assemblies. Electromagnetic coils are to consume no more than 1.5W during normal operation. Locks are to have an integrated door position switch, tamper switch, and lock bond sensor. Locks are to have integrated motion sensor and/or security camera as indicated in the hardware sets. Locks to be capable of detecting door prop conditions and entering low power mode. Provide mounting accessories as needed to suit opening conditions. Power supply to be by the same manufacturer as the lock with combined products having a lifetime replacement warranty.

1. Manufacturers:

a. Securitron (SU) - M680E Series.

2.9 ELECTRIC STRIKES

A. Standard Electric Strikes: Electric strikes tested to ANSI/BHMA A156.31, Grade 1, for use on non-rated or fire rated openings. Strikes shall be of stainless steel construction tested to a minimum of 1500 pounds of static strength and 70 foot-pounds of dynamic strength with a minimum endurance of 1 million operating cycles. Provide strikes with 12 or 24 VDC capability, fail-secure unless otherwise specified. Where specified provide latchbolt and latchbolt strike monitoring indicating both the position of the latchbolt and locked condition of the strike.

1. Manufacturers:

a. HES (HS) - 1500/1600 Series.

B. Provide electric strikes with in-line power controller and surge suppressor by the same manufacturer as the strike with the combined products having a five year warranty.

2.10 CONVENTIONAL EXIT DEVICES

A. General Requirements: All exit devices specified herein shall meet or exceed the following criteria:

1. At doors not requiring a fire rating, provide devices complying with NFPA 101 and listed and labeled for "Panic Hardware" according to UL305. Provide proper fasteners as required by manufacturer including sex nuts and bolts at openings specified in the Hardware Sets.

2. Where exit devices are required on fire rated doors, provide devices complying with NFPA 80 and with UL labeling indicating "Fire Exit Hardware". Provide devices with the proper fasteners for installation as tested and listed by UL. Consult manufacturer’s catalog and template book for specific requirements.

3. Except on fire rated doors, provide exit devices with hex key dogging device to hold the pushbar and latch in a retracted position. Provide optional keyed cylinder dogging on devices where specified in Hardware Sets.

4. Devices must fit flat against the door face with no gap that permits unauthorized dogging of the push bar. The addition of filler strips is required in any case where the door light extends behind the device as in a full glass configuration.

5. Lever Operating Trim: Where exit devices require lever trim, furnish manufacturer's heavy duty escutcheon trim with threaded studs for thru-bolts.

   a. Lock Trim Design: As indicated in Hardware Sets, provide finishes and designs to match that of the specified locksets.
   b. Where function of exit device requires a cylinder, provide a cylinder (Rim or Mortise) as specified in Hardware Sets.

6. Vertical Rod Exit Devices: Where surface or concealed vertical rod exit devices are used at interior openings, provide as less bottom rod (LBR) unless otherwise indicated. Provide dust proof strikes where thermal pins are required to project into the floor.

7. Narrow Stile Applications: At doors constructed with narrow stiles, or as specified in Hardware Sets, provide devices designed for maximum 2” wide stiles.

8. Dummy Push Bar: Nonfunctioning push bar matching functional push bar.

9. Extended cycle test: Devices to have been cycle tested 50 million cycles.

10. Rail Sizing: Provide exit device rails factory sized for proper door width application.

11. Through Bolt Installation: For exit devices and trim as indicated in Door Hardware Sets.

B. Conventional Push Rail Exit Devices (Heavy Duty): ANSI/BHMA A156.3, Grade 1 Certified Products Directory (CPD) listed panic and fire exit hardware devices furnished in the functions specified in the Hardware Sets. Exit device latch to be stainless steel, pullman type, with deadlock feature.

1. Manufacturers:

a. Sargent Manufacturing (SA) - 80 Series.
b. No Substitution.

2.11 DOOR CLOSERS

A. All door closers specified herein shall meet or exceed the following criteria:

1. General: Door closers to be from one manufacturer, matching in design and style, with the same type door preparations and templates regardless of application or spring size. Closers to be non-handed with full sized covers.

2. Standards: Closers to comply with UL-10C for Positive Pressure Fire Test and be U.L. listed for use of fire rated doors.

3. Size of Units: Comply with manufacturer's written recommendations for sizing of door closers depending on size of door, exposure to weather, and anticipated frequency of use. Where closers are indicated for doors required to be accessible to the Americans with Disabilities Act, provide units complying with ANSI ICC/A117.1.

4. Closer Arms: Provide heavy duty, forged steel closer arms unless otherwise indicated in Hardware Sets.

5. Closers shall not be installed on exterior or corridor side of doors; where possible install closers on door for optimum aesthetics.

6. Closer Accessories: Provide door closer accessories including custom templates, special mounting brackets, spacers and drop plates as required for proper installation. Provide through-bolt and security type fasteners as specified in the hardware sets.

B. Door Closers, Surface Mounted (Large Body Cast Iron): ANSI/BHMA A156.4, Grade 1 Certified Products Directory (CPD) listed surface mounted, heavy duty door closers with complete spring power adjustment, sizes 1 thru 6; and fully operational adjustable according to door size, frequency of use, and opening force. Closers to be rack and pinion type, one piece cast iron body construction, with adjustable backcheck and separate non-critical valves for closing sweep and latch speed control.

1. Manufacturers:

a. Norton Rixson (NO) - 9500 Series.
b. Sargent Manufacturing (SA) - 281 Series.

2.12 ELECTROHYDRAULIC DOOR OPERATORS

A. General: Provide low energy operators of size recommended by manufacturer for door size, weight, and movement; for condition of exposure; and for compliance with UL 325. Coordinate operator mechanisms with door operation, hinges, and activation devices.

1. Fire-Rated Doors: Provide door operators for fire-rated door assemblies that comply with NFPA 80 for fire-rated door components and are listed and labeled by a qualified testing agency.

B. Standard: Certified ANSI/BHMA A156.19.

C. Performance Requirements:

1. Opening Force if Power Fails: Not more than 15 lbf required to release a latch if provided, not more than 30 lbf required to manually set door in motion, and not more than 15 lbf required to fully open door.
2. Entrapment Protection: Not more than 15 lbf required to prevent stopped door from closing or opening.

D. Configuration: Surface mounted or in-ground as required. Door operators to control single swinging and pair of swinging doors.

E. Operation: Power opening and spring closing operation capable of meeting ANSI A117.1 accessibility guideline. Provide time delay for door to remain open before initiating closing cycle as required by ANSI/BHMA A156.19. When not in automatic mode, door operator to function as manual door closer with fully adjustable opening and closing forces, with or without electrical power.

F. Features: Operator units to have full feature adjustments for door opening and closing force and speed, backcheck, motor assist acceleration from 0 to 30 seconds, time delay, vestibule interface delay, obstruction recycle, and hold open time from 0 up to 30 seconds.

G. Provide outputs and relays on board the operator to allow for coordination of exit device latch retraction, electric strikes, magnetic locks, card readers, safety and motion sensors and specified auxiliary contacts.

H. Brackets and Reinforcements: Manufacturer's standard, fabricated from aluminum with nonferrous shims for aligning system components.

I. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Norton Rixson (NO) - 6000 Series.
2. No Substitution.

2.13 ARCHITECTURAL TRIM

A. Door Protective Trim

1. General: Door protective trim units to be of type and design as specified below or in the Hardware Sets.

2. Size: Fabricate protection plates (kick, armor, or mop) not more than 2" less than door width (LDW) on stop side of single doors and 1" LDW on stop side of pairs of doors, and not more than 1" less than door width on pull side. Coordinate and provide proper width and height as required where conflicting hardware dictates. Height to be as specified in the Hardware Sets.

3. Where plates are applied to fire rated doors with the top of the plate more than 16" above the bottom of the door, provide plates complying with NFPA 80. Consult manufacturer's catalog and template book for specific requirements for size and applications.

4. Protection Plates: ANSI/BHMA A156.6 certified protection plates (kick, armor, or mop), fabricated from the following:

    a. Stainless Steel: 300 grade, 050-inch thick.

5. Options and fasteners: Provide manufacturer's designated fastener type as specified in the Hardware Sets. Provide countersunk screw holes.

6. Manufacturers:

    a. Rockwood (RO).
    b. Trimco (TC).

2.14 DOOR STOPS AND HOLDERS

A. General: Door stops and holders to be of type and design as specified below or in the Hardware Sets.

B. Door Stops and Bumpers: ANSI/BHMA A156.16, Grade 1 certified door stops and wall bumpers. Provide wall bumpers, either convex or concave types with anchorage as indicated, unless floor or other types of door stops are specified in Hardware Sets. Do not mount floor stops where they will impede traffic. Where floor or wall bumpers are not appropriate, provide overhead type stops and holders.

1. Manufacturers:

    a. Rockwood (RO).
    b. Trimco (TC).

C. Overhead Door Stops and Holders: ANSI/BHMA A156.8, Grade 1 Certified Products Directory (CPD) listed overhead stops and holders to be surface or concealed types as indicated in Hardware Sets. Track, slide, arm and jamb bracket to be constructed of extruded bronze and shock absorber spring of heavy tempered steel. Provide non-handed design with mounting brackets as required for proper operation and function.

1. Manufacturers:

    a. Norton Rixson (RF).

b. Sargent Manufacturing (SA).

2.15 ARCHITECTURAL SEALS

A. General: Thresholds, weatherstripping, and gasket seals to be of type and design as specified below or in the Hardware Sets. Provide continuous weatherstrip gasketing on exterior doors and provide smoke, light, or sound gasketing on interior doors where indicated. At exterior applications provide non-corrosive fasteners and elsewhere where indicated.

B. Smoke Labeled Gasketing: Assemblies complying with NFPA 105 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for smoke control ratings indicated, based on testing according to UL 1784.

1. Provide smoke labeled perimeter gasketing at all smoke labeled openings.

C. Fire Labeled Gasketing: Assemblies complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to UL-10C.

1. Provide intumescent seals as indicated to meet UL10C Standard for Positive Pressure Fire Tests of Door Assemblies, and NPFA 252, Standard Methods of Fire Tests of Door Assemblies.

D. Sound-Rated Gasketing: Assemblies that are listed and labeled by a testing and inspecting agency, for sound ratings indicated.

E. Replaceable Seal Strips: Provide only those units where resilient or flexible seal strips are easily replaceable and readily available from stocks maintained by manufacturer.

F. Manufacturers:

1. Pemko (PE).
2. Reese Enterprises, Inc. (RE).

2.16 ELECTRONIC ACCESSORIES

A. Request-to-Exit Motion Sensor: Request-to-Exit Sensors motion detectors specifically designed for detecting exiting through a door from the secure area to a non-secure area. Include built-in timers (up to 60 second adjustable timing), door monitor with sounder alert, internal vertical pointability coverage, 12VDC or 24VDC power and selectable relay trigger with fail safe/fail secure modes.

1. Manufacturers:

a. Alarm Controls (AK) - SREX Series.
b. Securitron (SU) - XMS Series.

B. Door Position Switches: Door position magnetic reed contact switches specifically designed for use in commercial door applications. On recessed models the contact and magnetic housing snap-lock into a 1" diameter hole. Surface mounted models include wide gap distance design

complete with armored flex cabling. Provide SPDT, N/O switches with optional Rare Earth Magnet installation on steel doors with flush top channels.

1. Manufacturers:

    a. Sargent Manufacturing (SA) - 3280 Series.
    b. Securitron (SU) - DPS Series.

C. Switching Power Supplies: Provide power supplies with either single or dual voltage configurations at 12 or 24VDC. Power supplies shall have battery backup function with an integrated battery charging circuit and shall provide capability for power distribution, direct lock control and Fire Alarm Interface (FAI) through add on modules. Power supplies shall be expandable up to 16 individually protected outputs. Output modules shall provide individually protected, continuous outputs and/or individually protected, relay controlled outputs.

1. Provide the least number of units, at the appropriate amperage level, sufficient to exceed the required total draw for the specified electrified hardware and access control equipment.

2. Manufacturers:

    a. Securitron (SU) - AQD Series.

2.17 FABRICATION

A. Fasteners: Provide door hardware manufactured to comply with published templates generally prepared for machine, wood, and sheet metal screws. Provide screws according to manufacturers recognized installation standards for application intended.

2.18 FINISHES

A. Standard: Designations used in the Hardware Sets and elsewhere indicate hardware finishes complying with ANSI/BHMA A156.18, including coordination with traditional U.S. finishes indicated by certain manufacturers for their products.

B. Provide quality of finish, including thickness of plating or coating (if any), composition, hardness, and other qualities complying with manufacturer's standards, but in no case less than specified by referenced standards for the applicable units of hardware

C. Protect mechanical finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine scheduled openings, with Installer present, for compliance with requirements for installation tolerances, labeled fire door assembly construction, wall and floor construction, and other conditions affecting performance.

B. Notify architect of any discrepancies or conflicts between the door schedule, door types, drawings and scheduled hardware. Proceed only after such discrepancies or conflicts have been resolved in writing.

3.2 PREPARATION

A. Hollow Metal Doors and Frames: Comply with ANSI/DHI A115 series.

B. Wood Doors: Comply with ANSI/DHI A115-W series.

3.3 INSTALLATION

A. Install each item of mechanical and electromechanical hardware and access control equipment to comply with manufacturer's written instructions and according to specifications.

1. Installers are to be trained and certified by the manufacturer on the proper installation and adjustment of fire, life safety, and security products including: hanging devices; locking devices; closing devices; and seals.

B. Mounting Heights: Mount door hardware units at heights indicated in following applicable publications, unless specifically indicated or required to comply with governing regulations:

1. Standard Steel Doors and Frames: DHI's "Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames."
2. DHI TDH-007-20: Installation Guide for Doors and Hardware.
3. Where indicated to comply with accessibility requirements, comply with ANSI A117.1 "Accessibility Guidelines for Buildings and Facilities."
4. Provide blocking in drywall partitions where wall stops or other wall mounted hardware is located.

C. Retrofitting: Install door hardware to comply with manufacturer's published templates and written instructions. Where cutting and fitting are required to install door hardware onto or into surfaces that are later to be painted or finished in another way, coordinate removal, storage, and reinstallation of surface protective trim units with finishing work specified in Division 9 Sections. Do not install surface-mounted items until finishes have been completed on substrates involved.

D. Thresholds: Set thresholds for exterior and acoustical doors in full bed of sealant complying with requirements specified in Division 7 Section "Joint Sealants."

E. Storage: Provide a secure lock up for hardware delivered to the project but not yet installed. Control the handling and installation of hardware items so that the completion of the work will not be delayed by hardware losses before and after installation.

3.4 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

3.5 ADJUSTING

A. Initial Adjustment: Adjust and check each operating item of door hardware and each door to ensure proper operation or function of every unit. Replace units that cannot be adjusted to operate as intended. Adjust door control devices to compensate for final operation of heating and ventilating equipment and to comply with referenced accessibility requirements.

3.6 CLEANING AND PROTECTION

A. Protect all hardware stored on construction site in a covered and dry place. Protect exposed hardware installed on doors during the construction phase. Install any and all hardware at the latest possible time frame.

B. Clean adjacent surfaces soiled by door hardware installation.

C. Clean operating items as necessary to restore proper finish. Provide final protection and maintain conditions that ensure door hardware is without damage or deterioration at time of owner occupancy.

3.7 DEMONSTRATION

A. Instruct Owner's maintenance personnel to adjust, operate, and maintain mechanical and electromechanical door hardware.

3.8 DOOR HARDWARE SETS

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set

should be scheduled with the appropriate additional hardware required for proper application and functionality.

1. Quantities listed are for each pair of doors, or for each single door.

2. The supplier is responsible for handing and sizing all products.

3. Where multiple options for a piece of hardware are given in a single line item, the supplier shall provide the appropriate application for the opening.

4. At existing openings with new hardware the supplier shall field inspect existing conditions prior to the submittal stage to verify the specified hardware will work as required. Provide alternate solutions and proposals as needed.

B. Manufacturer's Abbreviations:

1. MK - McKinney
2. PE - Pemko
3. RF - Rixson
4. RO - Rockwood
5. SA - SARGENT
6. SU - Securitron
7. HS - HES
8. NO - Norton
9. OT - Other

Hardware Sets

Set: 1.0
Doors: C7A
Description: Ext - Pair - CVR/NL - ELR - Card Reader - Closer/stop

2	Continuous Hinge	CFM__HD1 SERxx		PE
1	CVR Exit, Exit Only	56 MD8610 EO	US32D	SA
1	CVR Exit, Nightlatch	DG1 56 MD8610 106	US32D	SA
2	Offset Door Pull	RM7220-36 Mtg-Type 12HD	US32D	RO
2	Surface Closer	281 CPS	EN	SA
1	Threshold	273x292AFGPK		PE
2	Sweep	315CN		PE
2	ElectroLynx Harness	QC-Cxxx sized for door width		MK
2	ElectroLynx Harness	QC-C1500P		MK
1	Card Reader	By security provider		OT
2	Position Switch	DPS-M-BK		SU
1	Power Supply	AQD6		SU

Notes:
Weatherstripping by Alum Door manufacturer

Coordinate voltage, operation and electrical characteristics with all related trades.

Card Reader, wiring and connections by security provider.

Set: 2.0
Doors: 1002A, C4A
Description: Ext - Pair - CVR/NL - ELR - Card Reader - Auto Operator

2	Continuous Hinge	CFM__HD1 SERxx		PE
1	CVR Exit, Exit Only	56 MD8610 EO	US32D	SA
1	CVR Exit, Nightlatch	DG1 56 MD8610 106	US32D	SA
2	Offset Door Pull	RM7220-36 Mtg-Type 12HD	US32D	RO
2	Automatic Opener	6000 Series	689	NO
1	Threshold	273x292AFGPK		PE
2	Sweep	315CN		PE
2	ElectroLynx Harness	QC-Cxxx sized for door width		MK
2	ElectroLynx Harness	QC-C1500P		MK
1	Card Reader	By security provider		OT
2	Position Switch	DPS-M-BK		SU
2	Touchless Switch (Microwave)	[673 | 674]		NO
1	Power Supply	AQD6		SU

Notes:
Weatherstripping by Alum Door manufacturer

Coordinate voltage, operation and electrical characteristics with all related trades.

Card Reader, wiring and connections by security provider.

Set: 3.0
Doors: 183A
Description: Pair - Storeroom - Elec Strk - RX - AFB - Card Reader - Closer - DC

1	Continuous Hinge	CFM__HD1		PE
1	Continuous Hinge	CFM__HD1 SERxx		PE
1	Automatic Flush Bolt	2842/2942	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Storeroom/Closet Lock	8204 LNP	US26D	SA
1	Electric Strike	1600-CLB-LMS	630	HS
1	Coordinator	2672	US28	RO
2	Mounting Bracket	2601AB or 2601C	US28	RO
2	Surface Closer	281 O/P	EN	SA
2	Armor Plate	K1050 36" 4BE CSKCSK	US32D	RO
2	W/F Stop	406 / 441CU	US26D	RO
1	ElectroLynx Harness	QC-Cxxx sized for door width		MK
1	Card Reader	By security provider		OT
2	Position Switch	DPS-M-BK		SU
1	Motion Sensor	XMS		SU
1	Power Supply	AQD1		SU

Notes:
Coordinate voltage, operation and electrical characteristics with all related trades.

Card Reader, wiring and connections by security provider.

Set: 4.0
Doors: 203A
Description: Pair - FS Lock - Mag Lock - AFB - Closer

1	Continuous Hinge	CFM__HD1		PE
1	Continuous Hinge	CFM__HD1 SERxx		PE
1	Automatic Flush Bolt	2842/2942	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Fail Safe Lock	RX 8270- LNP	US26D	SA
2	Magnetic Lock	M680EBD	628	SU
1	Coordinator	2672	US28	RO
2	Surface Closer	281 O/P	EN	SA
2	Armor Plate	K1050 36" 4BE CSKCSK	US32D	RO
2	W/F Stop	406 / 441CU	US26D	RO
2	Edge Guard	310B UL 36" CUTOUT-1	US32D	RO
2	Edge Guard	310B UL 36" CUTOUT-2	US32D	RO
1	ElectroLynx Harness	QC-Cxxx sized for door width		MK
1	ElectroLynx Harness	QC-C1500P		MK
1	Motion Sensor	XMS		SU
1	Push Button	EEB2		SU
1	Power Supply	AQD6		SU

Notes:
TWO INTERLOCK SWITCHES PER LINAC MANUF.

Coordinate voltage, operation and electrical characteristics with all related trades.

Card Reader, wiring and connections by security provider.

Set: 5.0
Doors: 195A
Description: Pair - Passage - CFB - Closer - OH Stop - KP

2	Continuous Hinge	CFM__HD1		PE
1	Self Latching Flush Bolt	2845/2945	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Passage Latch	8215 LNP	US26D	SA
1	Coordinator	2672	US28	RO
1	Surf Overhead Stop	10-336	630	RF
1	Surface Closer	281 O/P	EN	SA
2	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Gasketing Pair	S88BL		PE
1	Astragal	3572SP		PE

Set: 6.0

Doors: 200A
Description: Pair - Entry - CFB - Closer - OH Stop - KP - Lead Lined

2	Pivot Set	L147-20	626	RF
2	Intermediate Pivot	ML19-20	626	RF
2	Self Latching Flush Bolt	2845/2945	US26D	RO
2	Dust Proof Strike	570	US26D	RO
1	Office/Entry Lock LL	74 8205 LNP	US26D	SA
1	Coordinator	2672	US28	RO
1	Surf Overhead Stop	10-336	630	RF
1	Surface Closer	281 O/P Lead Line Cover	EN	SA
2	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Gasketing Pair	S88BL		PE
1	Astragal	357SP Leadline		PE

Set: 7.0
Doors: C6A
Description: Pair - Entry - Elec Strk - AFB - Auto Operator - AP

1	Continuous Hinge	CFM__HD1		PE
1	Continuous Hinge	CFM__HD1 SERxx		PE
1	Automatic Flush Bolt	2842/2942	US26D	RO
1	Dust Proof Strike	570	US26D	RO
1	Office/Entry Lock	8205 LNP	US26D	SA
1	Electric Strike	1600-CLB-LMS	630	HS
1	Coordinator	2672	US28	RO
1	Surface Closer	281 O/P	EN	SA
1	Automatic Opener	6000 Series	689	NO
2	Armor Plate	K1050 36" 4BE CSKCSK	US32D	RO
2	Edge Guard	310B UL 36" CUTOUT-1	US32D	RO
1	ElectroLynx Harness	QC-Cxxx sized for door width		MK
1	ElectroLynx Harness	QC-C1500P		MK
2	Touchless Switch (Microwave)	[673 | 674]		NO

Set: 8.0
Doors: 152A, C2A, C3A, C5A
Description: Sgl - Storeroom - Elec Strk - RX - Card Reader - Closer - DC

1	Continuous Hinge	CFM__HD1		PE
1	Storeroom/Closet Lock	8204 LNP	US26D	SA
1	Electric Strike	1600-CLB-LMS	630	HS
1	Surface Closer	281 O/P	EN	SA
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	W/F Stop	406 / 441CU	US26D	RO
3	Silencer - Metal Frame	608		RO
1	Card Reader	By security provider		OT
1	Position Switch	DPS-M-BK		SU
1	Motion Sensor	XMS		SU
1	Power Supply	AQD1		SU

Notes:
Coordinate voltage, operation and electrical characteristics with all related trades.

Card Reader, wiring and connections by security provider.

Set: 9.0
Doors: 118B, 171A
Description: Sgl - Storeroom - Elec Strk - RX - Card Reader - Closer - DC

1	Continuous Hinge	CFM__HD1		PE
1	Storeroom/Closet Lock	8204 LNP	US26D	SA
1	Electric Strike	1600-CLB-LMS	630	HS
1	Surface Closer	281 O/P	EN	SA
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	W/F Stop	406 / 441CU	US26D	RO
3	Silencer - Metal Frame	608		RO
1	Card Reader	By security provider		OT
1	Position Switch	DPS-M-BK		SU
1	Motion Sensor	XMS		SU
1	Power Supply	AQD1		SU

Notes:
Coordinate voltage, operation and electrical characteristics with all related trades.

Card Reader, wiring and connections by security provider.

Set: 10.0
Doors: 192A
Description: Sgl - Entry - Elec Strk - Auto Operator - KP

1	Continuous Hinge	CFM__HD1		PE
1	Office/Entry Lock	8205 LNP	US26D	SA
1	Electric Strike	1600-CLB-LMS	630	HS
1	Automatic Opener	6000 Series	689	NO
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	ElectroLynx Harness	QC-C1500P		MK
2	Touchless Switch (Microwave)	[673 | 674]		NO

Set: 11.0
Doors: 173A, 174A
Description: Sgl - Storeroom - Closer - KP

1	Continuous Hinge	CFM__HD1		PE
1	Storeroom/Closet Lock	8204 LNP	US26D	SA
1	Surface Closer	281 O/P	EN	SA
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	W/F Stop	406 / 441CU	US26D	RO
1	Gasketing Sgl	S88BL		PE

Set: 12.0

Doors: 187A, 201A, 204A, 205
Description: Sgl - Storeroom - Closer/stop - KP

1	Continuous Hinge	CFM__HD1		PE
1	Storeroom/Closet Lock	8204 LNP	US26D	SA
1	Surface Closer	281 PS	EN	SA
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	Gasketing Sgl	S88BL		PE

Set: 13.0
Doors: 188A, 191A
Description: Sgl - Storeroom - Closer - KP

1	Continuous Hinge	CFM__HD1		PE
1	Storeroom/Closet Lock	8204 LNP	US26D	SA
1	Surface Closer	281 O/P	EN	SA
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	W/F Stop	406 / 441CU	US26D	RO
3	Silencer - Metal Frame	608		RO

Set: 14.0
Doors: 182A
Description: Sgl - Storeroom - Closer - KP

1	Continuous Hinge	CFM__HD1		PE
1	Storeroom/Closet Lock	8204 LNP	US26D	SA
1	Surface Closer	281 O/P	EN	SA
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	W/F Stop	406 / 441CU	US26D	RO
3	Silencer - Metal Frame	608		RO

Set: 15.0
Doors: 151A, 172A, 177A, 178A, 179A, 180A, 181A, 190A
Description: Sgl - Office

1	Continuous Hinge	CFM__HD1		PE
1	Office/Entry Lock	8205 LNP	US26D	SA
1	W/F Stop	406 / 441CU	US26D	RO
1	Silencer - Metal Frame	608		RO

Set: 16.0
Doors: 189A
Description: Sgl - Passage - Closer - KP

1	Continuous Hinge	CFM__HD1		PE
1	Passage Latch	8215 LNP	US26D	SA
1	Surface Closer	281 O/P	EN	SA
1	Kick Plate	K1050 10" 4BE CSK	US32D	RO
1	W/F Stop	406 / 441CU	US26D	RO
3	Silencer - Metal Frame	608		RO

Set: 17.0
Doors: 142A, 143A, 144A, 156A, 157A, 158A, 159A
Description: Sgl - Passage

1	Continuous Hinge	CFM__HD1		PE
1	Passage Latch	8215 LNP	US26D	SA
1	W/F Stop	406 / 441CU	US26D	RO
3	Silencer - Metal Frame	608		RO

Set: 18.0
Doors: 189B, 200B
Description: Sgl - Passage - OH Stop - Lead Lined

1	Pivot Set	L147-20	626	RF
1	Intermediate Pivot	ML19-20	626	RF
1	Passage Latch LL	8215 LNP	US26D	SA
1	Surf Overhead Stop	9-X36	630	RF
3	Silencer - Metal Frame	608		RO

Set: 19.0
Doors: 150A, 153A, 154A, 155A, 184A, 185A, 186A, 193A, 194A, 194B, 194C, 196A, 197A
Description: Sgl - Privacy/IND - Coat Hook

1	Continuous Hinge	CFM__HD1		PE
1	Privacy Lock	V20 8265 LNP	US26D	SA
1	W/F Stop	406 / 441CU	US26D	RO
1	Gasketing Sgl	S88BL		PE
1	Coat Hook	RM802	US32D	RO

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish interior power door operators with visible mounting. Automatic door operators shall be configured as follows:

1. Single doors: Outswing or Inswing.
2. Simultaneous pairs: Outswing or Inswing.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 01 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Submit manufacturer's complete product and installation data.

C. Submit drawings showing layout, profiles, product components including anchorage, accessories, finish and glazing details (where required).

D. Closeout Submittals: Submit the following:

1. Owner’s Manual.
2. Warranty document as specified herein.

1.04 QUALITY ASSURANCE

A. Use personnel skilled in work required, completely familiar with manufacturers' recommended methods of installation, and thoroughly familiar with requirements of this work.

B. Obtain automatic door operators through one source from a single manufacturer.

C. 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

D. Opening Force Requirements for Egress Doors: In the event power failure to the operator, swinging automatic entrance doors shall open with a manual force, not to exceed 30 lbf (133 N) applied at 1” (25 mm) form the latch edge of the door.

1.05 PRODUCT HANDLING

A. Comply with factory's ordering instructions and lead time requirements. Delivery shall be in factory's original, unopened, undamaged containers with identification labels intact.

B. Protection: Provide protection from exposure to harmful weather conditions and vandalism.

C. Replacements: In event of damage, immediately make repairs and replacements necessary at Contractor's expense.

1.06 RELATED WORK

A. Electrical: To be provided under Division 26: 120 or 220 VAC, 60 cycle, 1 phase, 10 amps for doors with operators in pairs, 5 amps for single doors.

1.07 WARRANTIES

A. Units to be warranted against defect in material and workmanship for a period of one year from the Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Manufacturer: Horton Automatics, a division of Overhead Door Corporation, shall manufacture automatic swing door(s) of type(s) and size(s) specified on plans and door schedule.

B. Automatic Operation:
   1. General: Pushbutton/Push Plate switch actuates door open; door closes after time delay expires. Opening and closing force, measured 1" (25.4 mm) out from the lock stile of the door, not to exceed 15 pounds (67 N) of force to stop the door when operating in either direction. Operator to include the following variable adjustments so as to comply with ANSI Standard A156.19: Opening speed – 4 1/2 to 6 seconds; Closing speed – 4 1/2 to 6 seconds.
   2. Two automatic operations:
      a. Where doors are indicated to be auto opened remotely from admissions desk: Remote card reader, card reader by door, and ‘request to exit’ push button (opposite side of door) all actuate door open; door closes after time delay expires.
      b. Other doors: Card reader by door and ‘request to exit’ push button (opposite side of door) both actuate door open; door closes after time delay expires.
   3. For both operations: Card readers and auto openers are to be wired into the electric strike so that the strike will release prior to the operator activating.

2.02 MATERIALS

A. Extruded Aluminum: ASTM B221, 6063-T5 alloy and temper, anodized: Structural Header Sections: Minimum 1/8" (3 mm) thickness

B. Finish (for all exposed aluminum surfaces) shall be: 204-R1 Clear: Arch. Class 2 Clear Anodized Coating, AA-MI2C22A31.

2.03 EQUIPMENT

A. EASYACCESS Series 7100: Surface Applied Operator with connecting arms and linkage shall provide positive control of door through entire swing; units shall permit use of butt hung and center pivot doors.

1. Mounting: The operator header shall be mounted to the surface of the existing door frame or wall.
2. Door Arms: Connecting hardware shall be a double arm arrangement that can either push the door or pull the door open to suit the job condition. When the operator mounting is on the pull side and adjacent wall is within 4" (102 mm) of the door frame, specify a parallel arm.
3. Fasteners and Accessories: Manufacturer's standard corrosion-resistant, non-staining, non-bleeding fasteners and accessories compatible with adjacent materials.

B. EASYACCESS Header Case: Shall be a side access extruded aluminum case. Standard header size shall be 4" x 6" (102 mm x 152 mm) with optional 6" x 6" (152 mm x 152 mm).

2.04 SWINGING DOOR OPERATORS

A. Operator: The Electric Operating Mechanism shall be Series 7000: Operator shall be mounted and concealed in an extruded aluminum case for smooth and quiet operation. Maximum current draw shall not exceed 3.15 amps.

1. Opening Action: Shall be accomplished by a 1/15 HP D.C. permanent magnet motor working through reduction gears to the output shaft.
2. Field Adjustable Spring Closing Action: shall be accomplished by a field replaceable spring. When the door is in the closing mode or fully closed, motor voltage shall not be required and will be off. The door can be manually operated with power on or off without damage to the operator.
3. Independent Adjustable Closing and Latching Speed Control: The operator shall employ a rheostat module to allow for independent field adjustment of closing and latching speeds using the motor as a dynamic brake.
4. Field Adjustable Open Stop: The operator shall provide a field adjustable open stop to accommodate opening angles from 80 to 135 degrees without the need for additional components.
5. Consistent Cycle: The operator shall deliver an even, consistent open force across the entire transition from door fully closed to door open check. Additionally, the

range of the force shall be field adjustable to accommodate a wide range of on-site conditions.

6. Manual Use: The operator shall function as a manual door closer in the direction of swing with or without electrical power. The operator shall deliver an even, consistent open force across the entire transition from door fully closed to door fully open.
7. Controller Protection: The controller shall incorporate the following features to ensure trouble free operation:
   a. Automatic Reset upon power up.
   b. Main fuse protection.
   c. Electronic surge protection.
   d. Internal power supply protection.
   e. Resettable sensor supply fuse protection.
8. Push Button Interface: The controller shall have push button switches with to allow for selection or change of the following parameters: carpet or timer logic, single or dual door, activation options, normal back check or large back check, push-to-open assist on/off.
9. Soft Start/Stop: A “soft-start” “soft-stop” motor driving circuit shall be provided for smooth normal opening and recycling.
10. Control Switch: Automatic door operators shall be equipped with a three-position function switch to control the operation of the door. Control switch shall provide three modes of operation, Automatic, Off, and Hold-Open.
11. Master Control: Shall incorporate the following features:
    a. Adjustable time delay of 2 to 30 seconds (ANSI A156.19 requirement is 5 second minimum time delay).
    b. Infinite adjustment to opening and open check speeds including adjusting the opening force without affecting the opening speed.
    c. Immediate reversal of door motion without undue strain on the drive train. This will be accomplished by supplying stepped voltage to the motor. The door shall reverse when closing if an object stops the door.
    d. Motor Protection Circuit: A locked door motor protection circuit will be supplied that will shut off current to the motor when the door is inadvertently locked or otherwise prevented from opening.

2.06 ACTIVATION AND SAFETY DEVICES

A. Activating Device shall be located on each side of the opening as per ANSI Safety Standard A117 and shall be hardwired to door operator controls. Optional wireless radio control. Activating device shall be momentary contact microswitch assembly in one of the following configurations:
   1. PUSH PLATE: 6" diameter (152 mm) round or 4 ½” (114 mm) square, stainless steel switch. Wall mounted. Optional engravings shall be:
      a. International symbol for accessibility and “Press To Open”.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install complete door operator system in accordance with manufacturer's instructions, including controls, control wiring, and remote power units (if any).

B. Set header assemblies, operating brackets, rails and guides level and true to location, with adequate anchorage for permanent support.

3.02 ADJUST AND CLEAN

A. After repeated operation of completed installation equivalent to 3 days use by normal traffic (100 to 300 cycles), readjust door operators and controls for optimum operating condition and safety. Lubricate operating equipment and clean exposed surfaces.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install glass specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Installers: Provide at least one person thoroughly trained and experienced in skills required, completely familiar with referenced standards and requirements of this work and to personally direct installation performed under this Section.

B. Applicable Standards For Glass and Glazing Work: Conform to the "Manual of Glazing" of the Flat Glass Marketing Association, requirements of Federal Specification DD-G-451c and Safety Standard 16 CFR 1201 of the U.S. Consumer Products Safety Commission.

1.05 PRODUCT HANDLING

A. Protection: Protect glass and glazing materials before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary and at Contractor's expense.

PART 2 - PRODUCTS

2.01 GENERAL QUALITY REQUIREMENTS

A. No manufacturer logos are allowed on any glass. Provide certification to General Contractor that tempered, heat strengthened, annealed, laminated, etc. glass was used where required.

B. Annealed float glass shall comply with ASTM C1036, Type I, Class 1 (clear), Class 2 (tinted), Quality-Q3.

C. Heat-Strengthened float glass shall comply with ASTM C1048, Type I, Class 1 (clear), Class 2 (tinted), Quality Q3, Kind HS.

D. Tempered float glass shall comply with ASTM C1048, Type I, Class 1 (clear), Class 2 (tinted), Quality Q3, Kind FT.

E. Heat-treated glass with elastomeric coating complying with ASTM C1048, Condition C (other coated glass), Type I (transparent glass, flat), Quality Q3 (glazing select) and with other requirements as specified.

F. GANA/GTA 89-1-31, "Specification for Environmental Durability of Fully Tempered or Heat-Strengthened Spandrel Glass with Applied Opacifiers", and with other requirements as specified.

G. Special Glass Required by Building Code:
1. Provide safety glazing as required by code.
2. Provide heat strengthened glass where required by design pressures, anticipated thermal stress, or use in spandrel areas.
3. Provide fully tempered glass only where safety glazing is mandatory or where pressures exceed capacity of heat strengthened glass.
4. Provide Fire Resistive and/or Fire Protective rated glass where required.

2.02 GLASS AND COATING SCHEDULES

A. Monolithic Glass Schedule:
GL 1 – ¼” Tempered, clear
GL 2 – ½” Tempered, clear

B. Specialty Glass Schedule:
SGL-1 X-Ray Protective Glass: Ray-Bar X-Ray Lead Glass, Federal Specification DD-G-451, in single or multiple layers of x-ray lead glass with lead equivalent not less than that of system in which it is installed. Glass must be clearly labeled or identified as “X-Ray Lead Glass”. X-Ray Safety Glass permanently labeled as impact resistant and must be utilized in any door vision lites or windows that occur within 24” of any door opening and must be permanently labeled in compliance with ANSI Z97.1 and CPSC 16 CFR Part 1201, CAT II for impact resistance, such as Ray-Bar X-Ray Safety Glass, manufactured solely by Ray-Bar Engineering Corporation, email: sales@raybar.com, www.raybar.com.
1. Provide equivalent thickness required in accordance with Physicist's report bound after Section 13 0900.

2.03 INSULATING GLASS UNITS

A. Manufacturer is used in this section to refer to a firm that produces primary glass or fabricated glass as defined in the referenced standards.
1. Oldcastle Glass

2. Guardian Industries
3. Pilkington
4. Vitro Industries
5. Visteon Float Glass
6. Approved equal

B. Insulating glass units are certified through the Insulating Glass Certification Council (IGCC) to either ASTM E774, or to ASTM E2190, or both.

C. Insulating glass shall have double edge seals. Primary seal shall be extruded polyisobutylene continuously bonded to glass surfaces and desiccant filled metal spacer, including corners. Minimum width of primary seal shall be 0.125 inch. Secondary seal shall be Momentive IGS 3723 or Dow Corning 982. Secondary seal shall completely cover spacer with no gaps or voids, and shall be continuously bonded to both plates of glass. Where insulating glass is supported by structural silicone, secondary seal shall be designed to transfer specified pressures from outdoor glass to indoor glass.
1. At structural silicone glazed assemblies, the metal spacer between panes of glass is to be Black.

D. Insulated Glass Unit Schedule:.
IGU1: 1 inch insulated glass lite
Guardian Super Neutral SNX 62/27.
Installed on "Clear - Clear" glass.
Glass will have standard air insultation (not argon)
Visual light transmittance: 62%
Solar heat Gain Coefficient: .27
Light to Solar Gain Ratio: 2.31
U-Value in winter: .29

IGU1S: "IGU1" glass Spandrel unit
Coated with ceramic frit, selected from Mfrs standard colors

2.04 GLAZING ACCESSORIES

A. Provide glazing accessories required to complete glazing work that are compatible with various components of the glazing system(s), and subject to approval of Architect.

B. Glazing Sealants: As specified in Section 07 9000

C. Glazing gaskets, sealant backers within glazing pockets, and continuous glass spacer pads at structural silicone shall be black extruded dense silicone.

D. Glazing Tape: Bostik "Chem Tape 60", Pecora "Shim-Seal", or Tremco "Pre-shimmed Tremco 440 Tape".

E. Setting Blocks: Silicone blocks tested for compatibility with specified glazing sealants. Provide side blocks at both jambs, between midheight and top corner of glass, at four-side conventional dry glazed openings. Side blocks are not required where glass is continuously sealed with silicone sealant at two or more edges.

F. Spacers: Saint-Gobain Performance Plastics V2100 Thermalbond Tape is acceptable as a glass spacer when used in conjunction with structural silicone, subject to verification of compatibility.

G. Compressible Filler Rod: Closed-cell or waterproof-jacketed foam of polyethylene, butyl rubber, neoprene, polyurethane or vinyl, tested for compatibility with specified glazing sealants, of 5 to 10 psi compression strength (25% deflection), recommended by sealant manufacturer for use in glazing channel to prevent sealant exudation from the channel.

H. Mirror Mastic: An adhesive setting compound, produced specifically for setting mirrors by spot application method (25% coverage) without support, to be used in 1/8" to 1/2" thickness.

PART 3 - EXECUTION

3.01 GLASS SIZES

A. Measure sizes for glass from actual frames, doors and windows. Contract requires glass to be set in place, and Contractor assumes responsibility for correct sizes. Use sizes shown on Drawings for estimating only as approximate dimensions.

3.02 GLAZING SURFACES

A. Glaze only dry surfaces, free from dust or ice. Clean dirty surfaces with cloth saturated with turpentine or mineral spirits before glazing. Remove loose dirt particles and mortar from recesses prior to installation of glass and glazing materials.

3.03 SETTING GLASS

A. Set glass to provide equal bearing for entire width of each pane. Contractor responsible for broken glass due to improper setting. Set using glazing stops furnished by door or fixed framing manufacturer unless otherwise shown or specified. Accurately set glass to fit frame, with all edges smooth. Sharp ragged edges are not acceptable. Cushion glass in fixed interior view windows with felt strips around entire perimeter.

3.04 CLEANING GLASS

A. Contractor shall employ services of a professional window washer at completion of all work to wash glass which has been installed under this contract, removing all stains.

B. Clean glass on both sides after painting operations are complete and dry. Do not use acid solutions or caustic soaps to clean glass.

C. Do not use razor blades to clean glass. Any scratches on the glass caused by the cleaning process will be cause for the removal and replacement of the damaged glass at the Contractor's expense.

END OF SECTION

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

A. This section applies to all floors identified in the contract documents to receive floor coverings, including but not limited to the following:
   1. Resilient flooring, tile, planks, and/or sheet.
   2. Fluid-applied resinous flooring
   3. Textile composite flooring.

B. Removal of existing floor coverings.

C. Preparation of new and existing concrete floor slabs for installation of floor coverings.

D. Testing of concrete floor slabs for moisture and alkalinity (pH).

E. Provide alternate adhesive due to unsatisfactory moisture or pH conditions.
   1. Contractor shall perform all specified installations with alternate adhesive, if special adhesive is needed as indicated by test results. See Allowances and Bid Form

F. 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 remediation is needed as indicated by test results. See Allowances and Bid Form

G. Patching compound.

1.03 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Limitations on curing requirements for new concrete floor slabs.

1.04 PRICE AND PAYMENT PROCEDURES

A. Allowances included in the Contract (Base Bid) Amount. Allowances are based on the proposed unit price multiplied by the indicated area.

1. Include costs for moisture and pH testing by an independent agency engaged by the Contractor in the contract sum (base bid).

B. Unit Price for Remedial Floor Coating: State the unit price per square foot for the floor coating, installed, in the event such remediation is required.
   1. Include costs for moisture and pH testing in the contract sum (base bid). Cost for moisture and pH testing is excluded from this unit price.

1.05 REFERENCES

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

C. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

D. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2011.

E. ASTM F3010 - Standard Practice for Two-Component Resin Based Membrane-Forming Moisture Mitigation Systems for Use Under Resilient Floor Coverings; 2018.

F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

G. International Concrete Repair Institute (ICRI) Certification program for concrete slab moisture testing.

1.06 ADMINISTRATIVE REQUIREMENTS

A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

1.07 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.

B. 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.

C. Testing Agency's Report:

1. Description of areas tested; include floor plans and photographs if helpful.
2. Summary of conditions encountered.
3. Moisture and alkalinity (pH) test reports.
4. Copies of specified test methods.
5. Include certification of accuracy by authorized official of testing agency.
6. Submit report to Architect Engineer and Owner.
7. Submit report not more than five business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

E. Remedial Materials Product Data: Manufacturer's published data on each product to be used for remediation.
1. Manufacturer's qualification statement.
2. Test reports indicating compliance with specified performance requirements, performed by nationally recognized independent testing agency.
3. Manufacturer's installation instructions.
4. Specimen Warranty: Copy of warranty to be issued by coating manufacturer and certificate of underwriter's coverage of warranty.

1.08 QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by General Contractor.

B. Contractor may perform adhesive and bond test with its own personnel or hire a testing agency.

C. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
1. Acceptable Testing Agencies:
a. George Donnelly Testing and Inspections, #1 Curso Lane, Hot Springs Village, AR 71909, (501) 915-0626.
b. Grubbs, Hoskyn,Barton & Wyatt, Inc., 1 Trigon Pl., Little Rock, AR 72209, (501) 455-2536.
c. Other testing agent approved by Owner.
d. Other testing agent certified as an ICRI Concrete Slab Moisture Testing Technician - Grade I.

D. Contractor's Responsibility Relating to Independent Agency Testing:
1. Provide access for and cooperate with testing agency.
2. Confirm date of start of testing at least 10 days prior to actual start.
3. Allow at least 4 business days on site for testing agency activities.
4. Achieve and maintain specified ambient conditions.
5. Notify Architect Engineer when specified ambient conditions have been achieved and when testing will start.

E. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

1.09 WARRANTY

A. Provide a 10-year minimum Manufacturer's Material and Labor Warranty for Moisture Control System components, including replacement of all damaged floor covering.

1.10 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.

1.11 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 For more than 85 degrees F.

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

2.01 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. Latex or polyvinyl acetate additions are permitted; gypsum content is prohibited.
   3. Compressive Strength: 4000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC.

C. Remedial Floor Coating: Single- or multi-layer coating or coating/overlay combination intended by its manufacturer to resist water vapor transmission to degree sufficient to meet flooring manufacturer's emission limits, resistant to the level of pH found, and suitable for adhesion of flooring without further treatment, installed per manufacturer's instructions including mechanical surface prep.

1. Acceptable Products (As recommended by manufacturer for specific project conditions):
   a. ARDEX Engineered Cements; either ARDEX MC ULTRA, ARDEX MC RAPID or ARDEX MC PLUS epoxy moisture control system; with either ARDEX K13 or K15 self-leveling underlayment: www.ardexamericas.com.
   b. KOSTER American Corp.; either KOSTER VAP I 2000, KOSTER VAP I 2000 F, KOSTER VAP I 2000 UFS or KOSTER VAP I 2000 ZERO VOC epoxy moisture vapor control system; with either KOSTER SL Standard or KOSTER SL Premium self-leveling underlayment: www.kosterusa.com.
   c. MAPEi; either MAPEi Planiseal EMB, MAPEi Planiseal VS ,or MAPEi Planiseal VS Fast epoxy moisture reduction barrier; with MAPEi Ultraplan 1 Plus self-leveling underlayment: www.mapei.com.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Prepare slab in accordance with ASTM F710.

B. Perform following operations in the order indicated:
1. Preliminary cleaning.
2. Moisture vapor emission tests; 3 tests in the first 1000 square feet and one test in each additional 1000 square feet, unless otherwise indicated or required by flooring manufacturer.
3. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
4. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
5. Specified remediation, if required.
6. Patching, smoothing, and leveling, as required.
7. Other preparation specified.
8. Adhesive bond and compatibility test.
9. Protection of substrate prior to flooring installation.

C. Remediations:
1. Active Water Leaks or Continuing Moisture Migration to Surface of Slab: Correct this condition before doing any other remediation; re-test after correction.
2. Excessive Moisture Emission or Relative Humidity: If an adhesive that is resistant to the level of moisture present is available and acceptable to flooring

manufacturer, use that adhesive for installation of the flooring; if not, apply remedial floor coating over entire suspect floor area.

3. Excessive pH: If remedial floor coating is necessary to address excessive moisture, no additional remediation is required; if not, if an adhesive that is resistant to the level present is available and acceptable to the flooring manufacturer, use that adhesive for installation of the flooring; otherwise, apply a skim coat of specified patching compound as recommended by flooring manufacturer.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFC! Recommended Work Practices for Removal of Resilient Floor Coverings, as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 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.

3.04 MOISTURE VAPOR EMISSION TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Test in accordance with ASTM F1869 and as follows.

C. Plastic sheet test and mat bond test may not be substituted for the specified ASTM test method, as those methods do not quantify the moisture content sufficiently.

D. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if test values exceed 3 pounds per 1000 square feet per 24 hours.

E. Report: Report the information required by the test method.

3.05 INTERNAL RELATIVE HUMIDITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F2170 Procedure A and as follows.

D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.

F. Report: Report the information required by the test method.

3.06 ALKALINITY TESTING

A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.

B. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

C. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.

D. Place several drops of water on a clean surface of concrete, forming a puddle approximately 1 inch in diameter. Allow the puddle to set for approximately 60 seconds, then dip the alkalinity (pH) test paper into the water, remove it, and compare immediately to chart to determine alkalinity (pH) reading.

E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if alkalinity (pH) test value is over 10.

3.07 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.

E. Provide finish surface tolerance meeting the requirements of the floor covering manufacturer. In the absence of manufacturer tolerance specifications ensure that the surface have no deviation exceeding 1/4" in 1O' measured by the straight edge method as referenced in ACI 117 Floor Flatness Tolerances. Note: if leveling compound is required address relative humidity content and application of remedial floor coating if required prior to the installation of leveling compound.

3.08 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.09 APPLICATION OF REMEDIAL FLOOR COATING

A. Comply with requirements and recommendations of coating manufacturer.

3.10 PROTECTION

A. Cover prepared floors with building paper or other durable covering.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Provide metal supports and fastenings, gypsum board, and related accessories specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Installers: Use only skilled and experienced gypsum drywall installers. Fully supervise at all times helpers and apprentices used for drywall work with thoroughly skilled gypsum drywall installers.

B. Manufacturers' Recommendations: Manufacturers' recommended use of materials, fastenings, and methods of installation is basis for acceptance or rejection of drywall work where not specifically otherwise shown or detailed.

1.05 FIELD CONDITIONS

A. Environmental Limitations: Comply with ASTM C 840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.

B. Do not install paper-faced gypsum panels until installation areas are enclosed and conditioned.

C. Do not install panels that are wet, those that are moisture damaged, and those that are mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

1.06 REFERENCE STANDARDS

A. ASTM E580, Suspension Systems in Areas Requiring Seismic Restraint.

B. ASTM C1396, "Gypsum Wallboard"

C. ASTM C840 Standard Specification for Application and Finishing of Gypsum Board

D. Gypsum Association publications:
   1. GA-214, "Recommended Levels of Gypsum Board Finish"
   2. GA-800, "Materials Handling Manual".

1.07 PRODUCT HANDLING

A. Protection: Protect gypsum drywall materials before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary and at Contractor's expense.

PART 2 - PRODUCTS

2.01 GYPSUM MATERIALS

A. Manufacturers: Use products and materials by the following manufacturers:
   1. United States Gypsum
   2. National Gypsum Company
   3. Georgia-Pacific Company
   4. Temple-Inland, Inc.
   5. CertainTeed Gypsum

B. Gypsum Wallboard: Conform to ASTM C1396, have tapered edges and furnished in largest practical sheet size to minimize number of joints. Provide thickness indicated on Drawings.

C. Backerboard for Ceramic Tile:
   1. Provide 5/8 inch "Dens-Shield" by Georgia Pacific Company, Diamondback GlasRoc Tilebacker by CertainTeed., or approved equal. Furnish largest size sheets practical to minimize joints. Conform to manufacturer's instructions for installation given the conditions detailed on the drawings. Caulk all joints where backer board comes into contact with dissimilar material.

D. Mold Resistant Gypsum Board: Provide 5/8" USG - Mold Tough gypsum board, CertainTeed - M2Tech gypsum board, or approved equal complying with ASTM D3273, "Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
   1. To be used at Toilet Room walls (where there is no tile) and at the ceiling.

E. Lead Lined Gypsum Board:
1. Lead Backed Gypsum Board: As manufactured by Ray-Bar Engineering Corporation, Radiation Protection Products, or approved equal; ASTM C1396, and as follows:
a. Sheet Size: Width and length as required for support spacing to prevent cracking during handling. Not to exceed 4'0" X 10'0", Type X Standard (RB-LBG).
b. Thickness: Not less than 5/8" inch - unless otherwise indicated.
c. A single thickness of unpierced lead sheet must be laminated to the back of gypsum board units. Lead thickness as indicated on Lead Protection Schedule. Provide minimum 1-1/2" wide lead batten strips for lapping at all vertical joints and inside and outside vertical corners, same height and lead thickness as on lead backed gypsum board.

2.02 JOINT TREATMENT MATERIALS

A. General: Comply with ASTM C 475/C 475M.

B. Joint Tape:
1. Interior Gypsum Board: Paper.
2. Exterior Gypsum Soffit Board: Paper.
3. Glass-Mat Gypsum Sheathing Board: 10-by-10 glass mesh.
4. Tile Backing Panels: As recommended by panel manufacturer.

C. Joint Compound for Interior Gypsum Board: For each coat use formulation that is compatible with other compounds applied on previous or for successive coats.

2.03 WALL AND PARTITION FRAMING

A. Provide products by Steel Framing Industry Association Members in good standing (listing found at http://www.archtest.com/certification/SFIA_SteelFraming.aspx).

B. Provide type, size, gauge and physical properties as described by the manufacturers load and height tables and in accordance with the current local building code. All section properties shall be calculated in accordance with the AISI Specification for the Design of Cold-Formed Steel Structural Members (latest edition).

C. Structural calculations specifically related to this project and performed by the manufacturer's structural engineer will indicate depths, gages and spacings of studs required to meet deflection and load bearing requirements.

D. Runners: Match studs; type recommended by stud manufacturer for floor and ceiling support of studs, and for vertical abutment of drywall work at other work.

E. Install supplementary steel framing, blocking and bracing in the metal framing system wherever walls or partitions are indicated to support work requiring attachment to the wall or partition. Where type of supplementary support is not otherwise indicated, comply with the stud manufacturer's recommendations and industry standards in each case, considering the weight or loading resulting from the item supported.

1. Screw attach blocking between studs for support of surface mounted items.
    a. Plumbing fixtures.
    b. Toilet partitions.
    c. Wall cabinets.
    d. Toilet accessories
    e. Hardware.
    f. Architectural woodwork.
    g. Grab bars.
    h. Handrails and railings.
    i. Signage.
    j. Other items requiring backing for attachment.

F. Deflection Track: Manufacturer's single, deep-leg, U-shaped steel track; unpunched, with unstiffened flanges, of web depth to contain studs while allowing free vertical movement, with flanges designed to support horizontal and lateral loads, as follows:
1. Minimum Uncoated-Steel Thickness: Match stud thickness.
2. Flange Width: Minimum 2".

G. Structural slotted deflection track: Brady SLP-TRK® Sliptrack Structural System by Clark Dietrich, 800-543-7140, clarkdietrich.com, or approved equal.
1. 1.5 mm (16 ga) thick, to ASTM A653/A653M, Grade 50 with a minimum yield point of 345 MPa 50,000 psi) thick,
2. 18 ga or 20 ga thick per manufacturer's recommendation, to ASTM A653/A653M, Grade 33 with a minimum yield point of 228 MPa (33,000 psi),
3. 3 5/8" or 6" wide, depending on partition type. See Drawings.
4. 3050 mm (10'-0") long
5. 63 mm (2-1/2 inch) down-standing legs with 6 mm (1/4 inch) wide by 38 mm (1-1/2 inch) high slots spaced at 25 mm (1 inch) on center. Deeper leg tracks as required by metal building manufacturer.
6. Galvanize to ASTM A924 / A924M, G60

H. Vertical Deflection Clips: Manufacturer's standard clips, capable of isolating wall stud from upward and downward vertical displacement of primary structure.

I. Drift Clips: Manufacturer's standard bypass or head clips, capable of accommodating upward and downward vertical displacement of primary structure.

J. Fasteners: Provide nut, bolts, washers, screws, and other fasteners with corrosion-resistant plated finish.

K. Electrodes for Welding: Comply with AWS Code and as recommended by stud manufacturer.

L. Galvanizing Repair: Where galvanized surfaces are damaged, prepare surfaces and repair in accordance with procedures specified in ASTM A 780.

2.04 ACOUSTICAL INSULATION

A. Provide unfaced Owens-Corning "EcoTouch" sound attenuation batt insulation, or approved equal complying with ASTM C 665, Type I.
   1. Combustion Characteristics: Passes ASTM E136.
   2. Flame Spread and Smoke Development: ASTM E84 <25/<50
   2. Fire Resistance Ratings: Part of ASTM E119 fire tested wall assemblies; or UL File #BKNV 3576 (Fire rated assemblies)
   3. Sound Transmission Class: ASTM C423

2.05 DIRECT CEILING SUSPENSION SYSTEMS

A. Grid Suspension System for Gypsum Board Ceilings: ASTM C 645, direct-hung system composed of main beams and cross-furring members that interlock.
   1. Products: Subject to compliance with requirements, provide one of the following:
      a. Armstrong World Industries, Inc.; Drywall Grid Systems.
      b. Chicago Metallic Corporation; Drywall Grid System.
      c. USG Corporation; Drywall Suspension System.

2.06 FASTENERS

A. Drywall Screws: Self-drilling type, 1" long for single layer application of gypsum board to metal studs and furring channels and of longer length for multiple layer installation.

B. Powder-Actuated Fasteners: Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

2.07 ACCESSORIES

A. Corner Beads: 0.014 inch thick, hot dip galvanized steel with 1" flanges with 1/16" radius nose with large openings in flange similar to 5/8" diameter holes 7/8" on center.

B. Control and Expansion Joints: "Sheetrock" zinc control joint No.093 by USG, or approved equal. Provide safing and/or acoustical insulation behind control joints as required for adjacent partition construction. Use fire rated control joints in partitions requiring a fire rating.

2.08 ACCESS DOORS

A. Ceiling Access: Provide 24" x 24" Model FG glass fiber reinforced gypsum drywall access door as manufactured by Karp Associates, Inc., 1-800-888-4212 or approved equal. Door are to be flush mounted gypsum panels in a 5/8" thick frame.

F. Wall Access: Provide 24" x 24" Model KDW Flush Access Door as manufactured by Karp Associates, Inc., 1-800-888-4212 or approved equal.

PART 3 - EXECUTION

3.01 GENERAL PROVISIONS

A. Comply with specified requirements, manufacturer's instructions and recommendations, and referenced standards.

B. In cold weather, heat building to provide uniform temperature of 50 to 70 and provide ventilation to eliminate excess moisture.

C. Deliver materials to job in original unopened containers or bundles and store protected from damage and exposure to the elements.

D. Provide casing beads where edges of gypsum board meet dissimilar materials.

E. Cooperate with carpenters in placing of backing and blocking required for millwork, fixtures, fittings, and accessories.

F. Make cut-outs in panels for pipes, fixtures and small openings. Make holes and cut-outs by method that will not fracture wallboard core or tear covering. Cut holes with accuracy so plates, escutcheons and trim cover edges.

G. Seal cut edges, holes, and areas where wallboard covering is broken, with resistant sealer.

H. Install trim in strict accordance with manufacturers' recommendations. Install trim plumb, level, and true to line with firm attachment to supporting members.

I. At any change in direction of gypsum board, provide sufficient auxiliary framing, blocking or nailers to allow secure attachment along every edge of every individual piece of gypsum board. Do not leave any loose edges.

3.02 INSTALLATION OF METAL SUPPORT SYSTEMS

A. Do not bridge building expansion joints with support system, frame both sides of joints with furring and other support as indicated.

B. Ceiling Support Suspension System: Install in accordance with manufacturers recommendations.

C. Wall/Partition Support System
   1. Install supplementary framing, blocking and bracing to support fixtures, equipment, services, heavy trim, furnishings and similar work which cannot be adequately supported on gypsum board alone.
   2. Isolate stud system from transfer of structural loading to system, both horizontally and vertically. Provide slip or cushioned type joints to attain lateral support and avoid axial loading.
   3. Do not attach stud system to ductwork, piping, conduit, etc.
   4. Install runners (tracks) at floors, ceiling and structural walls and columns where gypsum drywall stud system abuts other work, except as otherwise indicated.

5. Extend partition stud system through acoustical ceilings and elsewhere as indicated to the structural support and substrate above the ceiling as indicated. Install angle bracing at 4'0" on center from ceiling runner to structure above.
6. Frame door openings with vertical studs securely attached by screws at each jamb either directly to frames or to jamb anchor slips on door frame; install runner track sections (for jack studs) at head and secure to jamb studs. Install angle bracing above ceiling to structural in each direction at strike side of door. Double studs at all door openings.
7. Provide runner tracks of same gage as jamb studs. Space jack studs same as partition studs.
8. Frame openings other than door openings in same manner as required for door openings; and install framing below sills of openings to match framing required above door heads. Opening for ductwork, piping must allow clearance for insulation, dampers, etc.
9. Install wall/partition support system to maximum tolerances of 1/8" in 12'-0" measured horizontally and vertically.

3.03 GENERAL GYPSUM BOARD INSTALLATION REQUIREMENTS

A. Pre-Installation Conference: Meet at the project site with the installers of related work and review the coordination and sequencing of work to ensure that everything to be concealed by gypsum drywall has been accomplished, and that chases, access panels, openings, supplementary framing and blocking and similar provisions have been completed.

B. Install sound attenuation blankets where indicated, prior to gypsum board unless readily installed after board has been installed.

C. Locate exposed end-butt joints as far from center of walls and ceilings as possible, and stagger not less than 1'-0" in alternate course of board.

D. Install ceiling boards in the direction and manner which will minimize the number of end-butt joints, and which will avoid end joints in the central area of each ceiling. Stagger end joints at least 1'-0".

E. Install wall/partition boards vertically to avoid end-butt joints wherever possible. At stairwells and similar high walls, install boards horizontally with end joints staggered over studs. Do not butt boards to concrete floor. Maintain a minimum 1/4" to a maximum 3/8" space between bottom of board and concrete.

F. Install exposed gypsum board with face side out. Do not install imperfect, damaged or damp boards. Butt boards together for a light contact at edges and ends with not more than 1/16 inch open space between boards. Do not force into place.

G. Locate either edge or end joints over supports, except in horizontal applications where intermediate supports or gypsum board back-blocking is provided behind end joints. Position boards so that like edges abut, tapered edges against tapered edges and mill-cut or field-cut ends against mill-cut or field cut ends. Do not place tapered edges against cut edges or ends. Stagger vertical joints over different studs on opposite sides of partitions.

H. Attach gypsum board to framing and blocking as required for additional support at openings and cutouts. Space between recessed boxes and cut edges shall not exceed 1/8 inches.

I. Form control joints and expansion joints with space between edges of boards, prepared to receive trim accessories described below in article entitled "INSTALLATION OF DRYWALL TRIM ACCESSORIES".

J. Cover both faces of partition framing with gypsum board in concealed spaces (above ceilings, etc.) except in chase wall which are braced internally.

K. Space fasteners in gypsum boards in accordance with referenced standards and manufacturer's recommendations, except as otherwise indicated.

3.04 INSTALLATION OF CEILING ACCESS PANELS

A. General Contractor is required to coordinate locations and number of access panels with affected trades in order to minimize the number of access panels required.

B. Provide ceiling access panels in gypsum board ceilings as specified. Provide quantity required for access to the following items commonly found above the ceiling plain:
   1. Operable portion of fire, smoke and other dampers
   2. Valves and other operable portions of sprinkler system
   3. Valves to mechanical, domestic and other piping systems
   4. Mechanical devices
   5. Fire alarm devices
   6. Communication system devices and connection points
   7. Sanitary and storm sewer clean outs
   8. Also included are any other items located above an otherwise inaccessible ceiling that will require adjustment, maintenance, inspection, connection or replacement in whole or in part at any time after the initial installation of the item or the ceiling.

3.05 METHODS OF GYPSUM BOARD APPLICATION

A. On ceilings:
   1. Apply gypsum board prior to wall/partition board application to the greatest extend possible. For single-ply construction, use perpendicular application. For two-ply assembles use perpendicular application and apply face ply of gypsum board so that joints of face ply do not occur at joints of base ply with joints over framing members.
   2. Where screws are used, they shall be spaced not more than 12 in. o.c. for ceilings where the framing members are 16 in. o.c.
   3. Screws shall be spaced not more than 12 in. o.c. for ceilings where framing members are 24 in. o.c.
   4. For applications on wood or other applications, refer to Gypsum Association GA-216 for fastener type and spacing.

B. On partitions except shaft wall:
   1. Use maximum length sheets practical to minimize end joints.
   2. When gypsum board is installed parallel to framing members, space fasteners 12 inches on center in field of the board, and 8 inches on center along edges.
   3. For applications on wood or other applications, refer to Gypsum Association GA-216 for fastener type and spacing.
   4. When gypsum board is installed perpendicular to framing members, space fasteners 12 inches (304.8mm) on center in field and along edges.
   5. Stagger screws on abutting edges or ends.
   6. For single-ply construction, apply gypsum board with long dimension either parallel or perpendicular to framing members as required to minimize number of joints.
   7. For two-ply gypsum board assemblies, apply base ply of gypsum board to assure minimum number of joints in face layer. Apply face ply of wallboard to base ply so that joints of face ply do not occur at joints of base ply with joints over framing members.

C. Wall Tile Base: Where drywall is base for thin set ceramic tile and similar rigid applied wall finishes, install gypsum backing board. At "wet" areas, install with un-cut long edge at bottom of work, and space 1/4" above fixture lips. Seal ends, cut-edges and penetrations of each piece with water resistant compound before installation.

3.06 INSTALLATION OF DRYWALL TRIM ACCESSORIES

A. General: Where feasible, use the same fasteners to anchor trim accessory flanges as required to fasten gypsum board to the supports. Otherwise, fasten flanges to comply with manufacturer's recommendations.

B. Install metal corner beads at external corners of drywall work. Corner beads are to be completely bedded and taped.

C. Install metal edge trim whenever edge of gypsum board would otherwise be exposed or semi-exposed, and except where plastic trim is indicated. Provide type with face flange to receive joint compound except where semi-finishing type is indicated. Install L-type trim where work is tightly abutted to other work, and install special kerf-type where other work is kerfed to receive long leg of L-type trim. Install U-type trim where edge is exposed, revealed, gasketed, or sealant-filled (including expansion joints).

D. Install metal control joints where indicated on drawings. If not indicated on drawings, install in accordance with the following:
   1. Interior Partitions: Maximum Single Dimension not to exceed 20 feet. Maximum Single Area not to exceed 400 Sq. Ft.
   2. Interior Ceiling With Perimeter Relief: Maximum Single Dimension not to exceed 40 feet. Maximum Single Area not to exceed 1,600 Sq.Ft. Install control joint at any change of direction of ceiling framing or support system.
   3. Interior Ceiling Without Perimeter Relief: Maximum Single Dimension not to exceed 20 feet. Maximum Single Area not to exceed 400 Sq.Ft. Install control joint at any change of direction of ceiling framing or support system.

3.07 INSTALLING CEILING SUSPENSION SYSTEMS

A. Install suspension system components according to spacings indicated, but not greater than spacings required by referenced installation standards for assembly types.
   1. Hangers: 48 inches o.c.
   2. Carrying Channels (Main Runners): 48 inches o.c.

B. Isolate suspension systems from building structure where they abut or are penetrated by building structure to prevent transfer of loading imposed by structural movement.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
   2. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, countersplaying, or other equally effective means.
   3. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
   4. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   6. Do not attach hangers to steel roof deck.
   7. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
   8. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   9. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Grid Suspension Systems: Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.

E. Installation Tolerances: Install suspension systems that are level to within 1/8 inch in 12 feet measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

3.08 JOINT TREATMENT AND FINISHING

A. General: Joint treatment for gypsum board surfaces is also described in Section 09 9000.

B. All joints in gypsum board construction are to be taped and floated. This includes work above ceilings, at concealed places and anywhere else joints in gypsum board construction occur.

1. All screw and/or nail heads are to be floated smooth both above and below ceiling line.

C. Finish Levels:

1. Level 1: At Ceiling plenum areas and concealed areas.
2. Level 2: At surfaces that are substrate for tile.
3. Level 3: At surfaces receiving medium (Orange Peel) or heavy (Knock-Down) texture finishes before painting or heavy wall coverings where lighting conditions are not critical.
4. **Level 4 (Typical Finish): At surfaces receiving light (Semi-Smooth) textured finishes before painting or standard wall coverings or satin/eggshell paint or flat paint.**
5. Level 5: At surfaces receiving gloss or semigloss enamels and/or other surfaces subject to severe lighting.

3.09 CLEANING UP

A. Do not allow accumulation of scraps and debris arising from work of this Section. Maintain premises in neat and orderly condition at all times. Immediately remove spilled or splashed compound material and all trace of residue from adjoining surfaces.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install tile specified on floors and walls shown.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Obtain each color, grade, finish, type, composition, and variety of tile from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

B. Obtain ingredients of a uniform quality from one manufacturer for each cementitious and admixture component and from one source or producer for each aggregate.

C. Engage an experienced Installer who has successfully completed tile installations similar in material, design, and extent to that indicated for Project.

D. Install ceramic tile in accordance with recommendations contained in "Handbook for Ceramic Tile Installation" of the Tile Council of America, Inc., latest edition.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store packaged materials in original containers with seals unbroken and labels intact until time of use. Comply with requirement of ANSI A137.1 for labeling sealed tile packages.

B. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

C. Handle tile with temporary protective coating on exposed surfaces to prevent coated surfaces from contacting backs or edges of other units. If despite these precautions coating does contact bonding surfaces of tile, remove coating from bonding surfaces before setting tile.

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Vent temporary heaters to exterior to prevent damage to tile work from carbon dioxide buildup.

C. Maintain temperatures at 50 F (10 C) or more in tiled areas during installation and for 7 days after completion, unless higher temperatures are required by referenced installation standard or manufacturer's instructions.

1.07 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials that match products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.
   1. Tile and Trim Units: Furnish quantity of full-size units equal to 3 percent of amount installed but a minimum of 12 pieces, for each type, composition, color, pattern, and size.

PART 2 - PRODUCTS

2.01 PRODUCTS, GENERAL

A. ANSI Standard for Ceramic Tile: Comply with ANSI A137.1 "American National Standard Specifications for Ceramic Tile" for types, compositions, and grades of tile indicated. Furnish tile complying with "Standard Grade" requirements unless otherwise indicated.

B. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.

C. Conform to ADA requirements for slip resistance by providing minimum coefficients of sliding friction of 0.6 COF for horizontal surfaces and 0.8 COF for ramps and other sloped surfaces.

D. Factory blending: For tile exhibiting color variations within the ranges selected during sample submittals, blend tile in factory and package accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples.

2.02 TILE PRODUCTS

A. Refer to Finish Legend on Sheet A801 for Material List.

2.03 SETTING MATERIALS

A. Thin-Set Applications at All Non-Wet Area Floors (TCA F115): Latex-Portland Cement Mortar: ANSI A118.4, composition as follows: Prepackaged dry mortar mix composed of portland cement, graded aggregate, and the manufacturer's standard dry polymer additive in the form of a re-emulsifiable powder to which only water is added at job site.

B. Thin-Set Applications at All Non-Wet Area Walls (TCA W243): Latex-Portland Cement Mortar: ANSI A118.4, composition as follows: Prepackaged dry mortar mix composed of portland cement, graded aggregate, and the manufacturer's standard dry polymer additive in the form of a re-emulsifiable powder to which only water is added at job site.

2.04 SETTING MATERIALS FOR LARGE TILE

A. Any tile with at least one dimension over 15" is considered to be Large. Setting method is the same as for normal size tile except as follows:
   1. A LFT (Large Format Tile) mortar is required.
   2. All cracks in the concrete substrate will receive a crack isolation membrane.
   3. If extensive cracking is evident, a full coverage isolation sheet will be required.
   4. At Wet Areas and Upper Level Toilet Rooms, provide waterproof membrane.

B. Materials:
   1. Self-leveler: TEC 318 or Ardex V1200 , Self Leveling Underlayment
   2. Crack Isolation Membrane: ANSI A118.12; TEC 317 Roll-On
   3. Medium Bed Mortar: Provide TEC 384/385 3N1 or Ardex A38

C. Installation:
   1. Tile: TCA F125 Partial or F125 Full as required by condition of substrate.
   2. Crack Isolation Membrane: ANSI A108.17

D. Substrate Preparation:
   1. Max. allowable variation is 1/8" in 10' with no more than 1/16" variation in 24" measured from the high points.
   2. Slab is to have a steel trowel and fine broom finish free of curing compounds.

2.05 GROUTING MATERIALS

A. Provide products to suit specific project requirements in accordance with TCA Handbook and as follows.
   1. Epoxy Grout: ANSI A118.3. Laticrete SpectraLOCK PRO, Ardex WA, or approved equal. Grout color to be selected from manufacturer's complete color line.

2.06 MISCELLANEOUS MATERIALS

A. Metal Edge Strips: Schluter "SCHIENE" single or multiple spacer design as required in

satin anodized aluminum.

B. Provide other materials, not specifically described but required for complete and proper tile installation, selected by Contractor subject to approval of Architect.

C. Expansion Joints: In accordance with TCA Method EJ171.

D. Sealant: ASTM C920; TEC 155, AccuColor 100, or Ardex SX 100% Silicone

2.07 MIXING MORTARS AND GROUT

A. Mix mortars and grouts to comply with requirements of referenced standards and manufacturers including those for accurate proportioning of materials, water, or additive content; type of mixing equipment, selection of mixer speeds, mixing containers, mixing time, and other procedures needed to produce mortars and grouts of uniform quality with optimum performance characteristics for application indicated.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and areas where tile will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed tile.
   1. Verify that substrates for setting tile are firm, dry, clean, and free from oil or waxy films and curing compounds.
   2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind tile has been completed before installing tile.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Blending: For tile exhibiting color variations within the ranges selected during sample submittals, verify that tile has been blended in factory and packaged accordingly so that tile units taken from one package show the same range in colors as those taken from other packages and match approved samples. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.03 INSTALLATION, GENERAL

A. ANSI Tile Installation Standard: Comply with parts of ANSI 108 series of tile installation standards included under "American National Standard Specifications for the Installation of Ceramic Tile" that apply to type of setting and grouting materials and methods indicated.

B. TCA Installation Guidelines: TCA "Handbook for Ceramic Tile Installation"; comply with TCA installation methods indicated.

C. Extend tile work into recesses and under or behind equipment and fixtures to form a complete covering without interruptions except as otherwise shown. Terminate work neatly at obstructions, edges, and corners without disrupting pattern or joint alignments.

D. Accurately form intersections and returns. Perform cutting and drilling of tile without marring visible surfaces. Carefully grind cut edges of tile abutting trim, finish, or built-in items for straight aligned joints. Fit tile closely to electrical outlets, piping, fixtures, and other penetrations so that plates, collars, or covers overlap tile.

E. Jointing Pattern: Unless otherwise shown, lay tile in grid pattern. Align joints when adjoining tiles on floor, base, walls, and trim are same size. Lay out tile work and center tile fields in both directions in each space or on each wall area. Adjust to minimize tile cutting. Provide uniform joint widths unless otherwise shown.

F. Lay out tile wainscots to next full tile beyond dimensions indicated.

G. Expansion Joints: Locate expansion joints and other sealant-filled joints, including control, contraction, and isolation joints, where indicated during installation of setting materials, mortar beds, and tile. Do not saw cut joints after installation of tiles.
   1. Locate joints in tile surfaces directly above joints in concrete substrates.
   2. Provide expansion and control joints at not more than 15 feet o.c., at all expansion and control joints in the concrete subfloor and where otherwise recommended by the "Handbook for Ceramic Tile Installation" of the Tile Council of America.
   3. Movement joints shall be provided throughout the tile and work will conform to ANSI Specification A108.01-3.7; A108.02 B 4.4.and TCA Details EJ171.
   4. Seal all joints in accordance with requirements of Section 07 6000.

H. Grout tile to comply with the requirements of the following installation standards:
   1. ANSI A108.

3.04 INSTALLATION METHODS

A. Conform to TCA Handbook for installation on various substrates shown on drawings, using materials listed in Part 2 of this Specification Section.

B. Metal Edge Strips: Install at locations indicated or where exposed edge of tile flooring meets carpet, wood, or other flooring that finishes flush with top of tile.

3.05 CLEANING AND PROTECTION

A. Cleaning: Upon completion of placement and grouting, clean all ceramic tile surfaces so they are free of foreign matter.
   1. Remove grout residue from tile as soon as possible.
   2. Unglazed tile may be cleaned with acid solutions only when permitted by tile and grout manufacturer's printed instructions, but no sooner than 14 days after installation. Protect metal surfaces, cast iron, and vitreous plumbing fixtures from effects of acid cleaning. Flush surface with clean water before and after cleaning.

B. Finished Tile Work: Leave finished installation clean and free of cracked, chipped, broken, unbonded, and otherwise defective tile work.

C. Provide final protection and maintain conditions in a manner acceptable to manufacturer and installer that ensures that tile is without damage or deterioration at time of Substantial Completion.
   1. When recommended by tile manufacturer, apply a protective coat of neutral protective cleaner to completed tile walls and floors. Protect installed tile work with kraft paper or other heavy covering during construction period to prevent staining, damage, and wear.
   2. Prohibit foot and wheel traffic from tiled floors for at least 7 days after grouting is completed.

D. Before final inspection, remove protective coverings and rinse neutral cleaner from tile surfaces.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install suspension systems, ceiling boards, panels and tiles, and accessories required for complete installation of acoustical ceilings specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 APPLICABLE STANDARDS

A. American Society for Testing and Materials:
   1. ASTM C 635, "Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings".
   2. ASTM C 636, "Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels".
   3. ASTM E 84, "Surface Burning Characteristics of Building Materials".
   4. ASTM E 580, "Application of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Requiring Seismic Restraint"
   5. International Building Code, Section 16, Suspended Ceilings (Seismic Restraint)

1.05 SEISMIC RESTRAINT REQUIREMENTS

A. Based upon seismic design analysis described in IBC. Refer to Code Data for Seismic Category.

B. Category A or B: Ceiling installation should conform to basic minimums established in ASTM C636.

1.06 PRODUCT HANDLING

A. Protection: Protect suspended acoustical ceiling materials before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary and at Contractor's expense.

1.07 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials, totaling 3% of the total installed, matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.

PART 2 - PRODUCTS

2.01 SUSPENSION SYSTEMS

A. Provide steel capped, 15/16" "Prelude" or 9/16" "Suprafine" as required, exposed tee grid by Armstrong World Industries, USG Interiors or Celotex.

B. Suspension Members: Intermediate or heavy duty type of sufficient strength and rigidity to carry acoustical ceiling units in true and level plane without exceeding 1/32" deflection in any 2 feet of their spans.

C. Fabrication: Fabricate suspension system components from cold-rolled sheet steel conforming to ASTM A 366. Protect from rust and corrosion with hot dipped galvanized coating.

D. Finish for Exposed Members: Factory applied, white, low-gloss, baked-enamel finish. Suspend main suspension system runners from overhead construction members with not less than 12 gauge galvanized steel wire conforming to Federal Specification QQ-W-461.

2.02 ACOUSTICAL CEILING BOARDS

A. Refer to Finish Legend on Sheet A801 for Material List.

PART 3 - EXECUTION

3.01 GENERAL INSTALLATION REQUIREMENTS

A. Examine surfaces and conditions affecting proper installation of acoustical materials. Do not proceed until unsatisfactory conditions are corrected.

B. Do not start acoustical ceiling work until glazing is completed and exterior openings are enclosed.

C. All wet work, including concrete and masonry work must be completed and dried out before work is started.

D. Do not install acoustical materials unless uniform temperature in spaces where acoustical tile work is performed is at least 60E F. during and after installation.

E. Install acoustical ceilings, complete, including component parts necessary to suspend systems from structure.

F. Install suspension systems to permit border units of greatest possible size where not full size.

G. Following installation, clean soiled and discolored surfaces. Remove and replace units damaged or improperly installed.

H. For any units that do not have square edges and must be cut for any reason, install edge angle or "T" at same elevation as other supporting members and make a field cut in the same profile as the factory edge or splice in a factory edge. Paint cut edges or splice joints to match giving a visually flawless result.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install resilient flooring and base specified. Clean and protect resilient floor areas after installation.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Obtain each type, color, and pattern of flooring from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

B. Qualifications of Installers: Use only skilled and experienced resilient flooring installers for preparation of substrate and installation of flooring. Supervise helpers and apprentices at all times with thoroughly skilled resilient flooring installers.

C. Manufacturers' Recommendations: Manufacturers' recommended methods of installation and the referenced applicable standards is basis for installation methods used on this work.

D. Applicable Standards:
   1. Resilient Tile Institute:
      (a) Recommended Installation Specifications for Vinyl Composition Tile Flooring and Asphalt Tile Flooring.
   2. Rubber Manufacturer's Association:
      (a) Manual for the Preparation of Subfloors for the Installation of Solid Vinyl and Rubber Flooring.
      (b) Specifications for Flexible Vinyl Cove Base.
      (c) Specifications for Rubber Cover Base.
      (d) Specifications for Solid Vinyl Flooring.
   3. Conform to ADA requirements for slip resistance by providing minimum coefficients of sliding friction of 0.6 COF for horizontal surfaces and 0.8 COF for ramps and other sloped surfaces.

1.05 MOISTURE SLAB TEST

A. One of the following three methods shall be used to determine moisture content of slab at time of application.

B. Using a Tramax concrete moisture detection device, firmly apply the test apparatus to concrete that has had sealers or other subsequent coatings removed. The readings shall be 4.2% or less. If readings are higher, use ASTM F- 2170 for non conditioned spaces and/or ASTM F1869 for conditioned spaces.

C. ASTM F-2170 in situ Relative Humidity Test. Follow test procedures of manufacturer of testing equipment. Reading should be below 75%. If above 75%, use the next test method below.

D. ASTM F-1869 Calcium Chloride Moisture Vapor Transmission Test. Follow test procedures of manufacturer of testing equipment. Results should be below 3 lbs/1,000 square feet/24 hours. (This test is valid only for conditioned spaces.)

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver flooring and installation accessories to Project site in original manufacturer's unopened cartons and containers each bearing names of product and manufacturer, Project identification, and shipping and handling instructions.

B. Store flooring materials in dry spaces protected from the weather with ambient temperatures maintained between 50 deg F (10 deg C) and 90 deg F (32 deg C).

C. Store flooring materials on flat surfaces. Move flooring and installation accessories into spaces where they will be installed at least 48 hours in advance of installation.

1.07 PROJECT CONDITIONS

A. Maintain a minimum temperature of 70 deg F (21 deg C) in spaces to receive flooring for at least 48 hours prior to installation, during installation, and for not less than 48 hours after installation. After this period, maintain a temperature of not less than 55 deg F (13 deg C).

B. Do not install flooring until they are at the same temperature as the space where they are to be installed.

C. Close spaces to traffic during installation.

1.08 SEQUENCING AND SCHEDULING

A. Install flooring and accessories after other finishing operations, including painting, have been completed.

B. Do not install flooring over concrete slabs until the slabs have cured and are sufficiently dry to bond with adhesive as determined by flooring manufacturer's recommended bond and moisture test.

1.09 EXTRA MATERIALS

A. Deliver extra materials to Owner. Furnish extra materials, totaling 3% of the total installed, matching products installed as described below, packaged with protective covering for storage and identified with labels clearly describing contents.

PART 2 - PRODUCTS

2.01 RESILIENT FLOORING

A. Refer to Finish Legend on Sheet A801 for Material List.

2.02 INSTALLATION ACCESSORIES

A. Concrete Slab Primer: Nonstaining type as recommended by flooring manufacturer.

B. Trowelable Underlayments and Patching Compounds: Latex-modified, portland-cement-based formulation provided or approved by flooring manufacturer for applications indicated. Provide materials for filling cracks and leveling floor depressions by Flintcote Underlayment, Floorstone, Stonehard Resurfacer, or approved equal.

C. Adhesives (Cements): Water-resistant type recommended by flooring manufacturer to suit resilient flooring products and substrate conditions indicated.

D. Metal Edge Strips: Refer to Finish Legend on Sheet A801 for Material List.

E. Furnish beveled edge strips 1-1/8" wide where resilient flooring adjoins other floor finish of lower level.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine areas where installation of flooring will occur, with Installer present, to verify that substrates and conditions are satisfactory for installation and comply with manufacturer's requirements and those specified in this Section. Do not proceed with installation until unsatisfactory conditions have been corrected.

B. Concrete Subfloors: Verify that concrete slabs comply with ASTM F 710 and the following:
   1. Slab substrates are dry and free of curing compounds, sealers, hardeners, and other materials whose presence would interfere with bonding of adhesive. Determine adhesion and dryness characteristics by performing bond and moisture tests recommended by manufacturer.
   2. Finishes of subfloors comply with tolerances and other requirements specified in Division 3 Section "Cast-In-Place Concrete" for slabs receiving resilient flooring.
   3. Subfloors are free of cracks, ridges, depressions, scale, and foreign deposits of any kind.

3.02 PREPARATION

A. Comply with manufacturer's installation specifications to prepare substrates indicated to receive flooring.

B. Use trowelable leveling and patching compounds per manufacturer's directions to fill cracks, holes, and depressions in substrates.

C. Remove coatings, including curing compounds, and other substances that are incompatible with flooring adhesives and that contain soap, wax, oil, or silicone, by using a terrazzo or concrete grinder, a drum sander, or a polishing machine equipped with a heavy-duty wire brush.

D. Broom or vacuum clean substrates to be covered by flooring immediately before installation. Following cleaning, examine substrates for moisture, alkaline salts, carbonation, or dust.

E. Apply concrete slab primer, if recommended by flooring manufacturer, prior to applying adhesive. Apply according to manufacturer's directions.

3.03 TILE FLOORING INSTALLATION

A. Comply with tile manufacturer's installation directions and other requirements indicated that are applicable to each type of tile installation included in Project.

B. Lay out tiles from center marks established with principal walls, discounting minor offsets, so tiles at opposite edges of room are of equal width. Adjust as necessary to avoid using cut widths at perimeter that equal less than one-half of a tile. Install tiles square with room axis, unless otherwise indicated.

C. Match tiles for color and pattern by selecting tiles from cartons in same sequence as manufactured and packaged, if so numbered. Cut tiles neatly around all fixtures. Discard broken, cracked, chipped, or deformed tiles.

D. Where demountable partitions and other items are indicated for installing on top of finished tile floor, install tile before these items are installed.

E. Scribe, cut, and fit tiles to butt tightly to vertical surfaces, permanent fixtures, built-in furniture including cabinets, pipes, outlets, edgings, thresholds, and nosings.

F. Extend tiles into toe spaces, door reveals, closets, and similar openings.

G. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.

H. Install 1-1/8" wide bullnose edging strips where edges of tile are exposed.

I. Install tiles on covers for telephone and electrical ducts, and similar items occurring within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly adhere edges to perimeter of floor around covers and to covers.

J. Adhere tiles to flooring substrates without producing open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections in completed tile installation.

K. Use full spread of adhesive applied to substrate in compliance with tile manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times.

L. Hand roll tiles where required by tile manufacturer.

3.04 SHEET FLOORING INSTALLATION

A. Comply with sheet vinyl floor covering manufacturer's installation instructions and other requirements indicated that are applicable to each type of floor covering installation included in Project.

B. Lay out sheet vinyl floor coverings to comply with the following requirements:
   1. Maintain uniformity of sheet vinyl floor covering direction.
   2. Arrange for a minimum number of seams and place them in inconspicuous and low traffic areas, but in no case less than 6 inches away from parallel joints in flooring substrates.
   3. Match edges of resilient floor coverings for color shading and pattern at seams. Avoid cross seams.

C. Where demountable partitions and other items are indicated for installing on top of finished floor covering, install floor covering before these items are installed.

D. Scribe, cut, and fit sheet vinyl floor coverings to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture, including cabinets, pipes, outlets, edgings, thresholds, and nosings.

E. Extend sheet vinyl floor coverings into toe spaces, door reveals, closets, and similar openings.

F. Maintain reference markers, holes, or openings that are in place or plainly marked for future cutting by repeating on finish flooring as marked on subfloor. Use chalk or other nonpermanent marking device.

G. Install sheet vinyl floor coverings on covers for telephone and electrical ducts, and similar items occurring within finished floor areas. Maintain overall continuity of color and pattern with pieces of flooring installed on these covers. Tightly adhere edges to perimeter of floor around covers and to covers.

H. Adhere sheet vinyl floor coverings to flooring substrates by method approved by floor covering manufacturer.
   1. Produce completed installation without open cracks, voids, raising and puckering at joints, telegraphing of adhesive spreader marks, or other surface imperfections.
   2. Comply with floor covering manufacturer's directions including those for trowel notching, adhesive mixing, and adhesive open and working times.

I. Hand roll sheet vinyl floor coverings in both directions from center out to embed floor coverings in adhesive and eliminate trapped air. At walls, door casings, and other locations where access by roller is impractical, press floor coverings firmly in place with flat-bladed instrument.

3.05 RESILIENT BASE INSTALLATION

A. Comply with manufacturer's written instructions for installing resilient base.

B. Apply resilient base to walls, columns, pilasters, casework and cabinets in toe spaces, and other permanent fixtures in rooms and areas where base is required.

C. Install resilient base in lengths as long as practical without gaps at seams and with tops of adjacent pieces aligned.

D. Tightly adhere resilient base to substrate throughout length of each piece, with base in continuous contact with horizontal and vertical substrates.

E. Do not stretch resilient base during installation.

F. On masonry surfaces or other similar irregular substrates, fill voids along top edge of resilient base with manufacturer's recommended adhesive filler material.

G. Preformed Corners: Install preformed corners before installing straight pieces.

H. Job-Formed Corners:
   1. Outside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 4 inches in length.
      a. Form without producing discoloration (whitening) at bends.
   2. Inside Corners: Use straight pieces of maximum lengths possible and form with returns not less than 4 inches in length.
      a. Miter or cope corners to minimize open joints.

3.06 CLEANING AND PROTECTION

A. Perform the following operations immediately after completing installation:
   1. Remove visible adhesive and other surface blemishes using cleaner recommended by flooring manufacturers.
   2. Sweep or vacuum floor thoroughly.
   3. Do not wash floor until after time period recommended by resilient flooring manufacturer.
   4. Damp-mop flooring to remove black marks and soil.

B. Protect flooring against mars, marks, indentations, and other damage from construction operations and placement of equipment and fixtures during remainder of construction period. Use protection methods indicated or recommended by flooring manufacturer.
   1. Apply protective floor polish to flooring surfaces that are free from soil, visible adhesive, and surface blemishes.
   2. Use commercially available, metal, cross-linked acrylic product acceptable to flooring manufacturer.
   3. Coordinate selection of floor polish with Owner's maintenance service.
   4. Cover flooring with undyed, untreated building paper until inspection for Substantial Completion.
   5. Do not move heavy and sharp objects directly over flooring. Place plywood or hardboard panels over flooring and under objects while they are being moved. Slide or roll objects over panels without moving panels.

C. Clean flooring not more than 4 days prior to dates scheduled for inspections intended to establish date of Substantial Completion in each area of Project. Clean flooring using method recommended by manufacturer.
   1. Strip protective floor polish that was applied after completing installation prior to cleaning.
   2. Reapply floor polish after cleaning.

END OF SECTION

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PART 1 - GENERAL

1.01 SUMMARY

A. Section Includes: Furnish labor, materials, tools and equipment required and install decorative, seamless epoxy flooring and cove base specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Subcontractor Qualifications: Use installer approved and licensed representative of manufacturer of materials used. Use mechanics experienced in commercial installation of materials used and factory trained and qualified by manufacturer.

B. Single Source Responsibility: Obtain each color, grade, finish, type, composition, and variety of flooring material from a single source with resources to provide products of consistent quality in appearance and physical properties without delaying progress of the Work.

C. Field Constructed Mock-up: Before installing flooring, erect mock-ups for each form of construction and finish required to verify selections made under sample submittals and to demonstrate aesthetic effects as well as qualities of materials and execution. Build mock-ups to comply with the following requirements, using materials indicated for final unit of Work.
   1. Locate mock-ups on site in location and size as directed by Architect.
   2. Demonstrate the proposed range of aesthetic effects and workmanship.
   3. Obtain Architect's acceptance of mock-ups before start of final unit of Work.
   4. Retain and maintain mock-ups during construction in undisturbed condition as a standard for judging completed unit of Work.
   5. When directed, demolish and remove mock-ups from Project site.

E. Pre-Installation Conference: Conduct conference at Project site as directed by Architect.

1.05 MOISTURE SLAB TEST

A. One of the following three methods shall be used to determine moisture content of slab at time of application.

B. Using a Tramax concrete moisture detection device, firmly apply the test apparatus to concrete that has had sealers or other subsequent coatings removed. The readings shall be 4.2% or less. If readings are higher, use ASTM F- 2170 for non conditioned spaces and/or ASTM F1869 for conditioned spaces.

C. ASTM F-2170 in situ Relative Humidity Test. Follow test procedures of manufacturer of testing equipment. Reading should be below 75%. If above 75%, use the next test method below.

D. ASTM F-1869 Calcium Chloride Moisture Vapor Transmission Test. Follow test procedures of manufacturer of testing equipment. Results should be below 3 lbs/1,000 square feet/24 hours. (This test is valid only for conditioned spaces.)

1.06 PROJECT CONDITIONS

A. Maintain environmental conditions and protect work during and after installation to comply with referenced standards and manufacturer's printed recommendations.

B. Maintain temperatures at 50NF (10NC) or more during installation and for 7 days after completion, unless higher temperatures are required by manufacturer's instructions.

C. Prevent damage or contamination to materials by water, freezing, foreign matter, and other causes.

1.07 WARRANTY

A. System manufacturer and system installer required to jointly warrant against bond failure, cracking, and deteriorations of seamless covering installed on structurally sound substrate for period of one year after acceptance of project and to replace, repair, or make good defective work or materials at Contractor's expense during warranty period.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Refer to Finish Legend on Sheet A801 for Material List.

B. Minimum Performance Characteristics:
   1. Impact Resistance: Gardner Impact Test. 160 in/lb - no cracking, chipping or delamination.
   2. Indentation Resistance: MIL D 3134F, Section 4.74. Withstands 2,000 lbs/sq. in. for 30 minutes without indentation.
   3. Tabor Abrasion Resistance: CS17 Wheels with 2,000 gm load for 10,000 cycles. 27.6 mg average loss per 1,000 cycles.

4. Toxicity: U.S. Department of Agriculture Research Service Meat Inspection Division, Non-Toxic.
5. Flammability: ASTM E-84 Tunnel Test. Flame Spread Classification (FSC) not to exceed 35.
6. Compressive Strength: ASTM C-579 - 10,400 psi.
7. Chemical Resistance: Unaffected by the following:

20% Hydrochloric Acid	10% Lactic Acid
Urine	Tea
Coffee	Mustard
Ethyl Alcohol	Mercurochrome
Iodine	Betadyne

PART 3 - EXECUTION

3.01 EXAMINATION

A. Examine substrates and areas where flooring will be installed, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of installed flooring.
   1. Verify that substrates are firm, dry, clean, and free from oil or waxy films and curing compounds.
   2. Verify that installation of grounds, anchors, recessed frames, electrical and mechanical units of work, and similar items located in or behind flooring has been completed before installing flooring.
   3. Notify the Architect of any cracks or irregularities in the substrate that might telegraph through the flooring or cause it to crack.

B. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. General: Prepare substrate surfaces including etching of concrete floors, application of sealer or primer coats and preparation required to obtain optimum adhesion to surfaces, to seal surfaces against migration of foreign materials through coating, and to provide for smooth, uniform finished surface.

B. Patch all depressions, divots, honeycombed or scaled concrete with filler as recommended by manufacturer.

C. Fill all non-moving cracks or control joints with joint filler as recommended by manufacturer.

D. Fill all moving cracks or joints with a firm but flexible sealant material as recommended by manufacturer. Control joints should be re-cut in finished floor if required and filled with sealants.

E. Mask surfaces that require protection.

3.03 INSTALLATION

A. Apply flooring in accordance with manufacturer's printed instructions, employing lead mechanic qualified under the quality assurance portion of this specification, using equipment specifically designed for this purpose.

B. Surfacing shall be tightly compacted, trowel applied. Trowel apply vertical cove base and hand sand cove base. Apply three coats of resin to assure a smooth surface and cove. Do not allow resin to puddle in cove.

C. Install integral cove base to height of 4" with 1" radius cove.
   1. Trowel apply vertical cove base.
   2. Hand sand cove base.
   3. Apply three coats of resin to assure a smooth surface and cove.
   4. Do not allow resin to puddle in cove.

D. Finished work shall match approved samples; be uniform in thickness, sheen, color, pattern, and texture; and be free from defects detrimental to performance.

3.04 PROTECTION

A. During work under this Section protect surfaces of other trades against damage. After installation allow no traffic on seamless covering for at least 72 hours. Protect completed flooring from damage until final acceptance of project by Owner.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Furnish and install specified carpet, including accessories required for complete and proper installation. Clean and protect installed carpet.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Installers: Use only thoroughly trained and experienced carpet installers completely familiar with materials specified, manufacturer's recommended methods of installation, and requirements of this work.

B. Manufacturer's Recommendations: Manufacturer's recommended methods of installation is basis for methods of installation used in this work.

C. Applicable Standards:
1. ASTM E 648, "Standard Method of Test for Critical Radiant Flux of Floor Covering Systems using a Radiant Heat Source", (GSA-372). Minimum of .25 Watts/cm^2.
2. Carpet and Rug Institute (CRI) "Carpet Specifiers Handbook".

1.05 MOISTURE SLAB TEST

A. One of the following three methods shall be used to determine moisture content of slab at time of application.

B. Using a Tramax concrete moisture detection device, firmly apply the test apparatus to concrete that has had sealers or other subsequent coatings removed. The readings shall be 4.2% or less. If readings are higher, use ASTM F- 2170 for non conditioned spaces and/or ASTM F1869 for conditioned spaces.

C. ASTM F-2170 in situ Relative Humidity Test. Follow test procedures of manufacturer of testing equipment. Reading should be below 75%. If above 75%, use the next test method below.

D. ASTM F-1869 Calcium Chloride Moisture Vapor Transmission Test. Follow test procedures of manufacturer of testing equipment. Results should be below 3 lbs/1,000 square feet/24 hours. (This test is valid only for conditioned spaces.)

1.06 WARRANTY

A. Carpet manufacturer to guarantee in writing, his goods for period of 2 years against defective workmanship and materials. Carpeting subcontractor to guarantee remaining materials and equipment to comply with requirements of Contract documents for period of 2 years, and agrees to promptly and without charge, make changes, replacements and corrections required to correct defects in design, material, or workmanship developing in materials or equipment under its intended use.

B. Carpeting subcontractor also, at his expense, shall promptly and properly replace improper work within 2 years after final approval as evidenced by date of final payment. Carpeting contractor will receive no compensation for loss in replacement of goods or workmanship. Foregoing two-year absolute guaranty and warranty does not in any way limit, restrict, or affect liability of Contractor, or his subcontractors for indemnity provided for in this Contract, nor does it in any way shorten limitation period fixed by law for filing any action against Contractor for enforcement or for breach of Contract.

PART 2 - PRODUCTS

2.01 CARPET

A. Refer to Finish Legend on Sheet A801 for Material List.

2.02 MATERIAL TOLERANCES

A. Final manufactured carpeting, all types, subject to following tolerances:
   1. Five percent (plus or minus) variation in basic raw materials, pile height and weight.
   2. Transverse and longitudinal rows perpendicular to each other with no tolerance allowed that causes uneven or bowed cross seams visible to the naked eye.

2.03 CARPET ACCESSORIES

A. Carpet Edge Guard and/or Transition Strip: Carpet edge guards and transition strips of types, sizes and profiles required. Submit color choices to Architect for selection of finish color.

B. Installation Adhesive: Water-resistant type recommended by carpet or cushion manufacturer, and complying with flammability requirements for installed carpet.

C. Seaming Cement: Hot melt seaming adhesive or similar product recommended by carpet manufacturer, for taping seams and buttering cut edges at backing to form secure seams and prevent pile loss at seams.

D. Trowelable Underlayment: Where carpet transitions up to other floor covering, provide trowelable underlayment material in thickness required sloping down to feather edge at 1/8" +/- per foot slope.

PART 3 - EXECUTION

3.01 MEASUREMENTS

A. Dimensions for carpet areas are approximate. Carefully check dimensions and other conditions affecting this work in the field. Contractor responsible for proper installation of carpet in areas designated.

3.02 PRE-INSTALLATION REQUIREMENTS

A. Installer must examine substrates for moisture content and other conditions under which carpeting is installed, and notify Contractor in writing of conditions detrimental to proper completion of this work. Do not proceed until unsatisfactory conditions are corrected.
   1. Floor preparation shall be free of cracks and holes. Gaps of 1/16" or more are to be filled with latex base flashing compound.
   2. Floor temperature should be at 65E at least 24 hours prior to installation and 48 hours after carpet is installed.

B. Clear debris and scrape up cementitious deposits from surfaces to receive carpeting. Vacuum clean immediately before installation. Check concrete surfaces to ensure no "dusting" results through installed carpet. Apply sealer when required to prevent dusting.

C. Sequence carpeting with other work to minimize possibility of damaging and soiling carpet during remainder of construction period.

3.03 INSTALLATION, GENERAL

A. Comply with CRI 104, Section 9 "Direct Glue-Down Installation" for carpet and Section 14 "Carpet Modules" for carpet tile, and with manufacturer's recommendations and final shop drawings for installation.

B. Extend carpet and carpet tile under open-bottomed obstructions and under removable flanges and furnishings, and into alcoves and closets of each space.

C. Provide cut-outs where required, and bind cut edges properly where not concealed by protective edge guards or overlapping flanges.

D. Coordinate installation with installation of edge/transition treatment.

E. Maintain dye lot integrity. Do not mix dye lots in same area.

3.04 CARPET TILE INSTALLATION

A. Comply with manufacturer's instructions and final shop drawings.

B. Cut and fit carpet tile to butt tightly to vertical surfaces, permanent fixtures, and built-in furniture including cabinets, pipes, outlets, edging, thresholds, and nosings. Bind or seal cut edges as recommended by carpet tile manufacturer.

C. Install in installation method scheduled using releasable adhesive.

D. Transition Strips: Place strips tightly butted and secured to flooring with adhesive

3.05 PROTECTION AND CLEANING OF CARPETING

A. Adequately cover and protect against damage during shipment and delivery to job site, and until acceptance by Owner.

B. Protect during installation using drop cloths, or heavy, reinforced, non-staining Kraft paper.

C. Damaged carpeting will be rejected and replaced by Contractor.

D. At completion of work and when directed by Owner, vacuum clean carpet and remove soiling.

E. Install plybar or 6 mil. visqueen protection over areas of carpeting. Lap 12" at edges. Continuously tape down edges and joints.

3.06 MAINTENANCE

A. Submit 2 copies of complete manual of manufacturer's maintenance recommendations for each type carpet specified.

3.07 OVERRUN AND ATTIC STOCK

A. Modular Attic Stock: 3 percent of job required yardage of each carpet.

B. Package overrun and attic stock pieces in wrapping suitable for storage, clearly labeled and marked as to construction quality, color, and sizes. Place in orderly manner in areas designated by Owner.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Provide specified painting and finishing of interior and exterior items.
   1. **Do not paint** over any code required labels, such as Underwriters' Laboratories and Factory Mutual, or any equipment identification, performance rating, name, or nomenclature plates. Mask off the label before applying finish and remove masking after finish is dry.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 DEFINITIONS

A. Term "paint", as used herein, includes enamels, paints, sealers, fillers, emulsions, varnishes, stains, and other coatings whether used as prime, intermediate, or finish coats.

1.05 QUALITY ASSURANCE

A. Qualifications of Painters: Use only qualified journeyman painters for mixing and application of paint. In acceptance or rejection of painting, no allowance made for lack of skill on part of painters.

1.06 PRODUCT HANDLING

A. Delivery: Deliver paint materials to job site in original unopened containers with labels intact and legible at time of use.

B. Protection:
   1. Store only approved materials at job site and store only in suitable and designated area restricted to storage of paint materials and related equipment.
   2. Ensure safe storage and use of paint materials and prompt and safe disposal of waste.
   3. Protect paint materials before, during, and after application and protect installed work and materials of other trades.

PART 2 - PRODUCTS

2.01 PAINT MATERIALS

A. Manufacturers: Provide paints, enamels, stains, varnishes, and admixtures of first line quality by Sherwin Williams. Sherwin Williams products specified herein establish minimum quality standards.

B. Compatibility:
   1. Paint materials and equipment to be compatible. Finish coats compatible with prime coats, prime coats compatible with surface to be coated, and tools and equipment compatible with coating applied.
   2. Thinners (when used): Use thinners recommended for that purpose by manufacturer of material thinned.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Carefully inspect installed work of other trades and verify work is complete to point where painting work may properly commence. Verify paint finishes may be applied in strict accordance with manufacturer's directions and requirements of these Specifications.

B. Discrepancies: Do not proceed with installation in areas of discrepancy until discrepancies are fully resolved.

3.02 PREPARATION OF SURFACES

A. Protection: Completely mask, remove, and adequately protect hardware, accessories, machined surfaces, plates, lighting fixtures, and similar items in contact with painted surfaces not scheduled to receive paint.

B. Priming: Use primer recommended by manufacturer of coating system. Spot prime exposed nails and metals to be painted with emulsion paints.

C. Cleaning: Thoroughly clean surfaces receiving paint. Schedule cleaning and painting so dust and contaminants from cleaning process will not fall on wet, newly painted surfaces.

D. Gypsum Board: Treat and conceal joints, screwheads, and depressions in gypsum board surface in accordance with manufacturer's recommendations and instructions. Painted surfaces must be completely clean and continuously smooth. Treat internal and exterior corners and angles formed by intersection of wallboard surfaces and wallboard edges with joint reinforcements system in accordance with manufacturer's standard installation specifications where intersections and edges do not have metal trim. **All joints in gypsum board construction are to be taped and floated. This includes work above ceilings, at concealed places and anywhere else joints in gypsum board construction occur.** A slight egg-shell texture may be acceptable if approved by Architect prior to application. Heavy "knockdown" texturing is not acceptable.

E. Wood: Clean wood surfaces free of dirt, oil, or foreign substances with scrapers, mineral spirits, and sandpaper. Sandpaper smooth those surfaces exposed to view, and then remove dust. Prime or seal wood requiring job painting immediately upon delivery to job. Prime edges, ends, faces, undersides, and backsides of this wood. Scrape and clean small, dry seasoned knots, and apply thin coat of white shellac or manufacturer's recommended knot sealer, before application of priming coat. After priming, fill holes and imperfections in finish surfaces with putty of plastic wood-filler. Sandpaper smooth when dried.

F. Primed Ferrous Metals: Clean ferrous metals free of dust, grease and grime. Sand smooth rust spots, mars and abrasions in surfaces. Touch-up shop-applied prime coats which have damage or bare areas. Wire-brush, solvent clean, and touch up with same primer as shop coat.

G. Galvanized Metal Surfaces: Clean free of oil and surface contaminates with acceptable non-petroleum based solvent. Touch up bare metal with zinc chromate primer.

3.03 WORKMANSHIP

A. Do not perform outside painting in extremely cold, frosty, or damp weather. Do not paint in dusty rooms. If required, sprinkle floors, to lay dust. Do not apply coats of paint on either wet or damp surfaces and in no case unless preceding coat is dry and hard.

B. Clean surfaces before priming. Remove dirt, oil, grease, rust, scale, and foreign matter. Clean with sandpaper, steel scraper, or wire brushes where necessary.

C. Specified coats are to cover completed painting and finishing work. Where color, stain, or undercoats show through final coat, install additional coats until uniform coverage is obtained.

D. Vary tints of undercoats slightly for identification of succeeding coats. Ample time of drying required to secure best possible results.

E. At all accent paint locations, contractor to mock-up approximately 3’-0” x 3’-0” color swatch, with final approval of color pending client walk-through.

F. Coats specified are in addition to shop or mill priming required under other Sections of these specifications.

G. All cabinet devices that require finish painting are to be painted with doors in the open position and shall be allowed to dry for a minimum of 24 hours in the open position. DO NOT PAINT DOORS CLOSED AND TRIM AFTER DRYING.

1. Cabinets that require finish painting include, but are not limited to, wall and ceiling access doors, fire extinguisher/hose/valve cabinets, electrical panel boxes, etc.

H. Corridor partitions, smokestop partitions, horizontal exit partitions, exit enclosures, and fire walls shall be effectively and permanently identified with signs or stenciling in a manner acceptable to the authority having jurisdiction. Label each wall at 20'-0" maximum. Such identification shall be above any decorative ceiling and in concealed spaces. Approved wording is to be:

FIRE AND SMOKE BARRIER - PROTECT ALL OPENINGS

3.04 PAINT SCHEDULE

A. Finish surfaces as follows: Refer to Finish Legend on Sheet A801 for Material List.

	SURFACE	TREATMENT
1.	**Exterior Ferrous Metals:**	1st Coat - SW Pro-Cryl Universal Water Based Primer, B66-310 Series (Touch up only on primed surfaces) 2nd & 3rd Coats - SW Pro Industrial DTM Acrylic Coating B66-1250 Series
2.	**Exterior Exposed Structural Steel Not Factory Galvanized:**	1st Coat – SW ZINC CLAD® 3100 Waterbased Pre-Construction Primer 2nd & 3rd Coats - SW Pro Industrial DTM Acrylic Coating B66-1250 Series
3.	**Interior Ferrous Metals:**	1st Coat - SW Pro-Cryl Universal Water Based Primer, B66-310 Series (Touch up only on primed surfaces) 2nd & 3rd Coats - SW Pro Industrial Acrylic, B66-600 Series.
4.	**High Performance Finish at Exterior, Exposed Steel:**	Touch-up primer on shop primed steel 1st Coat - SW Pro-Cryl Universal Water Based Primer, B66-310 Series 2nd & 3rd Coats - SW Sher-Cryl High Performance Acrylic Coating B66-350 Series
5.	**Galvanized Metal:** (Includes exposed galvanized steel lintels, railings, stairs, doors and frames at interior and exterior locations)	1st Coat - SW Pro-Cryl Universal Water Based Primer, B66-310 Series (Touch up only on primed surfaces) 2nd & 3rd Coats - SW Pro Industrial Acrylic, B66-600 Series
6.	**Int. Gyp. Board - Painted:**	1st Coat - SW ProMar 200 Zero VOC Latex Primer, B28W2600 2nd & 3rd Coats - SW ProMar 200 Zero VOC Latex .
7.	**Int. Gyp. Board - Glazecoat:**	1st Coat - SW ProMar 200 Zero VOC Latex Primer, B28W2600 2nd & 3rd Coats - K46W00151 - Pro Industrial PreCatalyzed Waterbased Semi-Gloss Epoxy
8.	**Architectural Woodwork: Paint Finished On-Site**	1st Coat - SW Multi-Purpose Latex Primer, B51-450 2nd & 3rd Coats - SW Pro Industrial Acrylic, B66-600.

3.05 PAINTING OF MECHANICAL AND ELECTRICAL WORK

A. Painting of pipe and duct insulation and uncoated ferrous metal in inaccessible pipe and duct chases, in plumbing chases, and in spaces above ceiling is not required.

B. Metal Work in Mechanical Room (finish as follows):
   1. Clean prefinished equipment and touch up with enamel to match manufacturer's final coat.
   2. Clean exposed pipe, exposed conduit and electric outlet boxes, hangers and brackets, valve handles, and miscellaneous pipe line devices and give two coats of medium gray enamel.
   3. Clean prime painted or unfinished items of manufactured mechanical and electrical equipment, then prime and finish with two coats of enamel to match other finished items of equipment.
   4. Finish remaining exposed metal items with two coats of light grey enamel.

C. Paint exposed interior metal work, including ferrous and non-ferrous piping, for heating ventilating, plumbing and electrical equipment, electric cabinets, ventilating grilles, metal access panels. Give exposed metal items one coat of enamel undercoater and one coat of enamel in addition to priming coat.

D. Give pipe and duct insulation exposed to view one coat glue size and two coats enamel.

E. Paint all mechanical, electrical and plumbing items that are visible through registers, grilles and diffusers with Flat Black-Out paint.

3.06 PROTECTION, CLEAN UP, AND TOUCH-UP

A. Protect all work from paint droppings and spattering by use of masking, drop cloths, removal of items or by other approved methods.

B. Upon completion, clean paint drops and smears from hardware, glass and other surfaces and items.

C. Before final inspection, touch-up or refinish painted surfaces which have become damaged or discolored.
   1. Perform touch-up work in a manner to produce solid even color and finish texture to match surrounding color and finish texture.
   2. Areas that receive touch-up work and do not match surrounding color or finish texture will be refinished at Contractors expense.

END OF SECTION

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PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section Includes:
   1. Corner guards.

1.03 SUBMITTALS

A. Product Data: Include construction details, material descriptions, impact strength, fire-test-response characteristics, dimensions of individual components and profiles, and finishes for each impact-resistant wall protection unit.

B. Samples for Initial Selection: For each type of impact-resistant wall protection unit indicated.
   1. Include similar Samples of accent strips and accessories involving color selection.

C. Warranty: Sample of warranty.

1.04 QUALITY ASSURANCE

A. Installer Qualifications: An employer of workers trained and approved by manufacturer.

B. Source Limitations: Obtain impact-resistant wall protection units from single source from single manufacturer.

C. Product Options: Drawings indicate size, profiles, and dimensional requirements of impact-resistant wall protection units and are based on the specific system indicated.

D. Surface-Burning Characteristics: Provide impact-resistant, plastic wall protection units with surface-burning characteristics as determined by testing identical products per ASTM E 84, NFPA 255, or UL 723 by UL or another qualified testing agency.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Store impact-resistant wall protection units in original undamaged packages and containers inside well-ventilated area protected from weather, moisture, soiling, extreme temperatures, and humidity.
   1. Maintain room temperature within storage area at not less than 70 deg F during the period plastic materials are stored.
   2. Keep plastic sheet material out of direct sunlight.

3. Store plastic wall protection components for a minimum of 72 hours, or until plastic material attains a minimum room temperature of 70 deg F.
    a. Store corner-guard covers in a vertical position.
    b. Store materials in a horizontal position.

1.06 WARRANTY

A. Manufacturer's standard form in which manufacturer agrees to repair or replace components of impact-resistant wall protection units that fail in materials or workmanship within specified warranty period.
    1. Warranty Period: Five years from date of Substantial Completion.

PART 2 – PRODUCTS

2.01 CORNER GUARDS

A. Refer to Finish Legend on Sheet A801 for Material List.

PART 3 – EXECUTION

3.01 EXAMINATION

A. Examine substrates and wall areas, with Installer present, for compliance with requirements for installation tolerances, fire rating, and other conditions affecting performance of work.

B. Examine walls to which impact-resistant wall protection will be attached for blocking, grounds, and other solid backing that have been installed in the locations required for secure attachment of support fasteners.
    1. For impact-resistant wall protection units attached with adhesive or foam tape, verify compatibility with and suitability of substrates, including compatibility with existing finishes or primers.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 PREPARATION

A. Complete finishing operations, including painting, before installing impact-resistant wall protection system components.

B. Before installation, clean substrate to remove dust, debris, and loose particles.

3.03 INSTALLATION

A. General: Install impact-resistant wall protection units level, plumb, and true to line without distortions. Do not use materials with chips, cracks, voids, stains, or other defects that might be visible in the finished Work.
    1. Install impact-resistant wall protection units in locations and at mounting heights indicated on Drawings.

2. Provide splices, mounting hardware, anchors, and other accessories required for a complete installation.

3.04 CLEANING

A. Immediately after completion of installation, clean plastic covers and accessories using a standard, ammonia-based, household cleaning agent.

B. Remove excess adhesive using methods and materials recommended in writing by manufacturer.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Work Included: Firefighting devices consist of hand-portable fire extinguishers and metal cabinets.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 PRODUCT HANDLING

A. Protection: Protect firefighting devices before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary at Contractor's expense.

PART 2 - PRODUCTS

2.01 FIRE EXTINGUISHERS

A. Provide multi-purpose, Model MP-10 dry chemical type for Class A, B and C fires with U.L. rating of 4A-80B:C as manufactured by Larsen's Mfg. Co., or approved equal.

2.02 FIRE EXTINGUISHER CABINETS

A. Semi-Recessed: Construct cabinets from 18 gauge, or heavier, stainless steel with #4 finish. Provide Larsen's Mfg. Co., "Architectural Series" No.SS2409-6R, or approved equal, with "Vertical Duo" doors and black vertical die cut lettering. Mount at 48" to top of handle.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Coordination: Coordinate with other trades to ensure proper and adequate provision in framing and wall covering for installation of recessed cabinets.

B. Inspection:
   1. Prior to installation, inspect cabinet recesses, and verify that necessary provisions have been made.
   2. Do not proceed with installation in areas of discrepancy until discrepancies have been fully resolved.

3.02 INSTALLATION

A. Install firefighting devices in full accordance with pertinent regulations and manufacturer's recommendations.

3.03 SERVICE

A. Determine approximate completion date of Work. Inspect, charge, and tag fire extinguishers at date not more than ten days before or less than one day before actual completion date of the Work.

END OF SECTION

PART 1 - GENERAL

1.01 WORK INCLUDED

A. Work in this section includes furnishing and installation of extruded aluminum overhead cantilever supported canopies.

B. Related Items and Considerations
1. Flashing of various designs may be required. Generic flashing supplied by manufacturer. Specialty flashing to be supplied by installer.
2. Determine wall construction, make-up and thickness.
3. Ensure adequate wall condition to carry canopy loads where required.
4. Consider water drainage away from canopy where necessary.
5. Any necessary removal or relocation of existing structures, obstructions or materials.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Products meeting these specifications established standard of quality required.

1.05 FIELD MEASUREMENT

A. Confirm dimensions prior to preparation of shop drawings when possible.

B. If requested, supply manufacturer s standard literature and specifications for canopies.

C. Submit shop drawings showing structural component locations/positions, material dimensions and details of construction and assembly.

1.06 PERFORMANCE REQUIREMENTS

A. Canopy must conform to local building codes.

B. PE Stamped calculations are not required.

1.07 DELIVER, STORAGE, HANDLING

A. Deliver and store all canopy components in protected areas.

PART 2 - PRODUCTS

2.01 MANUFACTURER

A. Mapes Canopies, Lincoln, Nebraska, 1-888-273-1132.
   1. Super Lumideck Flat Soffit
   2. 10 inch C-Channel Fascia
   3. Anchoring– CMU with through Mount

2.02 MATERIALS

A. Decking shall consist of 3" extruded flat soffit .078 decking.

B. Intermediate framing members shall be extruded aluminum, alloy 6063-T6, in profile and thickness shown in shop drawings.

C. Cantilever supported brackets shall be standard finish.

2.03 FINISHES

A. Finish type shall be 2-Coat Kynar Finish to be chosen from standard colors

2.04 FABRICATION

A. All connections shall be mechanically assembled utilizing 3/16 fasteners with a minimum shear stress of 350 lb. Pre-welded or factory-welded connections are not acceptable.

B. Decking shall be designed with interlocking roll-formed aluminum members.

C. Concealed drainage. Water shall drain from covered surfaces into intermediate trough and be directed to Front Scupper.

PART 3 - EXECUTION

3.01 INSPECTION

A. Confirm that surrounding area is ready for the canopy installation.

B. Installer shall confirm dimensions and elevations to be as shown on drawings provided.

C. Erection shall be performed by an approved installer and scheduled after all concrete, masonry and roofing in the area is completed

3.02 INSTALLATION

A. Install components in strict accordance with manufacturer's instructions and approved shop drawings. Use proper fasteners and hardware for material attachments as specified.

B. Use methods of attachment to structure allowing sufficient adjustment to accommodate tolerances.

C. Remove all protective coverings on panels immediately after installation.

3.03 CLEANING

A. Follow manufacturer's instructions when washing down exposed panel surfaces using a solution of mild detergent in warm water that is applied with soft, clean wiping cloths.

B. Follow strict panel manufacturer guidelines when removing foreign substances from panel surfaces requiring mineral spirits or any solvents that are acceptable for use.

C. Installers shall leave panel system clean at completion of installation. Final cleaning is by others upon completion of project, following manufacturer's cleaning instructions.

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish and install metal accessories called for in Toilet Accessory Schedule.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Use personnel skilled in work required, completely familiar with manufacturers' recommended methods of installation, and thoroughly familiar with requirements of this work.

1.05 PRODUCT HANDLING

A. Protection: Protect toilet and bath accessories before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary at Contractor's expense.

PART 2 - PRODUCTS

2.01 METAL TOILET ACCESSORIES

A. Manufacturers and Accessory Numbers are listed in Toilet Accessory Schedule. Manufacturers who may furnish products for review by Architect are: Bobrick, Bradley, McKinney or American Specialties.

2.02 MATERIALS

A. Stainless Steel: AISI Type 302/304, with Brushed finish, 0.034-inch (22-gage) minimum thickness.

B. Brass: Leaded and unleaded, flat products, ASTM B 19; rods, shapes, forgings, and flat products with finished edges, ASTM B 16; Castings, ASTM B 30.

C. Sheet Steel: Cold-rolled, commercial quality ASTM A 366, 0.04-inch (20-gage) minimum. Surface preparation and metal pretreatment as required for applied finish.

D. Galvanized Steel Sheet: ASTM A 527, G60.

E. Chromium Plating: Nickel and chromium electro-deposited on base metal, ASTM B 456, Type SC 2.

2.03 FASTENERS

A. Provide screws, bolts, and other devices of same material as accessory unit, or of galvanized steel where concealed.

2.04 PLUMBING PIPE WRAP

A. At all exposed lavatory piping, provide "Trap Wrap" insulated lavatory safety kit as distributed by C.A. Riner Co., Inc., 7620 Hardin Drive, North Little Rock, Arkansas, or approved equal. Color to be selected by Architect from manufacturer's standard color line.

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Coordinate with other trades to ensure proper and adequate provision in framing and wall finish for installation of selected accessories.

B. Prior to installation, inspect location of accessories and verify that necessary provisions have been made. Do not proceed with installation in areas of discrepancy until discrepancies have been fully resolved.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturers' recommendations, anchoring components firmly in place.

3.03 TOILET ACCESSORY SCHEDULE

C1 – Toilet Seat Cover Dispenser : American Specialties, Profile Collection Surface Mounted Toilet Seat Cover Dispenser # 9477-SM, Stainless

E1 – ADA Toilet Grab Bar : American Specialties, 1 ½” dia Grab Bar Series with Flanges for Concealed Mounting, 3800 Series, 18” L (Mounted Vertically)

E4 – ADA Toilet Grab Bar : American Specialties, 1 ½” dia Grab Bar Series with Flanges for Concealed Mounting, 3800 Series, 36” L

E5 -- ADA Toilet Grab Bar : American Specialties, 1 ½" dia Grab Bar Series with Flanges for Concealed Mounting, 3800 Series, 42" L

F1 – Sanitary Napkin Disposal : American Specialties, Roval Surface Mounted Sanitary Waste Receptacle #20852, Stainless

F3 – Semi-Recessed Waste Receptacle : American Specialties, Roval Semi-Recessed Removable Waste Receptacle #20458, stainless

F4 –Recessed Waste Receptacle : American Specialties, Simplicity Waste Receptacle – Recessed #6459, stainless

H1 – Single Robe Hook : American Specialties, Robe Hook (Single) – Surface Mounted, Satin Finish, # 7340-S, Stainless

J1 – Framed Mirror : American Specialties, #620 Series (24x42), Stainless Frame

J2 – Framed Mirror : American Specialties, #620 Series (24x36), Stainless Frame

J3 – Framed Mirror : American Specialties #620 Series (24x54), Stainless Frame

M2 – Utility Shelf : American Specialties, Utility Shelf with Mop Holders, Drying Rod, and Rag Hooks #1315-4 (36" L)

N2 – Diaper Changing Station : Koala Kare KB301-05 White Granite Vertical Baby Changing Station, Surface-Mounted

END OF SECTION

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PART 1 - GENERAL

1.01 DESCRIPTION

A. Provide miscellaneous specialties specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Furnish at least one person, present at all times, thoroughly familiar with installation requirements of each item, to personally supervise installation.

1.05 PRODUCT HANDLING

A. Protection: Protect miscellaneous specialty items before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements at Contractor's expense.

PART 2 - PRODUCTS

2.01 KNOX-BOX

A. Provide "Knox-Box" 3200 Series as manufactured by Knox Company, 1601 W Deer Valley Road, Phoenix, AZ 85027 (800) 552-5669; surface mount with hinged door, 1/4” plate steel housing. 1/2” thick steel door with interior gasket seal and stainless-steel door hinge. Box and lock UL listed. Lock has 1/8” thick stainless-steel dust cover with tamper seal mounting capacity.
   1. Exterior Dimensions: 4”H x 5”Wx3-3/4”D
   2. Lock: UL listed. Double action rotating tumblers and hardened steel pins accessed by a biased cut key.
   3. Finish/Color: Knox-Coat finishing process; Gray

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Prior to installation, verify items may be installed in accordance with manufacturers' recommendations.

B. Notify Architect of conditions that would adversely affect installation.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.02 INSTALLATION

A. Install miscellaneous specialties in strict accordance with manufacturers' current recommendations and instructions.

3.03 ADJUSTMENT AND CLEANING

A. Verify that trim is in place and adjust components.

B. Remove labels from equipment and remove packing materials from job site.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Furnish labor, materials, tools, and equipment required to perform radiation protection work specified.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 QUALITY ASSURANCE

A. Qualifications of Installers: Perform work under this Section by specialty subcontractor regularly engaged in type work required. Use workmen experienced in installation of specified products. Have qualified, competent foreman present and in charge at all times work under this Section is performed.

B. Installer of Radiation Protection: Guarantee in writing, all surfaces protected under this Section against radiation leakage for 2 year period after acceptance and make good at his own expense any leakage developing within period stated above.

1.05 PRODUCT HANDLING

A. Protection: Use means necessary to protect materials of this Section before, during, and after installation. Protect installed work and materials of other trades.

B. Replacements: In event of damage, immediately make repairs and replacements necessary to approval of Architect and at Contractor's expense.

PART 2 - PRODUCTS

2.01 APPROVED MANUFACTURERS

A. Ray-Bar Engineering Corporation
B. Radiation Protection Products
C. Approved equal.

2.02 MATERIALS AND FABRICATION

A. Lead Sheet: In compliance with Federal Specification QQ-L-201f, Grade C, 99.9% pure, and ASTM B 749, Type L5 1121. Thickness as indicated on Lead Protection Schedule, to 7'0" high, minimum national standard on walls (unless otherwise noted).

B. Leadlined Hollow Metal Door Frames: Comply with requirements of Section 08 1000.
   1. Provide additional reinforcements and internal supports to adequately carry weight of lead lined doors. Perform such work before installation of lead lining into frames.
   2. Line inside of frames with single unpierced strip of sheet lead of not less than same thickness as lead in doors and walls in which installed. Form lead sheet to match contour of frame on radiation exposure side of frame, continuous in each jamb and across head and overlap into formed stop. Form lead shields around areas prepared to receive hardware. Fabricate lead lining wide enough to maintain an effective 1/2" minimum overlap lap with lead of adjoining shielding.

C. View Window Frames: Ray-Bar lead lined Telescopic Steel View Window Frame, fabricated from 16 gauge jetcoat electro-Galvanized Steel lead lined with equal or greater lead as in wall that window occurs in and telescope to wall thickness required.
   1. Match concealed lead lining in frame to that of surrounding wall system. Optional bottom voice passage in frame sill where required / indicated on plans.

D. Lead Glass: As specified in Section 08 8000, "Glass and Glazing". X-Ray Protective type.

E. Floor Lead: If required or indicated on Lead Protection Schedule, a single layer of unpierced lead sheet meeting Federal Specification QQ-L-201f, Grade C, 99.9% pure and of the thickness specified on Lead Protection Schedule
   1. Sheet Size: Required width, length and area as shown on plans or shielding report, multiple pieces for overall required area coverage is acceptable with proper overlaps not less than 1/2".
   2. Installation
      a) Floor to be smooth, flat, level, clean and free of dust or oil for application of the lead shielding.
      b) Lead to be clean and degreased. Adhesive or mastic to be rated for the proper bonding of metal. .
      c) Apply sheet lead in required single thickness and size, or as multiple pieces for area coverage.
      d) Joints to have a minimum of 1/2" overlap. All lead to be bonded tight and rolled flat on floor.

F. Ceiling Lead Shielding: As specified in Section 09 2500, Lead backed 5/8" drywall to be installed on ceiling areas when required to provide shielding for occupancy above on areas where appropriate and indicated on plans per shielding report provided by physicist of record for project. All penetrations and joints between lead backed drywall sheets are to be properly shielded with same techniques as on wall partitions.
   1. Ceiling must be framed for "hard lid" at 12" on center for support and to prevent sagging.

2. Framing to be of size and gauge of metal as determined and specified by the project structural engineer.
3. T-Bar, grids and suspended ceilings are not acceptable systems for proper radiation shielding.
4. All penetrations in leadlined ceilings such as HVAC, fire sprinklers, ducts, etc. must be properly backed with lead of same thickness as in ceiling with proper overlaps. Lead Lined access panels to be installed where required to provide continuous radiation protection

PART 3 - EXECUTION

3.01 SURFACE CONDITIONS

A. Inspection: Carefully inspect installed work of other trades and verify that work is complete to point where this installation may properly commence.

B. Discrepancies: Do not proceed with installation in areas of discrepancy until discrepancies have been fully resolved.

3.02 INSTALLING LEAD-BACKED GYPSUM BOARD

A. Apply with long dimension parallel to framing members with abutting ends and edges occurring over studs. Overlap all lead joints. Install drywall screws through 1" x 2" x 1/8" thick lead strip and through the lead-backed gypsum board into studs at 12" o.c. in the field of the board and 8" o.c. staggered at joints. Bend the standing end of lead strips to overlap screw heads. Apply filling, leveling, and laminating compound over face of lead-backing gypsum board so there is complete and uniform contact between it and the face layer of gypsum board. Erect face layer immediately after compound has been spread. Hold in place with temporary bracing friction connected to the face layer. Do not allow screws, nails or fastenings to rupture the lead sheet. Remove temporary bracing after 48 hours drying time and finish gypsum board face as specified in Section 09 9000, "Painting".

3.03 INSTALLING SHEET LEAD

A. Install sheet lead in lead-lined door frames and where otherwise shown complying with detail requirements.

3.04 INSTALLING VIEW WINDOW

A. Install complying with manufacturer's directions.

3.05 TESTING

A. After X-ray equipment has been installed and placed in operating condition, radiation shielding shall be tested by a health physicist, certified by nationally recognized agency, at contractors expense.

B. Testing will be performed in accordance with requirements of NBS Handbook H-76 "Medical X-Ray Protection Up To Three Million Volts". Decision of acceptability by health physicist's report shall be forwarded to the Architect/Engineer and Owner.

C. Repair or replace defective work including other work affected thereby and conduct additional testing to satisfaction of health physicist, at not additional expense to Owner.

3.06 PHYSICIST'S REPORT

A. An analysis and report of minimum lead shielding requirements for this Project is attached to this Section.

END OF SECTION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. All work under this section is subject to the Contract Documents and the subcontractor shall be responsible for and governed by all the requirements there under.

B. Design, provide, and test an MRI rated radio frequency and/or magnetic shielded enclosure.

C. Coordinate the design of the shielded enclosure with current architectural and M.E.P. drawings and the MR manufacturer's drawings when appropriate. Conflicts between the documents are to be resolved by the customer's agent.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS

A. Shop Drawings: Include typical floor plan of space, enclosure elevations, typical construction, sections, and locations of RF shielded penetrations.

B. Test Reports (Upon Completion)
1. RF Qualification Test
2. RF Acceptance Test
3. Ground Isolation monitoring Test (Before any utility connections)

C. Warranty Certificate

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications
1. Shall be recognized and/or approved by either the customer or his architect or the MR manufacturer.
2. Shall have within his direct employ experienced and properly equipped engineering, drafting, and project management departments.

B. Use of Dissimilar Metals
1. The use of dissimilar metals shall not be allowed.
   a. RF shielding medium shall display an anodic voltage differential index of less than 0.40 volts and a cathodic group number of 1 (0.00 volts) to 9 (0.40 volts).

b. Construct shielding system with proper materials so that ionic conduction across joints and RF seams shall be less than 0.10 volts.

2. Use of the following in manufacture and installation of shielded enclosure shall be permitted.
   a. Bronze or brass flame sprayed treatment of steel or aluminum RF contact surfaces.

1.05 REFERENCES

A. The standards of the issue listed below form a part of this specification. Standards are referred in the text by basic reference only.

B. Standards:
1. IEEE-299 - (as modified for MRI testing) Methods of Attenuation Measurements for Electromagnetic Shielding Enclosures for Electrical Test Purposes.
2. MIL-STD-220-A - Methods of Insertion Loss Measurements for Radio Frequency Power Line Filters.
3. ASTM Standards: E84-01 – surface burning characteristics
4. ASTM F-1869
5. ASTM E90/E413 – acoustic performance

1.06 WARRANTY

A. Warrant the system to be free of defects in materials and workmanship as evidenced by retention of specified RF shielding characteristics for periods as follows and in accordance with the Shielding Manufacturer's standard warranty for this product.
1. Basic Enclosure: Five (5) years.
2. EMI Electrical Filters, RF Shielded Doors, RF Shielded Windows, Pipe Penetrations, and Air Vent RF Filters: One (1) year.

B. Pass-through warranties provided by subcontractors to manufacturer shall not be allowed.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. The project architect has determined that products produced by ETS-Lindgren will meet the specific requirements of project design and the selected MR system. The following manufacturer’s product specification meets the universal requirements of the project.

B. **ETS-Lindgren, Inc**., 17915 E. 95th St. N. – Owasso, OK 74055,
John Stanfield Ph. (630) 912-1905, FAX (630) 912-1915
Email: john.stanfield@ets-lindgren.com Web site: www.ets-lindgren.com

2.02 RF ATTENUATIING MATERIAL

A. Primary shield:
1. Attenuating material: The shielding material shall be annealed, pure copper. Therefore, acceptable manufacturers must provide a copper RF shielded enclosure

unless otherwise stipulated by the magnet vendor's performance specifications or by the architect in the form of an addendum issued five (5) days prior to bid due date or listed under 13095-2.02A.2

2. Material substitution: See A2.03A (A) RF Shield Floor Substitution

2.03 RF SHIELD ASSEMBLY

A. Primary shield:

1. **RF shield wall assembly:** The shield system wall panels shall be vertically self-supported and structurally independent from the parent building. The wall assembly shall allow for the addition of customer provided interior finishes without penetration of the attenuating materials.
2. **RF shield ceiling assembly:** The RF shield ceiling assembly shall be supported from customer provided structural assemblies and provide interior surfaces that allow for customer connections of interior finishes and utilities without penetration of the attenuating materials. RF ceiling supports shall employ RF competent fasteners.
3. **RF Shielded Patient Entry EVO-AS Pneumatic door:**
    a. **Door system**: shall be visually similar to standard, hospital grade interior doors and shall utilize conventional hospital quality hardware.
    b. **RF Performance**: The RF door leaf, frame and seal assembly shall maintain a shielding effectiveness equal to that of the shielded enclosure.
    c. **Material**: The door shall be manufactured of all 304 stainless steel construction inclusive of both the RF door leaf and jamb assemblies.
    d. **Sound Rating**: The door assembly shall have, as a minimum, an (STC32 or STC44) sound manufacturer or field test certifications are not acceptable.
    e. **RF sealing mechanism**: Shall consist of a smooth surface, continuous, phosphor-bronze (beryllium/copper alloys are forbidden) strip running the full length of each edge of the RF door jamb and bottom edge of the door leaf.
    f. **Failsafe feature**: Door shall employ fail-safe unlatching. Upon loss of any one power service the door will revert to an unsealed condition. The door shall have optional remote activation/deactivation capabilities.
    g. **Door Latch**: ADA compliant standard lever action passage latch set with Schlage integral keyed security lock outside and turn push button inside.
    h. **Door Leaf Hinges**: Minimum 4-1/2 inch brass or stainless steel, fully mortised, with minimum of two ball-bearing swing joints per hinge. Provide minimum of three hinges per leaf.
    i. **Door threshold**: The door threshold shall be flat without taper with a maximum height from the MRI room's parent slab depression of 5/8" (16mm).
    j. **RF Door Finish**: Plastic laminate, as specified by the Owner or his agent.
    k. **MRI Interlock**: Provide a RF door interlock switch. (Electrical interconnections and mounting by Division 16 subcontractor)
    l. **Air Compressor**: Provide a low noise, reciprocating piston, 120^{vac} electric air compressor capable of 120-psi output pressure with on-board receiver tank. Provide coalescent air filter and automatic vaporous drain system for condensate water.

Available options:

m. **SVIP Intravenous tubing pass-through system:**
Construction:
   a) Intra Frame RF Attenuation Slot
   b) Available for both left and right hinged doors
   c) Factory fabricated into the RF door frame
   d) Line capacity: =/<11 standard 0.156"o.d. IV lines.

n. **Fully automatic opener/closure mechanism:** Provide a fully programmable opener/closure door operator system. Provide over-current, anti-collision safety system. Provide programmable opening/closing speeds and selectable time to close interval.

o. Cipher key pad security system or interface to customer's security systems

4. **RF shield floor**: The RF shield vendor shall provide an alternate line item price for a water resistant RF shielded flooring system within the entire area of the RF enclosure (inclusive of any depicted cable trenching designed flush with finished floor). Note: if the bidder is not capable of providing the required alternate floor assembly state "not available" in the line item.

a. **Basic system**: Provide an all copper, monolithic, RF floor membrane. RF solder weld all copper membrane seams.

b. **Electrical isolation**: Provide electrical isolation of enclosure and RF floor system by use of a two-part, thermosetting resin applied directly to concrete floor substrate. Use of Masonite, other pressed wood materials, plastic sheet or other sheet goods for electrical isolation or as a moisture barrier is forbidden.

c. **Substrates**: in contact with soil must have a properly engineered and installed, effective vapor barrier system that prohibits hydrostatic, capillary, or moisture vapor pressure. Concrete must contain less than 3 lbs moisture per 1000 sq. ft per 24 hours when tested per ASTM F-1869.

d. **Membrane Adhesive**: Bond monolithic copper membrane to dielectric barrier with a two part adhesive resin compatible with both the copper and dielectric barrier.

e. **Epoxy Grout Coating**: Over-coat copper membrane with an epoxy grout chemically cured to a minimum 5,000psi bearing. Install grout underlayment to a minimum 1/2-inch thickness over entire exam room surface. Grout coating shall not delaminate and must withstand the direct loading of the magnet cryostat and patient table.

f. **Customer/GC responsibilities:**
- Slab must be clean down to the bear surface by surface shot blast surface profile of (3) CSP3
- Do not apply any concrete sealer.
- The parent slab must be level to at least the minimum requirements of the magnet manufacturer or as stated in the RF shield submittal plans.
- **Only use ARDEX K-15** floor leveling compound to bring the parent slab into specification for levelness.
- The total moisture content of the parent slab cannot exceed 95% relative humidity.

Installation of magnetic floor shielding may require additional preparation and/or modification to the floor slab, all slab preparation and modifications are by the customer.

B. **RF Shielded Patient View Window:** Construct RF shielded view window assembly utilizing an aluminum extrusion of an engineered shape to affix RF attenuating screens and provide a means of securing double-sided ¼", laminated safety glass. Treat contact surface of extrusion with brass flame spray.

1. RF Performance: Provide a proven RF seal design that is easily maintained and serviced. RF window frame and seal assembly shall maintain a shielding effectiveness equal to that of the shielded enclosure.
2. Construct RF screen of a double layer of 304 stainless steel and place layers in orientation to each other so that the resultant distortion of viewed image through the RF shielded window approaches zero.
3. Stain, not paint, the visible area of RF screens black in color for optimum image visibility.
4. The attachment of RF screen material to wood frames by the use of staples, nails, or screws is prohibited.

C: **RF Window Wall Assembly:**

1. Assembly to be the **"*Clearshield*™"** Aluminum window wall assembly.
2. General:
   a. RF Performance:
      1) Utilize a proven RF seal design that is easily maintained and serviced.
      2) Maintain a shielding effectiveness equal to that of the shielded enclosure
3. Frame:
   a. Aluminum extrusion engineered to affix RF attenuating screens and single or double-sided glazing. To provide superior optical performance frames are to provide constant tension to both screen layers to eliminate sag and uneven tension areas in the screen surfaces.
   b. Frame mullions shall not exceed **3"** in width
   c. Treat contact surface of extrusion with brass flame spray
   d. Shall be demountable for magnet delivery
4. RF Screen Material:
   a. Dual layers of Type 304 stainless steel placed in horizontal relation to each other so that resultant distortion of viewed image through RF shield window approaches zero. Width to Length (w/l) aspect ratio to be =/< 0.8 to maintain proper screen rotation
   b. Stain the visible area of RF screens in color which creates optimum image visibility
   c. The attachment of each window RF screen layer to wood frames by the use of staples, nails, or screws is forbidden
5. Installation:
   a. Secure RF window frames to RF shield panels with compression bolts

D. **Heating Ventilation and Air Conditioning**

1. Vent Type: Wave-guide below cutoff type, 3/16-inch brass hex cell, and 1 inch in thickness.
2. Design RF shielded air vents to maintain a shielding effectiveness equal to that of the shielded enclosure.
3 Provide interior and exterior dielectric collars for the attachment of ventilation ductwork.
4. Heating Ventilation and Air Conditioning services entering the RF enclosure shall be installed by the customers' division 15 subcontractor using RF suppliers/magnet manufacturers approved techniques.

E. **Sound attenuation**: (WHEN REQUIRED BY THE CUSTOMER)
1. Provide optional certified sound rated RF door assemblies
2. Provide optional RF shield sound reduction systems

F. **Cryogenic Gas Exhaust Wave Guide Vent:** Wave-guide below cutoff type, size as required by MRI system manufacturer. Construct cryogenic wave-guide vent of suitable material to maintain a shielding effectiveness equal to that of the shielded enclosure and to prevent structural failure of the wave-guide tube during a magnet quench event.
1. The division 15 subcontractor shall provide dielectric connections at both the interior and exterior side of the cryogenic RF vent of a suitable material to maintain a minimum of 1,000 ohms DC resistance to earth ground and prevent structural failure during a magnet quench event.
2. Cryogenic Gas Exhaust piping systems both below and above the cryogen wave-guide tube assembly shall be installed by the customers' division 15 subcontractor using RF suppliers/magnet manufacturers approved techniques.

G. **EMI Rated Power Line and Signal Electrical Filters:** RF shielded electrical filters shall provide an insertion loss as specified within MIL-STD 220-A and maintain the shielding effectiveness equal to that of the shielded enclosure. Provide an EMI filter for each electrical conductor that penetrates the enclosure, including neutral conductors. UL certification will be required for all power line filters.
1. It is the responsibility of the customer to provide to the RF enclosure subcontractor the specific electrical characteristics of and the total number of conductors required for all: lighting and power circuits, communication devices, environmental control devices, data transmission devices, and fire alarm devices that will be utilized within the RF enclosure.
2. All electrical services entering and routing within the RF enclosure shall be installed by the customers' division 16 subcontractor using RF suppliers/magnet manufacturers approved techniques.

H. **Mechanical Pipe Penetrations:** Wave-guide below cutoff type. Construct pipe penetrations of a material suitable to the conditions of service on which it is installed, and to maintain shielding effectiveness equal to that of the shielded enclosure.
1. All Mechanical Pipe Penetration services entering and routing within the RF enclosure shall be installed by the customers' division 16 subcontractor using RF suppliers/magnet manufacturers approved techniques.

I. **Medical Gas Piping Systems:** Provide a medical gas panel that complies with NFPA chapter 99C-42 and of the wave-guide below cutoff type. Each individual medical gas line shall be medically clean type K copper and pass, without seams, through the

provided pipe wave-guides. Provide a brass or copper mechanical coupling between the exterior end of the threaded gas line wave-guide that the pass through copper pipe. Customer‘s division 15 subcontractor to RF seal the exterior end of each pipe wave-guide to the respective gas pipe using approved methods.

2. The use of threaded fittings with dielectric connectors shall be prohibited.
3. The division 15 subcontractor shall provide and install all medical gas lines.

J. **Grounding Conductor Terminal**: Provide a single point ground conductor terminal using a brass stud and an external and internal tapped and threaded copper buss bar. The grounding stud shall be common to both interior and exterior of enclosure. Locate grounding buss bar terminal as directed by the MR manufacturer in relation to both the MRI penetration panel and EMI power line filters.

1. All ground conductors entering and routing within the RF enclosure shall be installed by the customers’ division 16 subcontractor using RF suppliers/magnet manufacturers approved techniques.
2. RF shield shall be properly grounded by the division 16 subcontractor prior to the connection of electrical services to any EMI power and/or signal filter.

K. **Optional components, devices, and systems**: The customer is to be made aware of optional items that will enhance the performance and/or personnel usability of the RF shielded enclosure. List optional:

1. Sound rated doors, automatic RF sealing doors, and door accessories
2. Optional RF flooring systems
3. Optional high visibility RF window systems
4. MRI rated interior lighting components and power systems
5. Interior LED illuminated image display systems
6. MRI safety systems and magnetic field compensation systems
7. Professional engineering services

L. Intentionally left blank

2.04 MAGNETIC MATERIALS

A. The requirement for magnetic shielding shall be determined by the MR manufacturer or at the determination of the customer’s agents.

B. When and if magnetic shielding is required the following must be provided:

1. Provide magnetic materials that conform to magnet manufacturers specifications with respect to:
    a. Chemistry of the magnetic materials
    b. Annealing processes if any
    c. Orientation about the magnetic iso-center

B. Structural supports

1. Unless otherwise stated all structural supports for the application of the magnetic materials are designed, provided and installed by the customer’s division 5 subcontractor, not the magnetic shield supplier
2. The magnetic shield supplier shall be responsible for the application of the magnetic materials to the structural supports.

2.05 PERFORMANCE

A. The installed enclosure shall, as a minimum, provide functional EMI attenuation to decibel ratings as follows:
   1. Magnetic Field – modify for specific magnet type
      a. Frequency range: as required by the MR manufacturer
      b. Decibel rating: as required by the MR manufacturer
   2. Electric Field – modify for specific magnet type
      a. Frequency range: as required by the MR manufacturer
      b. Decibel rating: as required by the MR manufacturer
   3. Plane Wave – modify for specific magnet type
      a. Frequency range: as required by the MR manufacturer
      b. Decibel rating: as required by the MR manufacturer

B. Construct installed enclosure so that, without connections to the earthing terminal, ohmic value of enclosure relative to earth ground shall be equal to or greater than 1,000 ohms or as required by the MR manufacturer.

PART 3 - EXECUTION

3.01 PREPARATION

A. The customer or the customer's agent shall be responsible for reconciliation of submittal drawings provided by the RF enclosure subcontractor with that of actual site dimensions and conditions.

B. When required to make dimensional verification and conditional acceptance of the installation site, the RF enclosure subcontractor will be afforded a minimum of 4 weeks after such on site verification to deliver the manufactured RF enclosure to the job site.
   1. Dimensional verification and conditional acceptance of the installation site: The site of the work must be completed to the extent that:
      a. All interior drywall is installed, taped, and bedded.
      b. All structural systems are in place.
      c. Foundations are complete, level to specifications and with proper surface preparation.
      d. The site must be functionally weather tight, dry, and heated.
      e. The site of the work is free and clear of all materials not directly related to the installation of the shielded enclosure
      f. All utility services are positioned and routed for proper connection to the shielded enclosure
      g. Sufficient storage space is provided near the site of the work.
      h. Temporary lighting and electrical power is made available
      i. An unimpeded delivery route is provided for all materials from truck to the site of the work.

3.02 INSTALLATION

A. The general subcontractor shall provide unrestricted access to the site of the work. The site of the work is to be prepared fully and completely as required by both the project documents and the shield suppliers approved shop drawings to accept the MRI shielding both RF and magnetic.
   1. Approved RF and/or magnetic shield shop drawings are made part of the construction documents and shall be the final determining document respective to proper site conditions for the construction of the shielding systems.

B. Assemble enclosure wall and ceiling RF panels into straight, level and plumb surfaces. Align and secure RF joints.

C. Perform installation by system manufacturer, or under manufacturer's direct supervision.

3.03 TESTING

A. Test enclosure in accordance with IEEE-299, as modified for MR system installation. Demonstrate the required attenuation as detailed under Performance paragraph.

B. Qualification Testing: Perform immediately after completion of the enclosure and prior to installation of architectural surfaces within or outside the enclosure. Make no trade connections to enclosure until successful completion of test process.
   1. An observer of the Owner, or the general subcontractor, or the MR manufacturer will witness the test procedure. Notify the contracting party that the RF test is to occur. If an observer fails to appear, the RF enclosure subcontractor is to commence with the RF test and furnish the test report as required in 3.03B.2.
   2. Furnish a certification of compliance to the contracting party.

C. Acceptance Testing: Perform immediately after installation of the selected MRI assembly and closure of the RF entrance panel.
   1. An observer of the Owner, or the general subcontractor, or the MR manufacturer will witness the test procedure. If an observer fails to appear, the RF enclosure subcontractor is to commence with the RF test and furnish the test report as required in 3.03C.2.
   2. Furnish a written test report to the contracting party.

D. Ground Isolation Monitoring: Monitor ground isolation during entire phase of construction for a minimum of 1,000 ohms above earth potential. Immediately correct deficiencies found that are the result of a fault condition caused by the enclosure supplier. Immediately report deficiencies found to be caused by other trades.
   1. Provide an adjustable audio and visual ground isolation device for continuous monitoring of the RF enclosures ground isolation. Device is to remain with the enclosure for follow up monitoring by the general subcontractor.
   2. Furnish a certification of compliance to the contracting party.

END OF SECTION

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SECTION 21 0500
COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe, fittings, sleeves, escutcheons, seals, and connections for sprinkler systems.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 09 9113 - Exterior Painting: Preparation and painting of exterior fire protection piping systems.

C. Section 09 9123 - Interior Painting: Preparation and painting of interior fire protection piping systems.

D. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

E. Section 21 0553 - Identification for Fire Suppression Piping and Equipment: Piping identification.

F. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.03 REFERENCE STANDARDS

A. ASME A112.18.1 - Plumbing Supply Fittings 2018, with Errata.

B. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.

E. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250 2021.

F. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).

G. ASTM A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).

H. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2016.

I. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

J. AWWA C110/A21.10 - Ductile-Iron and Gray-Iron Fittings 2012.

K. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.

L. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast 2017, with Errata (2018).

M. AWWA C606 - Grooved and Shouldered Joints 2015.

N. FM (AG) - FM Approval Guide current edition.

O. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

P. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information. Indicate valve data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, and floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

D. Manufacturer's Qualification Statement.

E. Installer's Qualification Statement.

F. Project Record Documents: Record actual locations of components and tag numbering.

G. Operation and Maintenance Data: Include installation instructions and spare parts lists.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 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.

1. Minimum three years experience.
2. Approved by manufacturer.

C. Comply with FM (AG) and UL (DIR) requirements.

D. Valves: Bear FM (AG) and UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.

E. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

F. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Comply with NFPA 13.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 ABOVE GROUND PIPING

A. Steel Pipe: Schedule 10 roll grooved meeting all NFPA 13 and Factory Mutual requirements or Schedule 40 threaded or grooved meeting all NFPA 13 and Factory Mutual requirements, black.

1. Steel Fittings: .
2. Cast Iron Fittings: ASME B16.1, flanges and flanged fittings and ASME B16.4, threaded fittings.
3. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.
4. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.
5. Mechanical Formed Fittings: Carbon steel housing with integral pipe stop and O-ring pocked and O-ring, uniformly compressed into permanent mechanical engagement onto pipe.

B. Ductile Iron Pipe: AWWA C151/A21.51.

1. Fittings: AWWA C110/A21.10, standard thickness.
2. Joints: AWWA C111/A21.11, SBR or vulcanized styrene-butadiene rubber gasket.
3. Mechanical Grooved Couplings: Malleable iron housing clamps to engage and lock, "C" shaped composition sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe.

2.03 PIPE SLEEVES

A. Vertical Piping:

1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.
3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.

B. Plastic, Sheet Metal, or Moisture-Resistant Fiber: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:

1. Zinc-coated or cast-iron pipe.
2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:

1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

E. Pipe Passing Through Mechanical Room Floors :

1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

F. Not required for wall hydrants for fire department connections or in drywall construction.

G. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.

H. Clearances:

1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. Rated Openings: Caulked tight with firestopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.04 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Modular/Mechanical Seal:

1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass-reinforced plastic pressure endplates.

2.05 FIRE-RATED ENCLOSURES

A. Provide as required to preserve fire resistance rating of building elements.

2.06 ESCUTCHEONS

A. Material:

1. Metals and Finish: Comply with ASME A112.18.1.

B. Construction:

1. One-piece for mounting on chrome-plated tubing or pipe and one-piece or split-pattern type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.07 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Wall Support for Pipe Sizes 4 inches and Over: Welded steel bracket and wrought steel clamp.

E. Vertical Support: Steel riser clamp.

F. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

G. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

H. Seismic Hangers and Couplings:

1. Provide coupling with a factory set disengagement rating of 140 percent to 160 percent of the static weight.
2. Provide resettable and reusable, break away couplings.
3. Provide tether cables to avoid excessive seismic joint movement.
4. Coupling to be manufactured from non-corrosive materials.

2.08 MECHANICAL COUPLINGS

A. Rigid Mechanical Couplings for Grooved Joints:

1. Dimensions and Testing: Comply with AWWA C606.
2. Minimum Working Pressure: 300 psig.
3. Housing Material: Fabricate of ductile iron complying with ASTM A536.
4. Housing Coating: Factory applied orange enamel.
5. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
6. Bolts and Nuts: Hot-dipped-galvanized or zinc-electroplated steel.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

F. Inserts:

1. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.

G. Pipe Hangers and Supports:

1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
   a. Painting of interior fire suppression systems is specified in Section 09 9123.
   b. Painting of exterior fire suppression systems is specified in Section 09 9113.

H. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

I. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

1. Painting of interior fire suppression systems is specified in Section 09 9123.
2. Painting of exterior fire suppression systems is specified in Section 09 9113.

J. Structural Considerations:

1. Do not penetrate building structural members unless indicated.

K. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
2. Aboveground Piping:
   a. Pack solid using mineral fiber complying with ASTM C592.
   b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
3. All Rated Openings: Caulk tight with firestopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.
4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

L. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a watertight seal.
6. Install in accordance with manufacturer's recommendations.

M. Escutcheons:

1. Install and firmly attach escutcheons at piping penetrations into finished spaces.
2. Provide escutcheons on both sides of partitions separating finished areas through which piping passes.
3. Attach plates at the underside only of suspended ceilings.
4. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

N. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

O. Die-cut threaded joints with full-cut, standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

C. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION

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SECTION 21 0523
GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Check valves.

B. Bronze OS&Y gate valves.

C. Iron OS&Y gate valves.

D. NRS gate valves.

E. Trim and drain valves.

1.02 RELATED REQUIREMENTS

A. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

B. Section 21 1300 - Fire-Suppression Sprinkler Systems.

1.03 ABBREVIATIONS AND ACRONYMS

A. NRS: Non-rising stem.

B. OS&Y: Outside screw and yoke.

C. PTFE: Polytetrafluoroethylene.

1.04 REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose, Inch 2013 (Reaffirmed 2018).

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.

C. ASME B31.9 - Building Services Piping 2020.

D. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

E. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 48-In. (50-mm Through 1,200-mm) NPS 2017.

F. AWWA C606 - Grooved and Shouldered Joints 2015.

G. FM (AG) - FM Approval Guide current edition.

H. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL (DIR) - Online Certifications Directory Current Edition.

J. UL 262 - Gate Valves for Fire-Protection Service Current Edition, Including All Revisions.

K. UL 312 - Check Valves for Fire-Protection Service Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.07 QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Obtain valves for each valve type from single manufacturer.
2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B. Where listed products are specified, provide products listed, classified, and labeled by FM (AG), UL (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for the purpose indicated.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX.

D. Installer Qualifications:

1. Company specializing in performing the work of this section with minimum five years documented experience.
2. Trained and approved by manufacturer to design, install, test and maintain the equipment specified herein.
3. Complies with manufacturer's certification requirements.
4. Complies with manufacturer's insurance requirements.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Protect internal parts against rust and corrosion.
2. Protect threads and flange faces.
3. Set valves open to minimize exposure of functional surfaces.

B. Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.
   a. Provide temporary inlet and outlet caps.
   b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
   a. Store valves indoors and maintain at higher than ambient dew point temperature.
   b. If outdoor storage is unavoidable, store valves off the ground in watertight enclosures.

C. Use the following precautions for handling:

1. Do not use operating handles or stems as lifting or rigging points.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. UL Listed: Provide valves listed in UL (DIR) under following headings and bearing UL mark:

1. Main Level: HAMV - Fire Main Equipment.
2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.
   a. Level 1: VQGU - Valves, Trim, and Drain.

B. FM Global Approved: Provide valves listed in FM (AG) Approval Guide under the following headings:

1. Automated Sprinkler Systems:
    a. Indicator posts.
    b. Valves:
        1) Gate valves.
        2) Single check valves.
        3) Miscellaneous valves.

C. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads on threaded-end valves.
3. ASME B31.9 for building services piping valves.

D. Comply with AWWA C606 for grooved-end connections.

E. Comply with NFPA 13 for valves.

F. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.

G. Valve Sizes: Same as upstream piping unless otherwise indicated.

H. Valve Actuator Types:

1. Worm-gear actuator with handwheel for quarter-turn valves, except trim and drain valves.
2. Handwheel: For other than quarter-turn trim and drain valves.
3. Hand-lever: For quarter-turn trim and drain valves 2 NPS and smaller.

2.02 CHECK VALVES

A. UL 312 and FM (AG) standard listing for check valves, Class Number 1045.

B. AWWA C508 compliant check valves.

C. Minimum Pressure Rating: 175 psig.

D. Type: Center guided check valve.

E. Body Material: Cast iron, ductile iron.

F. Center guided check with elastomeric seal.

G. Hinge Spring: Stainless steel.

H. End Connections: Flanged, grooved, or threaded.

2.03 BRONZE OS&Y GATE VALVES

A. UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).

B. Minimum Pressure Rating: 175 psig.

C. Body and Bonnet Material: Bronze or brass.

D. Wedge: One-piece bronze or brass.

E. Wedge Seat: Bronze.

F. Stem: Bronze or brass.

G. Packing: Non-asbestos PTFE.

H. Supervisory Switch: External.

I. End Connections: Threaded.

2.04 IRON OS&Y GATE VALVES

A. UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).

B. AWWA C508 compliant gate valves.

C. Minimum Pressure Rating: 175 psig.

D. Body and Bonnet Material: Cast or ductile iron.

E. Wedge: Cast or ductile iron, or bronze with elastomeric coating.

F. Wedge Seat: Cast or ductile iron, or bronze with elastomeric coating.

G. Stem: Brass or bronze.

H. Packing: Non-asbestos PTFE.

I. Supervisory Switch: External.

J. End Connections: Flanged.

2.05 NRS GATE VALVES

A. UL 262 and FM (AG) standard listing for fire-service water control valves (OS&Y and NRS-type gate valves).

B. Minimum Pressure Rating: 175 psig.

C. Body and Bonnet Material: Cast or ductile iron.

D. Wedge: Cast or ductile iron with elastomeric coating.

E. Stem: Brass or bronze.

F. Packing: Non-asbestos PTFE.

G. Supervisory Switch: External.

H. End Connections: Flanged.

2.06 TRIM AND DRAIN VALVES

A. Ball Valves:

1. Description:
   a. Pressure Rating: 175 psig.
   b. Body Design: Two piece.
   c. Body Material: Forged brass or bronze.
   d. Port Size: Full or standard.
   e. Seat: PTFE.
   f. Stem: Bronze or stainless steel.
   g. Ball: Chrome-plated brass.
   h. Actuator: Hand-lever.
   i. End Connections for Valves 1 NPS through 2-1/2 NPS: Threaded ends.
   j. End Connections for Valves 1-1/4 NPS and 2-1/2 NPS: Grooved ends.

B. Angle Valves:

1. Description:
   a. Pressure Rating: 175 psig.
   b. Body Material: Brass or bronze.
   c. Ends: Threaded.
   d. Stem: Bronze.
   e. Disc: Bronze.
   f. Packing: Asbestos free.
   g. Handwheel: Malleable iron, bronze, or aluminum.

C. Globe Valves:

1. Description:

a. Pressure Rating: 175 psig.
b. Body Material: Bronze with integral seat and screw-in bonnet.
c. Ends: Threaded.
d. Stem: Bronze.
e. Disc Holder and Nut: Bronze.
f. Disc Seat: Nitrile.
g. Packing: Asbestos free.
h. Handwheel: Malleable iron, bronze, or aluminum.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Confirm valve interior to be free of foreign matter and corrosion.

B. Remove packing materials.

C. Examine guides and seats by operating valves from the fully open position to the fully closed position.

D. Examine valve threads and mating pipe for form and cleanliness.

E. Examine mating flange faces for conditions that might cause leakage.

1. Check bolting for proper size, length, and material.
2. Verify gasket for size, defects, damage, and suitable material composition for service.
3. Replace all defective valves with new valves.

3.02 INSTALLATION

A. Comply with specific valve installation requirements and application in the following Sections:

1. Section 21 1300 for application of valves in wet and dry pipe, fire-suppression sprinkler systems.

B. Install listed fire protection shutoff valves supervised-open, located to control sources of water supply except from fire department connections.

1. Install permanent identification signs indicating portion of system controlled by each valve.

C. Install check valve in water supply connections and backflow preventer at potable water supply connections.

D. Valves with threaded connections to have unions at equipment arranged for easy access, service, maintenance, and equipment removal without system shutdown.

E. Valves in horizontal piping installed with stem at or above the pipe center.

F. Position valves to allow full stem movement.

G. Install valve tags. Comply with Section 21 0553 requirements for valve tags, schedules, and signs on surfaces concealing valves; and the appropriate NFPA standard applying to the piping system in which valves are installed.

END OF SECTION

SECTION 21 0553
IDENTIFICATION FOR FIRE SUPPRESSION PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

D. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Stencil paint.

1.03 REFERENCE STANDARDS

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Major Control Components: Nameplates.

B. Piping: Tags.

C. Valves: Nameplates and ceiling tacks where above lay-in ceilings.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

A. Color: Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Underground Plastic Pipe Markers: Bright colored continuously printed plastic ribbon tape, minimum 6 inches wide by 4 mil thick, manufactured for direct burial service.

E. Color code as follows:

1. Fire Quenching Fluids: Red with white letters.

2.05 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 9123 for stencil painting.

3.02 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Install plastic pipe markers in accordance with manufacturer's instructions.

D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

E. Locate ceiling tacks to locate valves above T-bar type panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 21 1100
FACILITY FIRE-SUPPRESSION WATER-SERVICE PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Water pipe.

B. Valves.

C. Fire department connections.

D. Bedding and cover materials.

E. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 21 0500 - Common Work Results for Fire Suppression.

B. Section 21 1300 - Fire-Suppression Sprinkler Systems.

1.03 REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.

B. ASME B16.4 - Gray Iron Threaded Fittings: Classes 125 and 250 2021.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

E. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

F. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2022.

G. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

H. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).

I. ASTM A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).

J. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings 2015 (Reapproved 2021).

K. ASTM B63 - Standard Test Method for Resistivity of Metallically Conducting Resistance and Contact Materials 2007 (Reapproved 2018).

L. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.

M. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.

N. ASTM B584 - Standard Specification for Copper Alloy Sand Castings for General Applications 2014 (Reapproved 2022).

O. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete 2022.

P. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.

Q. AWWA C104/A21.4 - Cement-Mortar Lining for Ductile Iron Pipe and Fittings 2016.

R. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems 2018.

S. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings 2017.

T. AWWA C205 - Cement–Mortar Protective Lining and Coating for Steel Water Pipe—4 In. (100 mm) and Larger—Shop Applied 2018.

U. AWWA C206 - Field Welding of Steel Water Pipe 2017.

V. AWWA C209 - Tape Coatings for Steel Water Pipe and Fittings 2019.

W. AWWA C509 - Resilient-Seated Gate Valves for Water Supply Service 2015.

X. AWWA C550 - Protective Interior Coatings for Valves and Hydrants 2017.

Y. AWWA C600 - Installation of Ductile-Iron Mains and Their Appurtenances 2017.

Z. AWWA M11 - Steel Pipe - A Guide for Design and Installation 2016, with Addendum (2019).

AA. CDA A4015 - The Copper Tube Handbook Current Edition.

BB. FM (AG) - FM Approval Guide current edition.

CC. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

DD. UL (DIR) - Online Certifications Directory Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.

C. Product Data:

1. Include data on pipe materials, pipe fittings, valves, and accessories.
2. Provide manufacturer's catalog information.
3. Indicate valve data and ratings.
4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

E. Test Reports: Factory certified tests to verify that short-term rupture strength for RTRP I (filament bound) jointing is 1,500 psi or greater.

F. Field Quality Control Submittals: Testing activities.

G. Project Record Documents:

1. Record actual locations of piping mains, valves, connections, fire hydrants, free-standing fire department connections, underground manholes and vaults, valve boxes, thrust restraints, and invert elevations.
2. Identify and describe unexpected variations to subsoil conditions or discovery of uncharted utilities.

H. Maintenance Data: Include installation instructions, spare parts lists, and exploded assembly views.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements for additional provisions.

1.06 QUALITY ASSURANCE

A. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

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 work of the type specified and with at least five years documented experience.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

E. Provide grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

F. Date stamp castings used for coupling housings, fittings, and valve bodies for quality assurance and traceability.

G. Coupling Manufacturer:

1. Perform on-site training by factory-trained representative to Contractor's field personnel in the proper use of grooving tools and installation of grooved joint products.
2. Periodic job site visits by factory-trained representative to ensure best practices in grooved joint installation.
3. A distributor's representative is not considered qualified to perform the training.

H. Welder Qualifications:

1. Certify in accordance with ASME BPVC-IX.
2. Provide certificate of compliance from local Authority Having Jurisdiction, indicating approval of welders.

I. Valves: Bearing product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.

J. Products:

1. Listed, classified, and labeled as suitable for the purpose specified and indicated.

2. Refer to FM (AG) - FM Approval Guide and UL (DIR).

K. Perform Work in accordance with local authorities having jurisdiction, municipality, and water utility requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 WATER PIPE

A. Steel Pipe and Fittings:

1. Pipe: Standard weight, zinc-coated, listed, ASTM A53/A53M.
2. Fittings: Comply with ASME B16.3 Class 150, zinc coated, threaded or ASME B16.4 Class 125, zinc-coated.
3. Mechanically Factory Applied Protective Materials:
   a. Clean by wire brushing and solvent cleaning.
   b. Apply one coat of coal-tar primer and two coats of coal-tar enamel complying with AWWA C203.
   c. Protect threaded pipe ends and fittings prior to coating.

B. Ductile Iron Pipe: Listed, AWWA C104/A21.4:

1. Fittings: Ductile iron, standard thickness.
2. Joints: AWWA C111/A21.11, styrene-butadiene rubber (SBR) or vulcanized SBR gasket with rods.

3. Jackets: AWWA C105/A21.5 polyethylene jacket.

C. Copper Tubing: Listed, ASTM B88 (ASTM B88M), Type K (A), annealed.

1. Fittings: ASME B16.18 cast copper or ASME B16.22 wrought copper.
2. Joints: Compression connection or AWS A5.8M/A5.8, BCuP silver braze.

2.02 VALVES

A. Valves: Manufacturer's name and pressure rating marked on valve body.

B. Detector Check with Water Meter:

1. 4 NPS up to and including 10 NPS:
   a. Description: Check valve, water meter, by-pass piping, and isolation valves designed to measure both low flow and high water volume usage.
      1) Listed.
      2) Valve Body: Comprised of epoxy coated stainless steel, ductile iron, or cast iron.
      3) Valve Ends: Flanged.

C. Water Pressure Reducing Valves:

1. 1-1/2 NPS up to and including 8 NPS:
   a. Function: Reduce higher inlet pressure to an adjustable, constant lower outlet pressure independent of flow rate fluctuations.
   b. Pilot-Operated Type: External pilot control.
   c. Construction:
      1) Listed .
      2) Body: Ductile iron complying with ASTM A536, Grade 65-45-12.
      3) Internal Ferrous Materials: Coated with 4 mils of epoxy.
      4) External Surfaces: Coated with 4 mils of epoxy followed by coat of fire red enamel paint.
      5) Main Valve Seat Ring: Bronze, complying with ASTM B61.
      6) Stem: Stainless Steel.
      7) Elastomers (diaphragms, resilient seats, and O-rings): Buna-N.
      8) Pilot Control System: Bronze, complying with ASTM B61, with stainless steel trim.

D. Gravity (Swing) Check Valve, Flanged End:

1. 2-1/2 NPS up to and including 10 NPS:
   a. Construction:
      1) Listed.
      2) Body: Cast iron complying with ASTM A126, Class B.
      3) Disc: ASTM A126 cast iron, ASTM A536 ductile iron, or ASTM B584 cast brass.
      4) Replaceable seats and discs.
      5) Maximum Working Pressure: 175 psi.

E. Gravity (Swing) Check Valve, Grooved End:

1. 2-1/2 NPS up to and including 6 NPS:
   a. Construction:
      1) Listed .
      2) Body: ASTM A48/A48M gray iron, ASTM A126 cast iron, or ASTM A536 cast iron.
      3) Coatings (as applicable): Rust inhibiting orange enamel paint on exterior and interior surfaces.
      4) Clapper:
         (a) Material: Constructed of stainless steel or ductile iron.
         (b) Facing: EPDM.
      5) Seat: Constructed of stainless steel, brass, or bronze.
      6) Spring: Stainless steel.
      7) Hinge Pin: Stainless steel.
      8) Maximum Working Pressure: 250 psi.

F. Detector Check Valve, Flanged End:

1. 4 NPS up to and including 10 NPS:
   a. Construction:
      1) Listed.
      2) Body: Constructed of heavy steel, 300 series stainless steel, or ASTM A536 ductile iron to AWWA C550, as applicable.
      3) Coating: Fusion bonded epoxy in accordance with AWWA C550.
      4) Spring and Linkage: Stainless steel.
      5) Removable Clapper Seat Ring: Bronze.
      6) Seat: ASTM B63 bronze.
      7) Maximum Working Pressure: 175 psi.

G. Double Check Detector Valve Assembly, Flanged End:

1. 2-1/2 NPS up to and including 10 NPS:
   a. Construction:
      1) Listed .
      2) Body: 300 Series stainless steel or ASTM A536 Grade 65-45-12 ductile iron.
      3) Two independently operating, spring-loaded, check valves.
      4) Two OSY resilient seated gate valves.
      5) Bypass Assembly:
         (a) Bypass Line: Hydraulically sized to accurately measure low flow.
         (b) Double check including shut-off valves, and required cocks.
         (c) Meter with readout.
      6) Cam-Check:
         (a) Internally loaded, providing positive, drip-tight closure against reverse flow.

(b) Stainless steel cam arm and spring, rubber-faced disc, and replaceable, thermoplastic seat.

7) Valve Cover:
(a) Provides access to all internal parts.
(b) Held in place through the use of a single grooved style two-bolt coupling.

H. Reduced-Pressure Zone (RPZ) Device, Flanged End:

1. 2-1/2 NPS up to and including 10 NPS:
a. Construction:
1) Listed .
2) Main Valve Body: ASTM A536 Grade 65-45-12 ductile iron, 300 Series, stainless steel, or 304 Series, stainless steel
3) Relief Valve Body: ASTM A536 Grade 65-45-12 ductile iron, 300 Series stainless steel, or 304 Series stainless steel
4) Coating (As Applicable): Fusion epoxy internal and external, AWWA C550.
5) Shutoff Valves: NRS resilient wedge gate valve, AWWA C509.
6) Check Seats: Stainless steel.
7) Disc Holder: Stainless steel.
8) Elastomer Disc: Silicone, PPE/polystyrene, EPDM, or Buna-N.
9) Spring: Stainless steel.
10) Inlet/Outlet Flow:
(a) Inlet:
(1) Orientation: Horizontal.
(2) Flow Direction: Up.
(b) Outlet:
(1) Orientation: Vertical.
(2) Flow Direction: Horizontal.

I. Atmospheric Vacuum Breaker, Threaded End:

1. 1 NPS up to and including 2 NPS:
a. Construction:
1) Valve Body and Cover: ASTM A126 Class B cast iron or ASTM A536 65-45-12 ductile iron
2) Float, Guide Shafts, and Bushings: Fabricate with Type 316 stainless steel or polymer based materials.

2.03 BEDDING AND COVER MATERIALS

A. Bedding: As specified in Section 31 2316.13.

B. Cover: As specified in Section 31 2316.13.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that building service connection and municipal utility water main size, location, and invert are as indicated.

3.02 INSTALLATION

A. General Requirements:

1. Location of Water Lines:
   a. Terminate the work covered by this Section at a point approximately 5 feet from the building unless indicated otherwise.
   b. Do not install water line closer horizontally than 10 feet from any sewer line.
   c. Do not install copper tubing in the same trench with ferrous piping materials.
   d. Do not install water piping through or to come into contact with any part of a sewer manhole.
   e. Where nonferrous metallic pipe crosses any ferrous piping, provide a minimum vertical separation of 1 foot between pipes.
2. Sleeving:
   a. Sleeve water piping where piping is required to be installed within 3 feet of existing structures.
   b. Provide ductile iron or Schedule 40 steel sleeves.
   c. Fill annular space between pipe and sleeves with mastic.
   d. Install water pipe and sleeve without damaging structures or causing settlement or movement of foundations or footings.
3. Pipe Laying and Jointing:
   a. Remove fins and burrs from pipe and fittings.
   b. Prior to placing in position, clean pipe, fittings, valves, and accessories, and maintain in clean condition.
   c. Provide proper facilities for lowering pipe sections into trenches.
   d. Dropping or dumping of piping, fittings, valves, or any other water line material into trenches is not permitted.
   e. Cut pipe in a neat, workmanlike manner accurately to length established at the site and work into place without forcing or springing.
   f. Replace by one of the proper length any pipe or fitting that does not allow sufficient space for proper installation of jointing material.
   g. Wedging or blocking between bells and spigots will not be permitted.
   h. Install bell-and-spigot pipe with the bell end pointing in the direction of laying.
   i. Grade the pipeline in straight lines avoiding the formation of dips and low points.
   j. Support piping at proper elevation and grade.
   k. Secure firm, uniform support.
   l. Wood support blocking will not be permitted.
   m. Install pipe so that the full length of each pipe section and each fitting will rest solidly on the pipe bedding; excavate recesses to accommodate bells, joints, and couplings.

n. Provide anchors and supports where indicated and necessary for fastening work into place.
o. Provide proper provisions for expansion and contraction of pipelines.
p. Keep trenches free of water until joints have been properly made.
q. Close open ends of piping temporarily with wood blocks or bulkheads at the end of each workday.
r. Do not install pipe during unacceptable trench conditions or inclement weather.
s. Minimum Depth of Pipe Cover: Not less than 2-1/2 feet.

4. Connections to Existing Water Lines:
   a. Ensure minimal interruption of service on the existing line.
   b. Make connections to existing lines under pressure in accordance with the recommended procedures of the manufacturer of the pipe being tapped.
5. Penetrations:
   a. Provide ductile-iron or Schedule 40 steel for pipes passing through walls of valve pits and structures.
   b. Fill annular space between sleeves and walls with rich cement mortar.
   c. Fill annular space between pipe and sleeves with mastic.
6. Flanged Pipe: Install only above grade.

B. Special Requirements:

1. Ductile Iron Piping:
   a. Unless otherwise specified, install pipe and fittings in accordance with paragraph "General Requirements".
   b. Jointing:
      1) Make push-on joints with the gaskets and lubricant specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly.
      2) Make mechanical joints with the gaskets, glands, bolts, and nuts specified for this type joint; assemble in accordance with the applicable requirements of AWWA C600 for joint assembly and the recommendations of Appendix A to AWWA C111/A21.11.
      3) Make flanged joints with the gaskets, bolts, and nuts specified for this type joint.
         (a) Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other accessories and equipment.
         (b) Align bolt holes for each flanged joint.
         (c) Use full size bolts for the bolt holes; use of undersized bolts to make up for misalignment of bolt holes or for any other purpose will not be permitted.
         (d) Do not allow adjoining flange faces to be out of parallel to such a degree that the flanged joint cannot be made watertight without over-straining the flange.
         (e) When flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified, replace it by one of proper dimensions.

(f) Use set-screwed flanges to make flanged joints where conditions prevent the use of full length, flanged pipe and assemble in accordance with the recommendations of the set-screwed flange manufacturer.

4) Assemble joints made with sleeve-type mechanical couplings in accordance with the recommendations of the coupling manufacturer.

5) Make grooved and shouldered type joints with the couplings previously specified for this type joint connecting pipe with the grooved or shouldered ends specified for this type joint; assemble in accordance with the recommendations of the coupling manufacturer.

(a) Groove pipe in the field only with approved grooved cutting equipment designed especially for the purpose and produced by a manufacturer of grooved joint couplings; secure approval for field-cut grooves before assembling the joint.

6) Make insulating joints with the gaskets, sleeves, washers, bolts, and nuts previously specified for this type joint.

(a) Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves be full size for the bolt holes.

(b) Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.

c. Allowable Deflection:

1) Maximum Allowable Deflection: As stated in AWWA C600.

2) If the alignment requires deflection in excess of the above limitations, furnish special blends or a sufficient number of shorter pipe lengths to provide angular deflections within the limit set forth.

d. Pipe Anchorage:

1) Provide concrete thrust blocks (reaction backing), for pipe anchorage except where metal harness is indicated.

2) Thrust blocks to comply with the requirements of AWWA C600 for thrust restraint, except that size and positioning of thrust blocks to be as indicated.

3) Use concrete, ASTM C94/C94M, having a minimum compressive strength of 2,500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.

4) Provide metal harness in accordance with the requirements of AWWA C600 for thrust restraint, using tie rods and clamps as indicated in NFPA 13, except as otherwise indicated.

e. Exterior Protection: Completely encase buried ductile iron pipelines with polyethylene tube or sheet, using Class A polyethylene film, in accordance with AWWA C105/A21.5.

2. Steel Piping:

a. Jointing:

1) Bell-and-Spigot: Make rubber-gasketed, bell-and-spigot joints with the gaskets previously specified for this type of joint, using an approved lubricant, all in

accordance with the pipe manufacturer's recommendations.

2) Welded: Make welded joints in accordance with AWWA C206 and install in accordance with AWWA M11.
3) Flanged:
   (a) Make flanged joints up tight; avoid undue strain on flanges, fittings, valves, and other equipment and accessories.
   (b) Align bolt holes for each flanged joint.
   (c) Use full-size bolts for the bolt holes; use of undersized bolts due to misalignment of bolt holes or for any other purpose will not be allowed.
   (d) Do not allow adjoining flange faces to be out of parallel to such a degree that the flanged joint cannot be made water-tight without straining the flange.
   (e) When flanged pipe or fitting has dimensions that do not allow the making of a proper flanged joint as specified, replace it with one of correct dimensions.
4) Grooved:
   (a) Make grooved type joints with the couplings specified for this type joint connecting pipe with roll-grooved ends or pipe with welded-on cut-grooved adapters, each with dimensions as previously specified for this type of joint.
   (b) Groove pipe ends in the field only with approved groove rolling equipment and groove adapters in the field only with approved groove cutting equipment; use only groove rolling and groove cutting equipment designed especially for the purpose and produced by a manufacturer of grooved joint couplings.
   (c) Obtain approval for field-cut grooves prior to assembling the joint.
5) Shouldered: Make shouldered type joints with the couplings specified for this type joint connecting pipe with the shouldered ends specified for this type of joint.
6) Assemble grooved and shouldered type joints in accordance with the recommendations of the coupling manufacturer.
7) Insulating:
   (a) Make insulating joints with the gaskets, sleeves, washers, bolts, and nuts specified for this type joint.
   (b) Assemble insulating joints as specified for flanged joints, except that bolts with insulating sleeves be full size for the bolt holes.
   (c) Ensure that there is no metal-to-metal contact between dissimilar metals after the joint has been assembled.
8) Joint Finishing:
   (a) Finish joints on piping with cement-mortar lining and on piping with cement-mortar coating as specified in Appendix on Field Joints in AWWA C205.
   (b) Finish joints on piping with coal-tar-enamel or coal-tar epoxy coating by cleaning, priming, coating, and wrapping with a cold-applied tape coating

complying with and applied in accordance with AWWA C209.

b. Allowable Offsets:
    1) For pipe with bell-and-spigot rubber-gasket joints, 5 degrees maximum allowable deflections from a straight line or grade, as required by vertical curves, horizontal curves, or offsets; unless a lesser amount is recommended by the manufacturer.
    2) Form short-radius curves and closures by short lengths of pipe or fabricated specials specified.
c. Pipe Anchorage:
    1) Provide concrete thrust blocks (reaction backing) for pipe anchorage, except where metal harness is indicated.
    2) Thrust blocks to be in accordance with the recommendations for thrust restraint in AWWA M11, except that size and positioning of thrust blocks are to be as indicated.
    3) Use ASTM C94/C94M concrete having a minimum compressive strength of 2500 psi at 28 days; or use concrete of a mix not leaner than one part cement, 2-1/2 parts sand, and 5 parts gravel, having the same minimum compressive strength.
    4) Metal Harness:
        (a) Provide in accordance with the recommendations for joint harnesses in AWWA M11, except as otherwise indicated.
        (b) Fabricated by the pipe manufacturer and furnished with the pipe.

3. Copper Piping:
    a. Install in accordance with the Copper Development Association's Copper Tube Handbook and manufacturer's recommendations - CDA A4015.
    b. Bed piping in 6 inches of sand.

C. Valves:

1. Set valves on solid bearing.
2. Center and plumb valve box over valve.
3. Set box cover flush with finished grade.

3.03 SERVICE CONNECTIONS

A. Provide fire water service to Local Authority Having Jurisdiction requirements with reduced pressure backflow preventer and water meter with by-pass valves and sand strainer.

B. Anchor fire service main to interior surface of foundation wall.

C. Provide 18 gage, 0.0478 inch galvanized sheet metal sleeve surrounding service main to 6 inches above floor and 6 feet minimum below grade. Size for 2 inches minimum of glass fiber insulation stuffing.

3.04 FIELD QUALITY CONTROL

A. Field Tests and Inspections:

1. See Section 01 4000 - Quality Requirements, for additional requirements.
2. Provide all labor, equipment, and incidentals required for field testing, except that water and electric power needed for field tests will be furnished as set forth in Section 01 5100 - Temporary Utilities.
3. Conduct piping tests before joints are covered and after concrete thrust blocks have hardened sufficiently and at least 5 days after placing of concrete after concrete thrust blocks have hardened sufficiently and at least 5 days after placing of concrete.
4. Prior to hydrostatic testing, obtain approval from Architect for proposed method for disposal of wastewater from hydrostatic testing.
5. The Architect will conduct field inspections and witness field tests as specified in this Section.
6. Fill pipeline 24 hours before testing and apply test pressure to stabilize system, using only potable water.
7. Test water piping in accordance with NFPA 13, where the additional water added to the system must not exceed the limits given in NFPA 13.
8. Pressure test piping to 200 psi for a period of two (2) hours.
9. If tests indicate Work does not meet specified requirements, remove Work, replace and retest at no cost to Owner.
10. Prepare reports of testing activities.

3.05 CLEANING

A. Upon completion of the installation of water lines and appurtenances, remove and haul away all surplus material, including debris resulting from the work.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate operation of system to Owner's personnel.

1. Use operation and maintenance data as reference during demonstration.
2. Conduct walking tour of project.
3. Briefly describe function, operation, and maintenance of each component.

D. Training: Train Owner's personnel on operation and maintenance of system.

END OF SECTION

SECTION 21 1300
FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. Preaction sprinkler system.

C. System design, installation, and certification.

D. Fire department connections.

1.02 RELATED REQUIREMENTS

A. Section 21 0500 - Common Work Results for Fire Suppression: Pipe and fittings.

B. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

C. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

D. Section 22 0553 - Identification for Plumbing Piping and Equipment.

E. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

F. Section 28 4600 - Fire Detection and Alarm.

1.03 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide current edition.

B. ICC-ES AC01 - Acceptance Criteria for Expansion Anchors in Masonry Elements 2015.

C. ICC-ES AC106 - Acceptance Criteria for Predrilled Fasteners (Screw Anchors) in Masonry Elements 2015.

D. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2015.

E. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.

F. NFPA 13 - Standard for the Installation of Sprinkler Systems Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 1963 - Standard for Fire Hose Connections 2019.

H. UL (DIR) - Online Certifications Directory Current Edition.

I. UL 405 - Standard for Safety Fire Department Connection Devices Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 QUALITY ASSURANCE

A. Comply with FM (AG) requirements.

B. Designer Qualifications: Design system under direct supervision of a NICET Level 3 certification in Fire Protection Engineering Technology Water Based System Layout experienced in design of this type of work.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum five years experience and approved by manufacturer.

E. Equipment and Components: Provide products that bear FM (AG) label or marking.

F. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

PART 2 - PRODUCTS

2.01 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for entire building, modifying existing system as necessary.

B. Occupancy: Light hazard; comply with NFPA 13.

C. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

D. Pipe Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
3. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
4. Other Types: As required.

2.02 SPRINKLERS

A. Suspended Ceiling Type: Concealed pendant type with matching push on cover plate.

1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Enamel, color as selected.
4. Cover Plate Finish: Enamel, color as selected.
5. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

B. Exposed Area Type: Pendant type.

1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Enamel, color as selected.
4. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

C. Sidewall Type: Recessed horizontal sidewall type with matching push on escutcheon plate.

1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Enamel, color as selected.
4. Escutcheon Plate Finish: Enamel, color as selected.
5. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

D. Dry Sprinklers: Concealed pendant type with matching push on cover plate.

1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Enamel, color as selected.
4. Cover Plate Finish: Enamel, color as selected.
5. Fusible Link: Fusible solder link type temperature rated for specific area hazard.

E. Flexible Drop System: Stainless steel, multiple use, open gate type.

1. Application: Use to properly locate sprinkler heads.
2. Include all supports and bracing.
3. Provide braided type tube as required for the application.
4. Piping drops will adhere to the FM Global requirement, maintaining a minimum of 7" radius.

2.03 PIPING SPECIALTIES

A. Wet Pipe Sprinkler Alarm Valve: Check type valve with divided seat ring, rubber-faced clapper to automatically actuate water motor alarm, pressure retard chamber and variable pressure trim with the following additional capabilities and features:

1. Activate electric alarm.
2. Test and drain valve.
3. Replaceable internal components without removing valve from installed position.

B. Preaction Valve:

1. Operated by detection system listed for releasing service and independent of building fire alarm system with provisions for local, manual, and indicated remote releases.
2. Incorporate mechanical latching mechanism incorporating valve clappers independent of system water pressure fluctuations.
3. Provide test detection device for each actuation circuit adjacent to each controlled valve in accordance with NFPA 13.

C. Backflow Preventer: Reduced pressure principle valve assembly backflow preventer with drain and OS & Y gate valve on each end.

D. Test Connections:

1. Inspector's Test Connection for Preaction Systems:
   a. Provide test connections approximately 6 ft above floor for each or portion of each sprinkler system equipped with an alarm device, located at the most remote part of each system.
   b. Route test connection to an open-site drain location, excluding janitor sinks, accepting full flow without negative consequences.
   c. Supply discharge orifice with same size as corresponding sprinkler orifice.
   d. Limit vertical height of exterior wall penetration to 2 ft above finished grade.
2. Backflow Preventer Test Connection:
   a. Provide downstream of the backflow prevention assembly, listed hose valves with 2.5 inch National Standard male hose threads with cap and chain.
   b. Furnish one valve for each 250 gpm of system demand or fraction thereof.
   c. Provide permanent sign reading "Test Valve" in accordance with Section 22 0553.

E. Water Motor Alarm: Hydraulically operated impeller type alarm with aluminum alloy chrome plated gong and motor housing, nylon bearings, and inlet strainer.

F. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC.

G. Fire Department Connections:

1. Type: Exposed, projected wall mount made of corrosion resistant metal complying with UL 405.
    a. Inlets: Two way, 2-1/2 inch swivel fittings, internal threaded. Thread size and inlets according to NFPA 1963 or Authority Having Jurisdiction. Brass caps with gaskets, chains, and lugs.
    b. Outlet: Back with pipe threads, 4 NPS.
    c. Rated Working Pressure: 175 psi.
    d. Finish: Chrome.
    e. Signage: Raised or engraved lettering 1 inch minimum indicating system type.

2.04 PREACTION VALVE CONTROL PANEL

A. Provide a modular type control panel for electrically operated detection and extinguishing systems for each preaction valve.

1. Factory mount in surface mounted, steel cabinet with hinged doors, and cylinder lock.
2. Provide factory wired assembly containing components and equipment as required to perform specified system operating and supervisory functions.
3. Include isolation switch to allow system testing without activation of the preaction valve.
4. House batteries in separate and lockable, steel cabinet.
5. Finish interior and exterior of cabinet with enamel paint and provide identification plates in accordance with Section 22 0553.
6. Include trouble lights and trouble alarm.
7. Provide 120 volt AC service transformed through a two-winding, isolation type transformer and rectified to low voltage DC for operation of all system actuating, signal sounding, trouble signal, and fire alarm tripping circuits.
8. Provide UL (DIR) listed as an extinguishing system releasing panel and separate from the building's fire alarm control panel.

B. Secondary Power Supply:

1. Provide nickel cadmium, lead calcium, or sealed lead acid rechargeable storage batteries and battery charger.
2. Storage Batteries:
    a. Provide with sufficient ampere-hour rating to operate under supervisory and trouble conditions, including audible trouble signal devices under alarm conditions for an additional 10 minutes and as required in accordance with the equipment listing.
    b. Prevent contact between terminals of adjacent cells, battery terminals, and other metal parts with separate cell construction.
3. Battery Charger:
    a. Provide solid-state automatic two rate type, capable of recharging completely discharged batteries to fully charged condition in 24 hours or less.
    b. Locate charger within control panel or battery cabinet.

C. Wiring: Refer to Section 26 0583.

D. Supervision: Refer to Section 28 4600.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Place pipe runs to minimize obstruction to other work.

D. Place piping in concealed spaces above finished ceilings.

E. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

F. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

G. Flush entire piping system of foreign matter.

H. Hydrostatically test entire system.

I. Require test be witnessed by Authority Having Jurisdiction.

3.02 INTERFACE WITH OTHER PRODUCTS

A. Ensure required devices are installed and connected as required to fire alarm system.

END OF SECTION

SECTION 22 0000
SUPPLEMENTARY PLUMBING GENERAL CONDITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes supplementary general requirements for the following :

1. Codes and Standards
2. Conflicting Requirements
3. Specifications and Drawing Conventions
4. Phased Construction
5. Work Restrictions
6. Fees, Permits, and Inspection
7. Submittals
8. Closeout Submittals
9. Quality Assurance
10. Product Delivery, Storage, and Handling
11. Product Warranties
12. Product Selection Procedures
13. Coordination Drawings
14. Emergency, Operation, and Maintenance Manuals
15. Record Drawings
16. Construction Waste
17. General Coordination for Plumbing Work
18. Cutting and Patching
19. Excavation and Trenching
20. Painting

1.03 DEFINITIONS

A. "Action Submittals": Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.

C. "Basis-of-Design Product": A product in which a specific manufacturer's product is named on the drawings or is accompanied by the words "basis-of-design product" in the specifications, including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

D. "Construction Waste": Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

E. "Cutting": Removal of in-place construction necessary to permit installation or performance of other work.

F. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

G. "Disposal": Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

H. "File Transfer Protocol (FTP)": Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

I. "Furnish": To supply, deliver, unload, and inspect for damage.

J. "General": Basic Contract definitions are included in the Conditions of the Contract.

K. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

L. "Informational Submittals": Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

M. "Install": To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

N. "Patching": Fitting and repair work required to restore construction to original conditions after installation of other work.

O. "Portable Document Format (PDF)": An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

P. "Product": Material, machinery, components, equipment, fixtures,and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Product may be new, never before used, or re-used materials or equipment.

Q. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

R. "Provide": Furnish and install, complete and ready for the intended use.

S. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

T. "Salvage": Recovery of construction waste and subsequent sale or reuse in another facility.

U. "Salvage and Reuse": Recovery of construction waste and subsequent incorporation into the Work.

V. "System": An organized collection of parts, equipment, or subsystems united by regular interaction.

W. "Subsystem": A portion of a system with characteristics similar to a system.

1.04 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AGA	American Gas Association	(202) 824-7000
	www.aga.org	
	www.gamanet.org	
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association	(908) 464-8200
	Division of Air-Conditioning, Heating, and Refrigeration Institute (AHRI)	
	www.ahrinet.org	
IGMA	Insulating Glass Manufacturers Alliance	(613) 233-1510
	www.igmaonline.org	
ISA	Instrumentation, Systems, and Automation Society, The	(919) 549-8411
	www.isa.org	
ISO	International Organization for Standardization	41 22 749 01 11
	www.iso.ch	
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.	(703) 281-6613
	www.mss-hq.com	

NEBB	National Environmental Balancing Bureau	(301) 977-3698
	www.nebb.org	
NEMA	National Electrical Manufacturers Association	(703) 841-3200
	www.nema.org	
NFPA	NFPA	(800) 344-3555
	(National Fire Protection Association)	(617) 770-3000
	www.nfpa.org	
UL	Underwriters Laboratories Inc.	(877) 854-3577
	www.ul.com	(847) 272-8800

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ICC	International Code Council	(888) 422-7233
	www.iccsafe.org	

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

DOE	Department of Energy	(202) 586-9220
	www.energy.gov	
EPA	Environmental Protection Agency	(202) 272-0167
	www.epa.gov	
FCC	Federal Communications Commission	(888) 225-5322
	www.fcc.gov	
OSHA	Occupational Safety & Health Administration	(800) 321-6742
	www.osha.gov	(202) 693-1999

PHS	Office of Public Health and Science	(202) 690-7694
	http://www.hhs.gov/ophs/	

USP	U.S. Pharmacopeia	(800) 227-8772
	www.usp.org	

USPS	Postal Service	(202) 268-2000
	www.usps.com	

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA)	(800) 872-2253

1.05 CODES AND STANDARDS

A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations. Where specific code requirements apply, they shall be included in the job, whether or not specifically shown or elsewhere specified.

B. Applicable codes and standards shall include all state laws, local ordinances, utility company regulations, and the applicable requirements of the following adopted codes and standards.

1. Building Codes for Arkansas
    a. International Building Code 2006
    b. Arkansas Fire Prevention Code 2007
    c. National Electrical Code 2017
    d. Arkansas Fuel Gas Code 2006 (International Fuel Gas Code 2006)
    e. International Existing Building Code 2006
    f. Arkansas Energy Code 2011 (based on ANSI/ASHRAE/IESNA Standard 90.1-2007)
    g. Arkansas State Plumbing Code 2006
    h. Arkansas Mechanical Code 2010
    i. Accessibility Code ICC/ANSI A117.1 2003

1.06 CONFLICTING REQUIREMENTS

A. Conflicting requirements: If compliance with standards, codes, regulations, and specifications establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.07 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.

3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.
4. The Plumbing Drawings show the general arrangement of all piping, equipment and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. The work shall conform to the requirements shown on all of the drawings. General and Structural Drawings shall take precedence over Plumbing Drawings. Because of the small scale of the Plumbing Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, offsets, valves and accessories as may be required to meet such conditions.

1.08 PHASED CONSTRUCTION

A. The Contractor shall refer to the General Requirements of this specification and prepare all work schedules required to perform all work as shown on the Drawings and as herein specified.

B. All services such as, but not limited to domestic water, sewer, and gas shall be maintained to all areas of the building during this Contract. Temporary service connections will be required where necessary to maintain these services. The Contractor will make these connections as required to provide continuous service.

C. It will be the responsibility of the Contractor to carefully review the drawings, specifications and existing conditions with reference to these types of services so that the building may function normally during the construction process.

1.09 WORK RESTRICTIONS

A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than 7 days in advance of proposed utility interruptions.
2. Obtain Owner's written permission before proceeding with utility interruptions.
3. Hours for Utility Shutdowns:[_____].
4. Any accidental disturbance of services as a result of this Contract will be immediately restored by the Contractor at no additional cost to the Owner.

B. Noise, Vibration, and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Owner occupancy with Owner.

1. Notify Owner not less than 2 days in advance of proposed disruptive operations.
2. Obtain Owner's written permission before proceeding with disruptive operations.

1.10 FEES, PERMITS, AND INSPECTIONS

A. All required fees, permits and inspections of all kind shall be obtained and paid for by the Contractor under the section of the specifications for which they are required.

B. Certificate of Final Inspection: Under each applicable section of the specifications, the Contractor shall, upon completion of the work under that section, furnish a certificate of final inspection to the Engineer from the inspection department having jurisdiction.

1.11 SUBMITTALS

A. Submittal Schedule

1. Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.
    a. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
    b. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
    c. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
        1) Submit revised submittal schedule to reflect changes in current status and timing for submittals.
    d. Format: Arrange the following information in a tabular format:
        1) Scheduled date for first submittal.
        2) Specification Section number and title.
        3) Submittal category: Action; informational.
        4) Name of subcontractor.
        5) Description of the Work covered.
        6) Scheduled date for Engineer's final release or approval.

B. Submittal Administrative Requirements

1. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
    a. Submit submittals to Engineer through the Architect.
    b. Engineer, through Architect, will return annotated file.
2. Digital Data Files:
    a. Electronic digital data files of the Project drawings may be provided by Engineer for Contractor's use in preparing submittals.
    b. Electronic digital data files supplied for use in submittal preparation will be subject to terms and conditions of the Engineer's Release Form. A signed release form and any payment required must be returned to the Engineer prior to the transmission of an electronic digital data files.
    c. Electronic digital data file formats may include AutoCAD drawings, Revit converted to AutoCAD drawings, or Revit model.
3. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
    a. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
    b. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
    c. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
    d. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
        1) Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
4. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
    a. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
    b. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
    c. Resubmittal Review: Allow 14 days for review of each resubmittal.
5. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
    a. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.

b. Name file with submittal number or other unique identifier, including revision identifier.
    1) File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
c. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.
d. Transmittal Form for Electronic Submittals: Use electronic form containing the following information:
    1) Project name.
    2) Name and address of Architect.
    3) Name and address of Engineer.
    4) Name of Contractor.
    5) Name of firm or entity that prepared submittal.
    6) Names of subcontractor, manufacturer, and supplier.
    7) Category and type of submittal.
    8) Submittal purpose and description.
    9) Specification Section number and title.
    10) Specification paragraph number or drawing designation and generic name for each of multiple items.
    11) Drawing number and detail references, as appropriate.
    12) Location(s) where product is to be installed, as appropriate.
    13) Related physical samples submitted directly.
    14) Indication of full or partial submittal.
    15) Transmittal number.
    16) Submittal and transmittal distribution record.
    17) Other necessary identification.
    18) Remarks.
e. Metadata: Include the following information as keywords in the electronic submittal file metadata:
    1) Project name.
    2) Number and title of appropriate Specification Section.
    3) Manufacturer name.
    4) Product name.

6. Options: Identify options requiring selection by Engineer.
7. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
8. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
    a. Note date and content of previous submittal.

b. Note date and content of revision in label or title block and clearly indicate extent of revision.
c. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.

9. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
10. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.
11. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
    a. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
    b. Engineer's Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor through Architect of approval or rejection of proposed comparable product request within 14 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
        1) Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.

1.12 CLOSEOUT SUBMITTALS

A. Closeout submittals shall include, but not limited to, the following:

1. Operation and Maintenance Materials
2. Record Drawings
3. Final Approved Submittals

B. Operation and Maintenance Materials Submittals

1. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
    a. Engineer will comment on whether content of operations and maintenance submittals are acceptable.
    b. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
2. Format: Submit operations and maintenance manuals in the following format:
    a. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Engineer.
        1) Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
        2) Enable inserted reviewer comments on draft submittals.

b. In addition to the electronic submit provide two paper copies of the corrected final submittal as part of the “Closeout Documents”. Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Engineer, through Architect, will return two copies. The two paper copies will be provided to the Owner as part of the “Closeout Documents”

3. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 days before commencing demonstration and training. Engineer will return copy with comments.
   a. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer's comments and prior to commencing demonstration and training.

C. Training Submittals

1. Demonstration to the Owner personnel of the Plumbing products and systems to be utilized on the project is required.
2. Training of Owner personnel in operation and maintenance is required for:
   a. Plumbing systems and equipment.
   b. All software-operated systems.
   c. Items specified in individual product Sections
3. Instruction Program: Submit outline of instructional program for demonstration and training, including a list of training modules and a schedule of proposed dates, times, length of instruction time, and instructors' names for each training module. Include learning objective and outline for each training module.
   a. Indicate proposed training modules using manufacturer-produced demonstration and training video recordings for systems, equipment, and products in lieu of video recording of live instructional module.
4. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
   a. Identification: On each copy, provide an applied label with the following information:
      1) Name of Project.
      2) Name and address of videographer.
      3) Name of Engineer.
      4) Name of Contractor.
   b. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals in PDF electronic file format on compact disc.

D. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.

3. Include the following information, as applicable:
    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.
    d. Statement of compliance with specified referenced standards.
    e. Testing by recognized testing agency.
    f. Application of testing agency labels and seals.
    g. Notation of coordination requirements.
    h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
    a. Wiring diagrams showing factory-installed wiring.
    b. Printed performance curves.
    c. Operational range diagrams.
    d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

E. Shop Drawings: Prepare Project-specific information, drawn accurately to scale and sufficiently large to show all pertinent features of the item, method of connections, and notations clearly legible. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Engineer's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    a. Identification of products.
    b. Schedules.
    c. Compliance with specified standards.
    d. Notation of coordination requirements.
    e. Notation of dimensions established by field measurement.
    f. Relationship and attachment to adjoining construction clearly indicated.
    g. Seal and signature of professional engineer if specified.
2. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 01 3100 "Project Management and Coordination."

G. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 4000 "Quality Requirements."

H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 7700 "Closeout Procedures."

I. Maintenance Data: Comply with requirements specified in Section 01 7823 "Operation and Maintenance Data."

J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.

K. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.

L. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

M. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

N. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

O. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

1.13 QUALITY ASSURANCE

A. Products:

1. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.

a. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
b. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.14 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project Site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation or moisture damage..
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.15 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submit warranties in accordance with "Closeout Procedures."

1.16 FIELD CONDITIONS

A. The Contractor shall visit the site of the building before submitting a proposal on this work, and shall thoroughly familiarize himself with the existing conditions and operations. Failure on his part to do this will not be cause of extras after the contract is signed, by reason of unforeseen conditions.

1.17 WARRANTY

A. The Contractor shall, after completion of the original test of the installation, and acceptance by the Engineer, provide any service incidental to the proper performance of the plumbing under guarantees outlined above for a period of 1 full year after acceptance by the Engineer and Owner. Regardless of anything to the contrary in warranties by the equipment manufacturer involved, the Contractor's warranty shall run for 1 full year after final acceptance by the Engineer.

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Were two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
4. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
5. Where products are accompanied by the term "as selected," Architect will make selection.
6. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
7. Products containing asbestos shall not be used.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:
   a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience shall be considered.
   b. Nonrestricted List: Where Specifications include a list of names of both available manufacturers and products, provide one of the products listed, or an unnamed product, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product.
4. Manufacturers:
   a. Restricted List: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience shall be considered.
   b. Nonrestricted List: Where Specifications include a list of available manufacturers, provide a product by one of the manufacturers listed, or a product by an unnamed manufacturer, that complies with requirements. Comply with requirements in "Comparable Products" Article for consideration of an unnamed manufacturer's product.
5. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers.

Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Selection Procedure: Where Specifications include the phrase "as selected by Architect" or similar phrase, select a product that complies with requirements. Architect will select option from manufacturer's product line that includes both standard and premium items.

D. Comparable Products

1. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
   a. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
   b. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
   c. Evidence that proposed product provides specified warranty.
   d. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
   e. Contractor is responsible for any modification required by products other than the basis of design product at no additional cost to the owner including but not limited to modifications to supports and connections,

2.02 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
   a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems

and components.

b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
e. Show location and size of access doors required for access to concealed valves and other controls.
f. Indicate required installation sequences.
g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, low voltage, and electrical work. Supplement plan drawings with section drawings where required to adequately represent the work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical, plumbing,fire protection, low voltage, and electrical equipment, and related work.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, low voltage, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.
6. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
7. Fire-Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.

8. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: DXF operating in Microsoft Windows operating system.
2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and supply Portable Data File (PDF) format.
3. BIM File Incorporation: Provide coordination drawing files into Building Information Model established for Project.
    a. Provide three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.

2.03 EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to

ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

F. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

G. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

H. Operation Manual

1. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   a. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   b. Performance and design criteria if Contractor has delegated design responsibility.
   c. Operating standards.
   d. Operating procedures.
   e. Operating logs.
   f. Wiring diagrams.
   g. Control diagrams.
   h. Piped system diagrams.
   i. Precautions against improper use.
   j. License requirements including inspection and renewal dates.
2. Descriptions: Include the following:
   a. Product name and model number. Use designations for products indicated on Contract Documents.
   b. Manufacturer's name.
   c. Equipment identification with serial number of each component.
   d. Equipment function.

e. Operating characteristics.
f. Limiting conditions.
g. Performance curves.
h. Engineering data and tests.
i. Complete nomenclature and number of replacement parts.

3. Operating Procedures: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Instructions on stopping.
   f. Normal shutdown instructions.
   g. Seasonal and weekend operating instructions.
   h. Required sequences for electric or electronic systems.
   i. Special operating instructions and procedures.
4. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
5. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

I. Maintenance Manuals

1. Content: Organize manual into a separate section for each product, system, subsystem, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
2. Source Information: List each product, system, or subsystem included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
3. Product Information: Include the following, as applicable:
   a. Product name and model number.
   b. Manufacturer's name.
   c. Color, pattern, and texture.
   d. Material and chemical composition.
   e. Reordering information for specially manufactured products.
   f. Standard maintenance instructions and bulletins.
   g. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   h. Identification and nomenclature of parts and components.
   i. List of items recommended to be stocked as spare parts.
4. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.

c. List of cleaning agents and methods of cleaning detrimental to product.
d. Schedule for routine cleaning and maintenance.
e. Repair instructions.
f. Test and inspection instructions.
g. Troubleshooting guide.
h. Precautions against improper maintenance.
i. Disassembly; component removal, repair, and replacement; and reassembly instructions.
j. Aligning, adjusting, and checking instructions.
k. Demonstration and training video recording, if available.

5. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.
6. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
   a. Include procedures to follow and required notifications for warranty claims.
7. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
   a. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
   b. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
8. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
9. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
10. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
    a. Include procedures to follow and required notifications for warranty claims.

2.04 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
   a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
   b. Accurately record information in an acceptable drawing technique.
   c. Record data as soon as possible after obtaining it.

d. Record and check the markup before enclosing concealed installations.
e. Cross-reference record prints to corresponding archive photographic documentation.

2. Content: Types of items requiring marking include, but are not limited to, the following:
   a. Dimensional changes to Drawings.
   b. Revisions to details shown on Drawings.
   c. Locations and depths of underground utilities.
   d. Revisions to routing of piping and conduits.
   e. Revisions to electrical circuitry.
   f. Actual equipment locations.
   g. Locations of concealed internal utilities.
   h. Changes made by Change Order or Change Directive.
   i. Changes made following Architect's written orders.
   j. Details not on the original Contract Drawings.
   k. Field records for variable and concealed conditions.
   l. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark important additional information that was either shown schematically or omitted from original Drawings.
5. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked-up record prints with Engineer. When authorized, prepare a full set of corrected digital data files of the Contract Drawings, as follows:

1. Format: Annotated PDF electronic file with comment function enabled.
2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
3. Refer instances of uncertainty to Engineer for resolution.

PART 3 - EXECUTION

3.01 CONTRACTOR'S SUBMITTAL REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date

of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ENGINEER'S SUBMITTAL ACTION

A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to the Architect to forward to the appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Engineer without action.

3.03 CONSTRUCTION WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Disposal: Remove waste materials from Owner's property and legally dispose of them

3.04 GENERAL COORDINATION FOR PLUMBING WORK

A. The Contractor shall compare the Plumbing Drawings and Specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the Engineer

and obtain written instructions for changes necessary in the Plumbing Work. The Plumbing Work shall be installed in cooperation with other trades installing related work. Before installation, the Contractor shall make proper provision to avoid interferences. All changes required in the work of the Contractor caused by a failure to coordinate the work with other trades shall be made by the Contractor at his own expense.

B. Anchor bolts, sleeves, inserts and supports that may be required for the Plumbing Work shall be furnished under the same section of the specifications as the respective items to be supported, and they shall be installed, except as otherwise specified, by the trade furnishing and installing the material in which they are to be located. Location of anchor bolts, sleeves, inserts and supports shall be directed by the trade requiring them, which trade shall also insure that they are properly installed. Any expense resulting from the improper location or installation of anchor bolts, sleeves, inserts and supports shall be paid for by the Contractor under the section of the specifications for the trade with the responsibility for directing their proper location.

C. Slots, chases, openings and recesses through floors, walls, ceilings and roofs as specified will be provided by the various trades in their respective materials, but the trade requiring them shall see that they are properly located, and shall do any cutting and patching caused by the neglect to do so. Slots, chases, openings and recesses in existing structure shall be cut by the trade requiring them and patched and repaired by that trade.

D. Locations of pipes, equipment, etc. shall be adjusted to accommodate the work and to avoid interferences anticipated and encountered. The Contractor shall determine the exact route and location of each pipe and duct prior to fabrication.

1. Right-of-Way: Lines which pitch shall have the right of way over those which do not pitch. For example: plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
2. Offsets, transitions and changes in direction in pipes shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. The Contractor shall furnish and install all traps, air vents, sanitary vents, etc., as required

to effect these offsets, transitions and changes in direction.

3. Installation and Arrangement: The Contractor shall install all Plumbing Work to permit removal (without damage to other parts) of coils, heat exchanger bundles, belt guards, sheaves and drives, and all other parts requiring periodic replacement or maintenance. The Contractor shall arrange pipes and equipment to permit ready access to valves, cocks, control components and to clear the openings of swinging and overhead doors and of access panels.
4. Access: The Contractor shall provide all necessary access panels in walls, ceilings, equipment, etc., as required for inspection of interiors and for proper maintenance and or installation of equipment valves. Where changes from the plans are made by the Contractor in the installation of his work, he shall provide any and all access panels required as a result of these changes.

E. Connections Different From Those Shown: Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly with the intent of the drawings and specifications. When directed, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes in piping, supports, insulation, etc. The Contractor shall provide any additional valves, fittings, and other additional equipment required for the proper operation of the system resulting from the selection of equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing in and connections by other trades. All changes shall be made at no increase in the contract amount or additional cost to the other trades.

F. Connections: All piping connecting to equipment shall be installed without strain at the piping connection

G. Inaccessible Equipment

1. Where the Engineer or Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action (such as providing access panels) performed as directed at no additional cost to the Owner.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

H. Electrical Coordination

1. Power: All power and motor wiring shall be performed under Division 26 unless otherwise noted for specific items. Control and interlock wiring shall be done by the Contractor of this Division.
2. Starters and Drives: All motor starters and drives unless included in other sections of the specifications shall be by Division 26. Furnish auxiliary contacts on magnetic starters to permit interlocking of starting circuits.
3. Disconnects: All equipment furnished under this Division required to have a means of disconnect shall be supplied with a disconnect or a disconnect shall be furnished and installed by Division 26. The Contractor shall coordinate between this Division and Division 26 to ensure that all disconnects required for the Project are furnished and installed.
4. The Contractor of this Division shall furnish and install any low voltage relays, pressure switches, and similar items required for the proper operation of the Plumbing equipment.

I. Dedicated Electrical Space: The space equal to the width and depth of the equipment and extending from the floor to a height of 6 feet above the equipment or to the structural ceiling, whichever is lower, shall be dedicated to the electrical installation. No piping, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in this zone. The area above the dedicated space shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks or breaks in foreign systems. Every effort shall be made to eliminate foreign systems above equipment to the structural ceiling. If this is not possible, the Contractor shall encase any pipe in a second pipe with a minimum number of joints.

J. Lubrication: The Contractor shall be held responsible for all damage to bearings while the equipment is being operated up to the date of acceptance of the equipment. The Contractor shall be required to protect all bearings during installation and shall thoroughly grease steel shafts to prevent corrosion. All motors and other equipment shall be provided with covers as required for proper protection during construction. Pump shafts, motor shafts, etc. shall be coated to prevent deterioration in moist or wet atmospheres.

3.05 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Under each section of the specifications, the Contractor shall be responsible for all required cutting, etc., incident to his work under that section, and shall make all satisfactory repairs, but in no case shall the Contractor cut into any major structural element, beam or column.
2. Each trade shall bear the expense of all cutting, patching, repairing or replacing of the work of other trades because of fault, error or tardiness or because of any damage done by own workmanship.
3. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

C. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Cut off pipe in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

D. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other

Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
   a. Clean piping and similar features before applying paint or other finishing materials.
   b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
   a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

E. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.06 EXCAVATION AND TRENCHING

A. The Contractor shall perform all excavation of every description and of whatever substances encountered, to the depths indicated on the drawings, or as otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other methods. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled if the pipe can be safely and properly installed and backfill can be properly tamped in such tunnel sections. The Contractor shall be

responsible for shoring all trenches in accordance with industry standards and local codes. The Contractor shall be liable for the safety of the workmen in the trench and observe safety rules at all times.

B. Trench Excavation: Trenches shall be of necessity width for the proper laying of the piping, and the banks shall be as nearly vertical as practicable. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for each section of the pipe on undisturbed soil at every point along its entire length. Except where rock is encountered, care shall be taken not to excavate below the depths indicated. Where rock excavations are required, the rock shall be excavated to a minimum overdepth of 4" below the trench depths indicated on the drawings or specified. Overdepths in the rock excavation and unauthorized overdepths shall be backfilled with loose, granular, moist earth, thoroughly tamped. Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe is encountered in the bottom of the trench, such soil shall be removed to the depth required and the trench backfilled to the proper grade with coarse sand, fine gravel or other suitable material, as hereinafter specified.

C. Depth of Cover: Trenches for utilities shall be of a depth that will provide the following minimum depths of cover from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown.

1. 2 feet - 6 inches minimum cover: Hydronic piping.

D. Excavations for Appurtenances: Excavation for tunnels and similar structures shall be sufficient to level at least 12" in the clear between their outer surfaces and the embankment or timbers which may be used to hold and protect the banks. Any overdepth excavation below such appurtenances shall be considered as unauthorized and shall be filled with sand, gravel, or concrete at the expense of the Contractor.

E. Protection of Existing Utilities: Existing utility lines to be retained that are shown on the drawings or the locations of which are made known to the Contractor prior to excavation, as

well as all utility lines uncovered during excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor at his expense.

F. Blasting will not be permitted.

G. Backfilling of Trenches

1. Trenches shall not be backfilled until all required pressure and other tests have been performed, witnessed by the Engineer, and until the utilities systems as installed confirm to the requirements of the drawings and specifications.
2. Normal Backfill: Where compacted backfill is not specified the trenches shall be carefully backfilled with the materials approved for backfilling (See appropriate section), deposited in 6" layers and thoroughly and carefully rammed until the pipe has a cover of not less than one foot. The remainder of the backfill material shall then be carefully placed in the trench in one foot layers and tamped. Settling the backfill with water will not be permitted. The surface shall be graded to a reasonable uniformity and the mounding over trenches left in a uniform and neat condition.
3. Compacted backfill shall be used under slabs on grade, building structure, concrete paving and asphaltic concrete paving. The soils used in the fill shall be granular in nature and shall not contain roots, sod, rubbish or stones over 1-1/2" maximum dimension.
   a. Required Density
      1) All fills shall be compacted to a dry density equal to at least 90% of the maximum density determined in accordance with the Modified AASHO Method of Compaction. The maximum density and optimum moisture content shall be determined on the basis of laboratory tests conducted on the materials used in the fill.
      2) Modified AASHO Compaction Method provides that soil samples be compacted in 5 equal layers in a standard compaction cylinder having a volume of 1/30 cu. ft. using 25 18" blows of 10 pound rammer to compact each layer.
   b. Control Tests: Adequacy of compaction shall be determined on the basis of in-place density determinations that are to be conducted while the fills are being placed. The results of these tests shall be the basis on which satisfactory completion of the work is judged. Should the fills fail to meet the specified densities, the Contractor shall remove and recompact the soils until the specified densities are achieved.
   c. Equipment: The choice of compaction equipment shall be made by the Contractor; however, the equipment shall be adequate for achieving the specified densities. Use of hand-operated, power-driven compaction equipment may be necessary at locations inaccessible to roller-type equipment.

3.07 PAINTING

A. The Contractor shall remove all rust, oil and grease from exposed surfaces and clean all apparatus or materials specified to be painted under this section of the specifications. Contractor shall paint equipment, piping, etc., in accordance with Division 9. Equipment specified to have factory finishes shall be protected until completion of the Contract, with Contractor being responsible for maintaining finishes.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Interior, Ferrous Piping: Use semi-gloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel Piping: Use semi-gloss, acrylic-enamel finish. Include 2 finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semi-gloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
4. Exterior, Ferrous Piping: Use semi-gloss, acrylic-enamel finish. Include 2 finish coats over rust-inhibitive metal primer.
5. Exterior, Galvanized-Steel Piping: Use semi-gloss, acrylic-enamel finish. Include 2 finish coats over galvanized metal primer.
6. Exterior, Ferrous Supports: Use semi-gloss, acrylic-enamel finish. Include 2 finish coats over rust-inhibitive metal primer.
7. Do not paint piping specialties with factory-applied finish.
8. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
9. Galvanized surfaces damaged during installation shall be repaired with a galvanized repair compound complying with Mil Spec DOD-P-21035B. Any equipment scratched, marred or damaged will be repainted to the original condition.

END OF SECTION

SECTION 22 0516
EXPANSION FITTINGS AND LOOPS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

C. Pipe loops, offsets, and swing joints.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

1.03 REFERENCE STANDARDS

A. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.

B. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard 2020.

C. ASME B16.11 - Forged Fittings, Socket-welding and Threaded 2016 (Errata 2017).

D. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service 2015a (Reapproved 2019).

E. EJMA (STDS) - EJMA Standards Tenth Edition.

F. FM (AG) - FM Approval Guide current edition.

G. ITS (DIR) - Directory of Listed Products current edition.

H. UL (DIR) - Online Certifications Directory Current Edition.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

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. Design Data: Indicate selection calculations.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions, special procedures, and external controls.

E. Maintenance Data: Include adjustment instructions.

F. Project Record Documents: Record installed locations of flexible pipe connectors, expansion joints, anchors, and guides.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Packing for Packed Expansion Joints: One set for each joint.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Comply with UL (DIR) requirements.

2.02 FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Inner Hose: Stainless steel.

B. Exterior Sleeve: Double braided, stainless steel.

C. Pressure Rating: 125 psi and 450 degrees F.

D. Joint: Flanged.

E. Size: Use pipe sized units.

F. Maximum offset: 3/4 inch on each side of installed center line.

2.03 FLEXIBLE PIPE CONNECTORS - COPPER PIPING

A. Inner Hose: Bronze.

B. Exterior Sleeve: Braided bronze.

C. Pressure Rating: 125 psi and 450 degrees F.

D. Joint: Flanged.

E. Size: Use pipe sized units.

F. Maximum offset: 3/4 inch on each side of installed center line.

G. Application: Copper piping.

2.04 EXPANSION JOINTS - TWO-PLY BRONZE BELLOWS TYPE

A. Construction: Bronze with anti-torque device, limit stops, internal guides.

B. Pressure Rating: 125 psi and 400 degrees F.

C. Maximum Compression: 1-3/4 inches.

D. Maximum Extension: 1/4 inch.

E. Joint: Soldered.

F. Size: Use pipe sized units.

G. Application: Copper piping.

2.05 EXPANSION JOINTS - LOW PRESSURE COMPENSATOR WITH TWO-PLY BRONZE BELLOWS

A. Working Pressure: 75 psi.

B. Maximum Temperatures: 250 degrees F.

C. Maximum Compression: 1/2 inch.

D. Maximum Extension: 5/32 inch.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Application: Copper or steel piping 3 inches and under.

2.06 ACCESSORIES

A. Pipe Alignment Guides:

1. 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 inches travel.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with EJMA (Expansion Joint Manufacturers Association) Standards.

C. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

D. 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.

E. Anchor pipe to building structure where indicated. Provide pipe guides so movement is directed along axis of pipe only. Erect piping such that strain and weight is not on cast connections or apparatus.

F. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

END OF SECTION

SECTION 22 0517
SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Manufactured sleeve-seal systems.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 09 9123 - Interior Painting: Preparation and painting of interior piping systems.

C. Section 22 0523 - General-Duty Valves for Plumbing Piping.

D. Section 22 0553 - Identification for Plumbing Piping and Equipment: Piping identification.

E. Section 22 0719 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2016.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Valve Stem Packings: Two for each type and size of valve.

1.05 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 this section.

1. Minimum three years experience.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 - PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping:

1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.
3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Plastic or Sheet Metal: Pipe passing through interior walls, partitions, and floors, unless steel or brass sleeves are specified below.

C. Pipe Passing Through Below Grade Exterior Walls:

1. Zinc coated or cast iron pipe.
2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

D. Pipe Passing Through Mechanical Room Floors above Basement:

1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

E. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.

F. Clearances:

1. Provide allowance for insulated piping.
2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Modular/Mechanical Seal:

1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

PART 3 - EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

3.02 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

E. Structural Considerations:

1. Do not penetrate building structural members unless indicated.

F. Provide sleeves when penetrating footings, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
2. Aboveground Piping:
   a. Pack solid using mineral fiber complying with ASTM C592.
   b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.
3. All Rated Openings: Caulk tight with fire stopping material complying with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.
4. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

G. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.03 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

C. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

END OF SECTION

SECTION 22 0519
METERS AND GAUGES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

C. Static pressure gauges.

1.02 RELATED REQUIREMENTS

A. Section 23 0923 - Direct-Digital Control System for HVAC.

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014 (Reapproved 2020).

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers 2014 (Reapproved 2021).

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements. for additional provisions.

1.05 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 - PRODUCTS

2.01 PRESSURE GAUGES

A. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi and kPa.

2.02 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

2.03 STEM TYPE THERMOMETERS

A. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Accuracy: 2 percent, per ASTM E77.
4. Calibration: Degrees F.

2.04 THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

B. Flange: 3 inch outside diameter reversible flange, designed to fasten to sheet metal air ducts, with brass perforated stem.

2.05 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gauges, one gauge adapters with 1/8 inch probes, two 1 inch dial thermometers.

2.06 STATIC PRESSURE GAUGES

A. 3-1/2 inch diameter dial in metal case, diaphragm actuated, black figures on white background, front recalibration adjustment, 2 percent of full scale accuracy.

B. Inclined manometer, red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.

C. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

C. Coil and conceal excess capillary on remote element instruments.

D. Provide instruments with scale ranges selected according to service with largest appropriate scale.

E. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

F. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

G. Locate test plugs where indicated.

END OF SECTION

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SECTION 22 0523
GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Applications.

B. General requirements.

C. Angle valves.

D. Ball valves.

E. Butterfly valves.

F. Check valves.

G. Gate valves.

H. Globe valves.

I. Plug valves.

1.02 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.

B. Section 22 0553 - Identification for Plumbing Piping and Equipment.

C. Section 22 0719 - Plumbing Piping Insulation.

D. Section 22 1005 - Plumbing Piping.

1.03 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Non-rising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. TFE: Tetrafluoroethylene.

1.04 REFERENCE STANDARDS

A. API STD 594 - Check Valves: Flanged, Lug, Wafer, and Butt-Welding 2022.

B. ASME B1.20.1 - Pipe Threads, General Purpose, Inch 2013 (Reaffirmed 2018).

C. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard 2020.

D. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves 2022.

E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.

F. ASME B16.34 - Valves — Flanged, Threaded, and Welding End 2020.

G. ASME B31.9 - Building Services Piping 2020.

H. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

I. ASTM A48/A48M - Standard Specification for Gray Iron Castings 2022.

J. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).

K. ASTM A395/A395M - Standard Specification for Ferritic Ductile Iron Pressure-Retaining Castings for Use at Elevated Temperatures 1999 (Reapproved 2018).

L. ASTM A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).

M. ASTM B61 - Standard Specification for Steam or Valve Bronze Castings 2015 (Reapproved 2021).

N. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.

O. AWWA C606 - Grooved and Shouldered Joints 2015.

P. MSS SP-45 - Drain and Bypass Connections 2020.

Q. MSS SP-67 - Butterfly Valves 2022.

R. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends 2011.

S. MSS SP-71 - Gray Iron Swing Check Valves, Flanged and Threaded Ends 2018.

T. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.

U. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends 2011.

V. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves 2019.

W. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends 2011.

X. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .

Y. MSS SP-125 - Check Valves: Gray Iron and Ductile Iron, In-Line, Spring-Loaded, Center-Guided 2018.

Z. NSF 61 - Drinking Water System Components - Health Effects 2021.

AA. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on valves including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

D. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

E. Maintenance Materials: Furnish Owner with one wrench for every five plug valves, in each size of square plug valve head.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.
2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
2. Protect valve parts exposed to piped medium against rust and corrosion.
3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
5. Secure check valves in either the closed position or open position.
6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.
   a. Provide temporary inlet and outlet caps.
   b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
   a. Store valves indoors in dry environment.
   b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

1.08 EXERCISE THE FOLLOWING PRECAUTIONS FOR HANDLING:

A. Avoid the use of operating handles or stems as rigging or lifting points.

PART 2 - PRODUCTS

2.01 APPLICATIONS

A. See drawings for specific valve locations.

B. All cast iron or ductile iron valves shall be epoxy coated on the interior surfaces.

C. Provide the following valves for the applications if not indicated on drawings:

1. Shutoff: Ball.
2. Dead-End: Single-flange butterfly (lug) type.
3. Throttling: Provide globe, angle, ball, or butterfly.
4. Swing Check (Pump Outlet):
   a. 2 NPS and Smaller: Bronze swing check valves with bronze disc.

D. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

E. Required Valve End Connections for Non-Wafer Types:

1. Steel Pipe:
   a. 2 NPS and Smaller: Threaded ends.
   b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.
   c. Grooved-End Copper Tubing and Steel Piping: Grooved.
2. Copper Tube:
   a. 2 NPS and Smaller: Threaded ends except where solder-joint valve-end option is indicated in valve schedules below.
   b. 2-1/2 NPS to 4 NPS: Grooved or flanged ends except where threaded valve-end option is indicated in valve schedules below.

F. Domestic, Hot and Cold Water Valves:

1. 2 NPS and Smaller:
   a. Bronze and Brass: Provide with solder-joint or threaded ends.
   b. Bronze Angle: Class 125, bronze disc.
   c. Ball: One piece, full port, brass or bronze with brass trim.
   d. Bronze Swing Check: Class 125, bronze disc.
   e. Bronze Gate: Class 125, NRS.
   f. Bronze Globe: Class 125, bronze disc.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:

1. Hand Lever: Quarter-turn valves 6 NPS and smaller.
2. Wrench: Plug valves with square heads.

D. Valves in Insulated Piping: With 2 NPS stem extensions and the following features:

1. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.

E. Valve-End Connections:

1. Threaded End Valves: ASME B1.20.1.
2. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.

3. Solder Joint Connections: ASME B16.18.
4. Grooved End Connections: AWWA C606.

F. General ASME Compliance:

1. Solder-joint Connections: ASME B16.18.
2. Building Services Piping Valves: ASME B31.9.

G. Valve Materials for Potable Water: NSF 61 and NSF 372.

H. Bronze Valves:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

I. Valve Bypass and Drain Connections: MSS SP-45.

J. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE ANGLE VALVES

A. Class 125: CWP Rating: 200 psig: and [_____].

1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. Ends: Threaded.
4. Stem: Bronze.
5. Disc: Bronze.
6. Packing: Asbestos free.
7. Handwheel: Bronze or aluminum.

2.04 BRASS BALL VALVES

A. One-Piece, Reduced-Port with Brass Trim:

1. Comply with MSS SP-110.
2. CWP Rating: 600 psig.
3. Body: Forged brass.
4. Ends: Threaded.
5. Seats: PTFE or TFE.
6. Stem: Brass.
7. Ball: Chrome-plated brass.

B. Two Piece, Full Port with Brass Trim:

1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Forged brass.
5. Ends: Threaded.
6. Seats: PTFE.

7. Stem: Brass.
8. Ball: Chrome-plated brass.

C. Three Piece, Full Port with Stainless Steel Trim:

1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Forged brass.
5. Ends: Threaded.
6. Seats: PTFE or TFE.
7. Stem: Stainless steel.
8. Ball: Stainless steel, vented.

2.05 BRONZE BALL VALVES

A. One Piece, Reduced Port with Bronze Trim:

1. Comply with MSS SP-110.
2. SWP Rating: 400 psig.
3. CWP Rating: 600 psig.
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE or TFE.
7. Stem: Bronze.
8. Ball: Chrome plated brass.

B. Two Piece, Standard Port with Bronze Trim:

1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE or TFE.
7. Stem: Bronze.
8. Ball: Chrome plated brass.

C. Three Piece, Full Port with Stainless Steel Trim:

1. Comply with MSS SP-110.
2. SWP Rating: 150 psig.
3. CWP Rating: 600 psig.
4. Body: Bronze.
5. Ends: Threaded.
6. Seats: PTFE or TFE
7. Stem: Stainless steel.
8. Ball: Stainless steel, vented.

2.06 IRON BALL VALVES

A. Class 125, Full Port, Stainless Steel Trim:

1. Comply with MSS SP-72.
2. CWP Rating: 200 psig.
3. Body: ASTM A536 Grade 65-45-12, ductile iron.
4. Ends: Flanged.
5. Seats: PTFE, TFE, or Teflon.
6. Stem: Stainless steel.
7. Ball: Stainless steel.
8. Operator: Lever, with locking handle.

2.07 IRON, SINGLE FLANGE BUTTERFLY VALVES

A. Lug type: Bi-directional dead-end service without use of downstream flange.

1. Comply with MSS SP-67, Type I.
2. CWP Rating: 200 psig.
3. Body: ASTM A126, cast iron or ASTM A536, ductile iron.
4. Stem: One or two-piece stainless steel.
5. Seat: EPDM.
6. Disc: Coated ductile iron.

2.08 IRON, GROOVED-END BUTTERFLY VALVES

A. CWP Rating: 175 psig (1200 kPa).

1. Comply with MSS SP-67, Type I.
2. Body: Coated ductile iron.
3. Stem: Two-piece stainless steel.
4. Disc: Coated ductile iron.
5. Disc Seal: EPDM.

2.09 BRONZE LIFT CHECK VALVES

A. Class 125:

1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
2. CWP Rating: 200 psig.
3. Design: Vertical flow.
4. Body: Comply with ASTM B61 or ASTM B62, bronze.
5. Ends: Threaded as indicated.
6. Disc (Type 1): Bronze.

2.10 BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa) and Class 150: CWP Rating: 300 psig (2070 kPa).

1. Comply with MSS SP-80, Type 3.
2. Design: Horizontal flow.
3. Body: Bronze, ASTM B62.
4. Ends: Threaded as indicated.
5. Disc: Bronze.

2.11 IRON SWING CHECK VALVES

A. Class 125:

1. Comply with MSS SP-71, Type I.
2. CWP Rating: 200 psig.
3. Design: Clear or full waterway.
4. Body: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged as indicated.
6. Trim: Composition.
7. Seat Ring and Disc Holder: Bronze.
8. Disc: PTFE or TFE.
9. Gasket: Asbestos free.

B. Class 250:

1. Comply with MSS SP-71, Type I.
2. CWP Rating: 500 psig.
3. Design: Clear or full waterway.
4. Body: ASTM A126, gray iron with bolted bonnet.
5. Ends: Flanged as indicated.
6. Trim: Bronze.
7. Metal Seat.
8. Gasket: Asbestos free.

2.12 IRON SWING CHECK VALVES WITH CLOSURE CONTROL

A. Class 125 with Lever and Spring-Closure Control.

1. Comply with MSS SP-71, Type I.
2. Description:
   a. CWP Rating: 200 psig.
   b. Design: Clear or full waterway.
   c. Body: ASTM A126, gray iron with bolted bonnet.
   d. Ends: Flanged as indicated.
   e. Trim: Bronze.
   f. Gasket: Asbestos free.
   g. Closer Control: Factory installed, exterior lever, and weight.

2.13 IRON GROOVED-END SWING CHECK VALVES

A. 300 CWP:

1. CWP Rating: 300 psig.
2. Body: ASTM A536, Grade 65-45-12 ductile iron.
3. Seal: EPDM or [____].
4. Disc: Ductile iron.
5. Coating: Black, non-lead paint.

2.14 IRON CENTER-GUIDED CHECK VALVES

A. Class 125, Compact-Wafer:

1. Comply with MSS SP-125.
2. CWP Rating: 200 psig.
3. Body: 316 stainless steel.
4. Metal Seat: Stainless steel.

B. Class 125, Globe:

1. Comply with MSS SP-125.
2. CWP Rating: 200 psig.
3. Body: Stainless steel.
4. Style: Spring loaded.
5. Ends: Flanged.
6. Metal Seat: Stainless steel.

C. Class 150, Compact-Wafer:

1. Comply with MSS SP-125.
2. CW P Rating: 300 psig.
3. Body: ASTM A395/A395M or ASTM A536, ductile iron.
4. Body: 316 Stainless steel.

D. Class 150, Globe:

1. Comply with MSS SP-125.
2. CWP Rating: 300 psig.
3. Body: Stainless steel.
4. Style: Spring loaded.
5. Ends: Flanged.
6. Metal Seat: Stainless steel.

E. Class 250, Compact-Wafer:

1. Comply with MSS SP-125.
2. CWP Rating: 400 psig.
3. Body: ASTM A126, gray iron.
4. Style: Spring loaded.
5. Metal Seat: Unleaded bronze.

F. Class 250, Globe:

1. Comply with MSS SP-125.

2. Body Material: ASTM A126, gray iron.
3. Style: Spring loaded.
4. Ends: Flanged.
5. Metal Seat: Unleaded bronze.

G. Class 300, Compact-Wafer:

1. Comply with MSS SP-125.
2. CWP Rating: 500 psig.
3. Body: ASTM A395/A395M or ASTM A536, ductile iron.
4. Style: Spring loaded.
5. Metal Seat: Unleaded bronze.

H. Class 300, Globe:

1. Comply with MSS SP-125.
2. CWP Rating: 500 psig.
3. Body: ASTM A395/A395M or ASTM A536, ductile iron.
4. Style: Spring loaded.
5. Ends: Flanged.
6. Metal Seat: Unleaded bronze.

2.15 IRON PLATE TYPE CHECK VALVES

A. Class 125 Single-Plate:

1. Comply with API STD 594.
2. CWP Rating: 200 psig.
3. Design: Wafer, spring-loaded plate.
4. Body: ASTM A126, gray iron.
5. Resilient Seat: EPDM or NBR.

B. Class 125, Dual-Plate:

1. Comply with API STD 594.
2. CWP Rating: 200 psig.
3. Design: Wafer, spring-loaded plates.
4. Body: ASTM A126, gray iron.
5. Resilient Seat: EPDM or NBR.

C. Class 150, Dual-Plate:

1. Comply with API STD 594.
2. CWP Rating: 300 psig.
3. Design: Wafer, spring-loaded plates.
4. Body: ASTM A395/A395M or ASTM A536, ductile iron.
5. Resilient Seat: EPDM or NBR.

D. Class 250, Single-Plate:

1. Comply with API STD 594.

2. CWP Rating: 400 psig.
3. Design: Wafer, spring-loaded plate.
4. Body: ASTM A126, gray iron.
5. Resilient Seat: EPDM or NBR.

E. Class 250, Dual-Plate:

1. Comply with API STD 594.
2. CWP Rating: 400 psig.
3. Design: Wafer, spring-loaded plates.
4. Body: ASTM A126, gray iron.
5. Resilient Seat: EPDM or NBR.

F. Class 300, Dual-Plate:

1. Comply with API STD 594.
2. CWP Rating: 500 psig.
3. Design: Wafer, spring-loaded plates.
4. Body: ASTM A395/A395M or ASTM A536, ductile iron.
5. Metal Seat: Bronze.

2.16 BRONZE GATE VALVES

A. Rising Stem (RS):

1. Comply with MSS SP-80, Type I.
2. Class 125: CWP Rating: 200 psig: and [_____].
3. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
4. Ends: Threaded or solder joint joint.
5. Stem: Bronze.
6. Disc: Solid wedge; bronze.
7. Packing: Asbestos free.
8. Handwheel: Malleable iron, bronze, or aluminum.

2.17 IRON GATE VALVES

A. OS & Y:

1. Comply with MSS SP-70, Type I.
2. Class 125: CWP Rating: 200 psig: and [_____].
3. Body: ASTM A126, gray iron with bolted bonnet.
4. Ends: Flanged.
5. Trim: Bronze.
6. Disc: Solid wedge.
7. Packing and Gasket: Asbestos free.

2.18 BRONZE GLOBE VALVES

A. Class 125: CWP Rating: 200 psig: and Class 150: CWP Rating: 300 psig:.

1. Comply with MSS SP-80, Type 1.
2. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
3. Ends: Threaded joint.
4. Stem: Bronze.
5. Disc: Bronze, PTFE, or TFE.
6. Packing: Asbestos free.
7. Handwheel: Malleable Iron.

2.19 IRON GLOBE VALVES

A. Class 125: CWP Rating: 200 psig:.

1. Comply with MSS SP-85, Type I.
2. Body: Gray iron; ASTM A126, with bolted bonnet.
3. Ends: Flanged.
4. Trim: Bronze.
5. Packing and Gasket: Asbestos free.
6. Operator: Handwheel or chainwheel.

2.20 LUBRICATED PLUG VALVES

A. Regular Gland with Flanged Ends:

1. Comply with MSS SP-78, Type II.
2. Class 125: CWP Rating: 200 psig.
3. Class 250: CWP Rating: 400 psig.
4. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
5. Pattern: Regular or short.
6. Plug: Cast iron or bronze with sealant groove.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Where valve support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.

D. Install check valves where necessary to maintain direction of flow as follows:

1. Lift Check: Install with stem plumb and vertical.
2. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION

SECTION 22 0529
HANGERS AND SUPPORTS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other plumbing work.

1.02 RELATED REQUIREMENTS

A. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

1.03 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 2016a.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping 2022.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).

F. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.

I. MFMA-4 - Metal Framing Standards Publication 2004.

J. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for metal channel (strut) framing systems and thermal insulated pipe supports.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

1. Application of protective inserts, saddles, and shields at pipe hangers for each type of insulation and hanger.

D. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.

E. Installer's Qualifications: Include evidence of compliance with specified requirements.

F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Installer Qualifications for Field-Welding: As specified in Section 05 5000.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Comply with MSS SP-58.
2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.

a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
b. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
c. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Materials for Metal Fabricated Supports: Comply with Section 05 5000.

C. Metal Channel (Strut) Framing Systems:

1. Manufacturers:
   a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Provide factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.
3. Comply with MFMA-4.
4. Channel Material:
   a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
5. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
6. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.

D. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Piping up to 1 inch (27 mm) nominal: 1/4 inch diameter.
   c. Piping larger than 1 inch (27 mm) nominal: 3/8 inch diameter.
   d. Trapeze Support for Multiple Pipes: 3/8 inch diameter.

E. Thermal Insulated Pipe Supports:

1. General Construction and Requirements:
   a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
   b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
   c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
   d. Insulation inserts to consist of rigid phenolic foam insulation surrounded by a 360 degree, PVC jacketing.
2. PVC Jacket:
   a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
   b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
   c. Thickness: 60 mil.

3. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

F. Pipe Supports:

1. Manufacturers:
   a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Liquid Temperatures Up To 122 degrees F:
   a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
   b. Support From Below: MSS SP-58 Types 35 through 38.
3. Operating Temperatures from 122 to 446 degrees F:
   a. Overhead Support: MSS SP-58 Type 1 or 3 through 12, with appropriate saddle of MSS SP-58 Type 40 for insulated pipe.

G. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.

1. Manufacturers:
   a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
3. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

H. Riser Clamps:

1. Manufacturers:
   a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Provide copper plated clamps for copper tubing support.
3. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

I. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

1. Manufacturers:
   a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

J. Strut Clamps: Two-piece pipe clamp.

1. Manufacturers:
   a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

K. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.

1. Manufacturers:
   a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

L. Pipe Hangers: For a given pipe run, use hangers of the same type and material.

1. Manufacturers:
   a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
3. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

M. Intermediate Pipe Guides: Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.

1. Manufacturers:
   a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Pipe Diameter 6 inches and Smaller: Provide minimum clearance of 0.16 inch.

N. Pipe Alignment Guides: Galvanized steel.

1. Manufacturers:
   a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Pipe Diameter 8 inches and Smaller: Spider or sleeve type.

O. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

1. Manufacturers:
   a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

P. Pipe Shields for Insulated Piping:

1. Manufacturers:
   a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. General Construction and Requirements:
   a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
   b. Shields Material: UV-resistant polypropylene with glass fill.
   c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
   d. Minimum Service Temperature: Minus 40 degrees F.
   e. Maximum Service Temperature: 178 degrees F.
   f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

Q. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Hollow Masonry: Use toggle bolts.
4. Hollow Stud Walls: Use toggle bolts.
5. Steel: Use beam clamps, machine bolts, or welded threaded studs.
6. Sheet Metal: Use sheet metal screws.
7. Plastic and lead anchors are not permitted.
8. Hammer-driven anchors and fasteners are not permitted.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

C. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

D. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

E. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

F. Secure fasteners according to manufacturer's recommended torque settings.

G. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 22 0548

VIBRATION AND SEISMIC CONTROLS FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Seismic control requirements.

1. Includes requirements for seismic qualification of equipment not specified in this section.

C. Vibration-isolated equipment support bases.

D. Vibration isolators.

E. External seismic snubber assemblies.

F. Seismic restraint systems.

1.02 RELATED REQUIREMENTS

A. Section 01 4533 - Code-Required Special Inspections and Procedures.

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 21 0548 - Vibration and Seismic Controls for Fire Suppression Piping and Equipment.

D. Section 22 0529 - Hangers and Supports for Plumbing Piping and Equipment.

E. Section 23 0548 - Vibration and Seismic Controls for HVAC.

1.03 DEFINITIONS

A. Plumbing Component: Where referenced in this section in regards to seismic controls, applies to any portion of the plumbing system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., piping).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASCE 19 - Structural Applications of Steel Cables for Buildings 2016.

C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

D. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment 2014.

E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment 2004.

F. FEMA 414 - Installing Seismic Restraints for Duct and Pipe 2004.

G. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage 2012.

H. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components 2010, with Editorial Revision (2015).

I. MFMA-4 - Metal Framing Standards Publication 2004.

J. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Seismic Controls:
    a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
    b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.

1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
2. Seismic Controls: Include seismic load capacities.

D. Shop Drawings - Vibration Isolation Systems:

1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

E. Shop Drawings - Seismic Controls:

1. Include dimensioned plan views and sections indicating proposed plumbing component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
2. Identify mounting conditions required for equipment seismic qualification.
3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
4. Indicate proposed arrangement of distributed system trapeze support groupings.
5. Indicate proposed locations for distributed system flexible fittings and/or connections.
6. Indicate locations of seismic separations where applicable.

F. Seismic Design Data:

1. Compile information on project-specific characteristics of actual installed plumbing components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
   a. Component operating weight and center of gravity.
   b. Component elevation in the building in relation to the roof elevation (z/h).
   c. Component importance factor (Ip).
   d. For distributed systems, component materials and connection methods.

e. Component amplification factor (ap) and component response modification factor (Rp), determined in accordance with ASCE 7 tables.
f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).

2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

G. Certification for seismically qualified equipment; identify basis for certification.

H. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

I. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

J. Evidence of qualifications for seismic controls designer.

K. Evidence of qualifications for manufacturer.

L. Manufacturer’s detailed field testing and inspection procedures.

M. Field quality control test reports.

1.07 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.

1. Designer may be employed by the manufacturer of the seismic restraint products.

D. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing plumbing equipment and/or plumbing connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:

1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

D. Piping Isolation:

1. Provide vibration isolators for piping supports:
   a. Located in equipment rooms.
   b. Located within 50 feet of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
   c. For piping over 2 inch located below or within 50 feet of noise-sensitive areas indicated.
2. Minimum Static Deflection:
   a. First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
   b. Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
3. Suspended Piping, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
4. Suspended Piping, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
5. Floor-Mounted Piping, Nonseismic Applications: Use open (unhoused) spring isolators.
6. Floor-Mounted Piping, Seismic Applications: Use seismic type restrained spring isolators.

7. Use modular seal or approved resilient material where vibration-isolated piping penetrates building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

2.02 SEISMIC CONTROL REQUIREMENTS

A. Design and provide plumbing component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor plumbing components.

B. Seismic Design Criteria: As indicated on drawings.

C. Component Importance Factor (Ip): Plumbing components essential to life safety to be assigned a component importance factor (Ip) of 1.5 as indicated or as required. This includes but is not limited to:

1. Plumbing components required to function for life safety purposes after an earthquake.
2. Plumbing components that support or otherwise contain hazardous substances.

D. Seismic Qualification of Equipment:

1. Provide special certification for plumbing equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
3. Notify Architect and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

E. Seismic Restraints:

1. Provide seismic restraints for plumbing components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
2. Seismic Restraint Exemptions:
    a. Exemptions for Seismic Design Category D, E, and F:
        1) Discrete plumbing components that are positively attached to the structure where either of the following apply:
            (a) The component weighs 400 pounds or less, has a center of mass located 4 feet or less above the adjacent floor level, flexible connections are provided

between the component and associated ductwork, piping, and conduit, and the component importance factor (Ip) is 1.0.

(b) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.

2) Plumbing piping with component importance factor (Ip) of 1.0 and nominal pipe size of 3 inch or less, or with component importance factor (Ip) of 1.5 and nominal pipe size of 1 inch or less, where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, and where piping is positively attached to the structure; exemption does not apply to piping constructed of low-deformability materials (e.g., cast iron, glass, nonductile plastics).

b. Plumbing Piping Exemptions, All Seismic Design Categories:

1) Plumbing piping where flexible connections, expansion loops, or other assemblies are provided between piping and associated components, where piping is positively attached to the structure, and where one of the following apply:

(a) Trapeze supported piping weighing less than 10 pounds per foot, where all pipes supported meet size requirements for exemption as single pipes described under specific seismic design category exemptions above.

(b) Trapeze supported piping with trapeze assemblies using 3/8 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (Ip) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 100 pounds or less.

(c) Trapeze supported piping with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 12 inches in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (Ip) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 200 pounds or less.

(d) Trapeze supported piping with trapeze assemblies using 1/2 inch diameter rod hangers not exceeding 24 inches in length from support point connection to the supporting structure, where all pipes supported have a component importance factor (Ip) of 1.0 and meet size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single trapeze is 100 pounds or less.

(e) Hanger supported piping with individual rod hangers 3/8 inch or 1/2 inch in diameter not exceeding 12 inches in length from support point connection

to the supporting structure, where pipe has a component importance factor (Ip) of 1.0 and meets size requirements for exemption as single pipes described under specific seismic design category exemptions above, and where the total weight supported by any single rod is 50 pounds or less.

3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
   a. ASHRAE (HVACA).
   b. FEMA 412.
   c. FEMA 413.
   d. FEMA 414.
   e. FEMA E-74.
   f. SMACNA (SRM).
4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
5. Seismic Type Vibration Isolators:
   a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
6. External Seismic Snubber Assemblies:
   a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
   b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
7. Seismic Restraint Systems:
   a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
   b. Use only cable restraints to restrain vibration-isolated plumbing components, including distributed systems.
   c. Use only one restraint system type for a given plumbing component or distributed system (e.g., piping) run; mixing of cable and rigid restraints on a given component/run is not permitted.
   d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain plumbing component in all lateral directions; consider bracket geometry in anchor load calculations.
   e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported plumbing component weight.
   f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported plumbing component weight.

g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
j. Manufacturer's certified seismic restraint design may be submitted as an alternative to project-specific design and documentation, subject to approval of authorities having jurisdiction.

F. Seismic Attachments:

1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
3. Do not use power-actuated fasteners.
4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
6. Concrete Housekeeping Pads:
   a. Increase size of pad as required to comply with anchor requirements.
   b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

G. Seismic Interactions:

1. Include provisions to prevent seismic impact between plumbing components and other structural or nonstructural components.
2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.

H. Seismic Relative Displacement Provisions:

1. Use suitable fittings or flexible connections to accommodate:
   a. Relative displacements at connections between components, including distributed systems (e.g., piping); do not exceed load limits for equipment utility connections.
   b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
   c. Design displacements at seismic separations.

d. Anticipated drifts between floors.

2.03 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:

1. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

2.04 VIBRATION ISOLATORS

A. Manufacturers:

1. Source Limitations: Furnish vibration-isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
   a. Color code or otherwise identify springs to indicate load capacity.
   b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
   c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
   d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
   e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
   f. Selected to function without undue stress or overloading.
3. Seismic Snubbing Elements for Seismic Isolators:
   a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
   b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

C. Vibration Isolators for Nonseismic Applications:

1. Resilient Material Isolator Pads:
   a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) isolator material.
   b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
   c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
2. Resilient Material Isolator Mounts, Nonseismic:
   a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; fail-safe type.
3. Open (Unhoused) Spring Isolators:

a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
c. Furnished with integral leveling device for positioning and securing supported equipment.

4. Housed Spring Isolators:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
   b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
   c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
   d. Furnished with integral leveling device for positioning and securing supported equipment.
5. Restrained Spring Isolators, Nonseismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
   b. Bottom Load Plate: Steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
   d. Provides constant free and operating height.
6. Resilient Material Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection.
7. Spring Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
8. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.

b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

D. Vibration Isolators for Seismic Applications:

1. Resilient Material Isolator Mounts, Seismic:
   a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
2. Restrained Spring Isolators, Seismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
   b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
   d. Provides constant free and operating height.
3. Resilient Material Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
4. Spring Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
5. Combination Resilient Material/Spring Isolator Hangers, Seismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
   b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.05 ACOUSTICAL AND VIBRATION ISOLATORS

A. Manufacturers:

1. Source Limitations: Furnish isolators and associated accessories produced by a single manufacturer and obtained from a single supplier.

B. General Requirements:

1. Acoustical Isolation System: Through-stud isolators, pipe clamps, riser clamp pads, neoprene and felt lining material and associated support brackets.

2.06 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Manufacturers:

1. Source Limitations: Furnish external seismic snubber assemblies and associated accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.

C. Seismic Snubbing Elements:

1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.07 SEISMIC RESTRAINT SYSTEMS

A. Manufacturers:

1. Source Limitations: Furnish seismic restraint system components and accessories produced by a single manufacturer and obtained from a single supplier.

B. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

C. Cable Restraints:

1. Comply with ASCE 19.
2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
4. Use protective thimbles for cable loops where potential for cable damage exists.

D. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

PART 3 EXECUTION

3.01 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 4533 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.

1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Seismic special inspections include, but are not limited to:

1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with the certificate of compliance.
2. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units for Seismic Design Categories C, D, E, and F; periodic inspection.
3. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where the approved Contract Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.

D. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

E. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:

1. Vibration-Isolated Equipment Support Bases:
    a. Provide specified minimum clearance beneath base.
2. Spring Isolators:
    a. Position equipment at operating height; provide temporary blocking as required.
    b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
    c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
3. Isolator Hangers:
    a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
    b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
6. Adjust isolators to be free of isolation short circuits during normal operation.
7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

F. Seismic Controls:

1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
4. Equipment with Sheet Metal Housings:

a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.

5. Concrete Housekeeping Pads:
   a. Size in accordance with seismic design to meet anchor requirements.
   b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.
6. Seismic Restraint Systems:
   a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
   b. Install restraints within permissible angles in accordance with seismic design.
   c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
   d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
   e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Vibration Isolation Systems:

1. Verify isolator static deflections.
2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Seismic Controls:

1. Verify snubbing element air gaps.

E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION

SECTION 22 0553
IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

E. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems 2020.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.

C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

D. Product Data: Provide manufacturers catalog literature for each product required.

E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.

F. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Piping: Tags.

B. Small-sized Equipment: Tags.

C. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.

B. Stencil Paint: As specified in Section 09 9123, semi-gloss enamel, colors complying with ASME A13.1.

2.05 PIPE MARKERS

A. Comply with ASME A13.1.

B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Color code as follows:

1. Potable, Water: Green with white letters.

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:

1. Plumbing Valves: Green.

PART 3 - EXECUTION

3.01 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 9123 for stencil painting.

3.02 INSTALLATION

A. Install plastic nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 9123.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Use tags on piping 3/4 inch diameter and smaller.

1. Identify service, flow direction, and pressure.
2. Install in clear view and align with axis of piping.
3. Locate identification not to exceed 20 feet on straight runs including risers and drops, adjacent to each valve and Tee, at each side of penetration of structure or enclosure, and at each obstruction.

G. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

SECTION 22 0719
PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 09 9123 - Interior Painting: Painting insulation jacket.

C. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.03 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus 2019.

B. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement 2007 (Reapproved 2019).

C. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement 2007 (Reapproved 2019).

D. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.

E. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022.

F. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

H. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Samples: Submit two samples of any representative size illustrating each insulation type.

D. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum [_____] years of experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER

A. Manufacturers:

1. Johns Manville Corporation; Micro-Lok: www.jm.com/#sle.
2. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com/#sle.
3. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.

1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.

1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 650 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

D. Vapor Barrier Jacket: White Kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

E. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

F. Vapor Barrier Lap Adhesive: Compatible with insulation.

G. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

H. Fibrous Glass Fabric:

1. Cloth: Untreated; 9 oz/sq yd weight.
2. Blanket: 1.0 lb/cu ft density.
3. Weave: 5 by 5.

I. Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz/sq yd weight.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

J. Insulating Cement: ASTM C449.

2.03 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:

1. Aeroflex USA, Inc; Aerocel Stay-Seal with Protape (SSPT): www.aeroflexusa.com/#sle.
2. Armacell LLC; AP Armaflex: www.armacell.us/#sle.
3. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 220 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.04 JACKETS

A. PVC Plastic.

1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
   a. Minimum Service Temperature: 0 degrees F.
   b. Maximum Service Temperature: 150 degrees F.
   c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
   d. Thickness: 10 mil.
   e. Connections: Brush on welding adhesive.
2. Covering Adhesive Mastic: Compatible with insulation.

B. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations.

D. Insulated pipes conveying fluids below ambient temperature: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.

E. Install cellular melamine with factory-applied jackets with a manufacturer-approved adhesive along seams, both straight lap joints and circumferential lap joints.

1. Install seal over seams with factory-approved room temperature vulcanization (RTV) silicone sealant to ensure a positive vapor barrier seal in outdoor and sanitary washdown environments.

F. Glass fiber insulated pipes conveying fluids below ambient temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.
2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

G. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.

H. Glass fiber insulated pipes conveying fluids above ambient temperature:

1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
2. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.

I. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.
2. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
3. Insert Location: Between support shield and piping and under the finish jacket.
4. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
5. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.

J. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 8400.

K. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with PVC jacket and fitting covers.

3.03 SCHEDULES

A. Plumbing Systems:

1. Domestic Cold Water
    a. Glass Fiber Insulation:
        1) Pipe Size Range: All Sizes.
        2) Thickness: 1/2 inch.
2. Domestic Hot Water Supply and Hot Water Recirculation:
    a. Glass Fiber Insulation:
        1) Pipe Size Range: NPS 2" and Smaller
            (a) Thickness: 1 inch
        2) Pipe Size Range: NPS 2-1/2" and Larger
            (a) Thickness: 1-1/2"

END OF SECTION

SECTION 22 1005
PLUMBING PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.

1. Sanitary sewer.
2. Domestic water.
3. Flanges, unions, and couplings.
4. Pipe hangers and supports.
5. Manufactured sleeve-seal systems.
6. Valves.
7. Flow controls.
8. Relief valves.
9. Strainers.

1.02 RELATED REQUIREMENTS

A. Section 09 9113 - Exterior Painting.

B. Section 09 9123 - Interior Painting.

C. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.

D. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

E. Section 22 0553 - Identification for Plumbing Piping and Equipment.

F. Section 22 0719 - Plumbing Piping Insulation.

G. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

H. Section 33 0110.58 - Disinfection of Water Utility Piping Systems.

1.03 REFERENCE STANDARDS

A. ANSI Z21.22 - American National Standard for Relief Valves for Hot Water Supply Systems 2015 (Reaffirmed 2020).

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

E. ASME B31.1 - Power Piping 2020.

F. ASME B31.9 - Building Services Piping 2020.

G. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers 2021.

H. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

I. ASSE 1003 - Performance Requirements for Water Pressure Reducing Valves for Potable Water Distribution Systems 2020.

J. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).

K. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

L. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings 2021.

M. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products 2017.

N. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.

O. ASTM B32 - Standard Specification for Solder Metal 2020.

P. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes 2020.

Q. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.

R. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.

S. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.

T. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.

U. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings 2020a.

V. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems 2020.

W. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings 2020.

X. ASTM D2855 - Standard Practice for the Two-Step (Primer and Solvent Cement) Method of Joining Poly (Vinyl Chloride) (PVC) or Chlorinated Poly (Vinyl Chloride) (CPVC) Pipe and Piping Components with Tapered Sockets 2020.

Y. ASTM D3034 - Standard Specification for Type PSM Poly(Vinyl Chloride) (PVC) Sewer Pipe and Fittings 2021.

Z. AWWA C550 - Protective Interior Coatings for Valves and Hydrants 2017.

AA. AWWA C606 - Grooved and Shouldered Joints 2015.

BB. AWWA C651 - Disinfecting Water Mains 2014, with Addendum (2020).

CC. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.

DD. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

EE. MSS SP-67 - Butterfly Valves 2022.

FF. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .

GG. NSF 61 - Drinking Water System Components - Health Effects 2021.

HH. NSF 372 - Drinking Water System Components - Lead Content 2022.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.

D. Project Record Documents: Record actual locations of valves.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.02 SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 service weight.

1. Fittings: Cast iron.
2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

B. PVC Pipe: ASTM D2665 or ASTM D3034.

1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.03 SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: ASTM A74, service weight.

1. Fittings: Cast iron.
2. Joint Seals: CISPI HSN compression type with ASTM C564 neoprene gaskets, or lead and oakum.

B. PVC Pipe: ASTM D2665.

1. Fittings: PVC.
2. Joints: Solvent welded, with ASTM D2564 solvent cement.

2.04 DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, hard drawn, Type K.

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22 wrought copper and bronze.
2. Joints: ASTM B32, brazed.

2.05 DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B).

1. Fittings: ASME B16.18, cast copper alloy or ASME B16.22, wrought copper and bronze.
2. Joints: ASTM B32, alloy Sn95 solder.
3. Mechanical Press Sealed Fittings: Double-pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic, synthetic rubber sealing elements.

2.06 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.

2. Joints: Threaded or welded to ASME B31.1.

2.07 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Ferrous Pipe: Class 150 malleable iron threaded unions.
2. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Size Over 1 Inch:

1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.
2. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.

1. Dimensions and Testing: In accordance with AWWA C606.
2. Housing Material: Provide ASTM A47/A47M malleable iron or ductile iron, galvanized.
3. Gasket Material: EPDM suitable for operating temperature range from minus 30 degrees F to 230 degrees F.
4. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
5. When pipe is field grooved, provide coupling manufacturer's grooving tools.

D. No-Hub Couplings:

1. Gasket Material: Neoprene complying with ASTM C564.
2. Band Material: Stainless steel.
3. Eyelet Material: Stainless steel.

E. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.08 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.
4. Vertical Pipe Support: Steel riser clamp.
5. Rooftop Supports for Low-Slope Roofs: Steel pedestals with bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified; and as follows:
   a. Bases: High-density polypropylene.

b. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
c. Steel Components: Stainless steel or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.
d. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion-resistant material.
e. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

B. Plumbing Piping - Drain, Waste, and Vent:

1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
2. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
4. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:

1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Malleable iron, adjustable swivel, split ring.
2. Hangers for Cold Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.
3. Hangers for Hot Pipe Sizes 2 Inches to 4 Inches: Carbon steel, adjustable, clevis.
4. Wall Support for Pipe Sizes to 3 Inches: Cast iron hook.
5. Wall Support for Pipe Sizes 4 Inches and Over: Welded steel bracket and wrought steel clamp.
6. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.
7. Floor Support for Hot Pipe Sizes to 4 Inches: Cast iron adjustable pipe saddle, locknut, nipple, floor flange, and concrete pier or steel support.
8. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

D. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
3. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.
4. Other Types: As required.

2.09 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Modular/Mechanical Seal:

1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.

4. Glass reinforced plastic pressure end plates.

2.10 BALL VALVES

A. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, threaded or grooved ends with union.

2.11 BUTTERFLY VALVES

A. Construction 1-1/2 Inches and Larger: MSS SP-67, 200 psi CWP, cast or ductile iron body, nickel-plated ductile iron disc, resilient replaceable EPDM seat, wafer ends, extended neck, 10 position lever handle.

2.12 PIPING SPECIALTIES

A. Flow Controls:

1. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
2. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

2.13 WATER PRESSURE REDUCING VALVES

A. Over 2 Inches:

1. ASSE 1003, cast iron body with interior lining complying with AWWA C550, bronze fitted, elastomeric diaphragm and seat disc, flanged.

2.14 RELIEF VALVES

A. Temperature and Pressure:

1. ANSI Z21.22, AGA certified, bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, temperature relief maximum 210 degrees F, capacity ASME BPVC-IV certified and labelled.

2.15 STRAINERS

A. Size 2 Inches and Under:

1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

B. Size 1-1/2 inch to 4 inches:

1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

1. Refer to Section 22 0719.

H. Provide access where valves and fittings are not exposed.

I. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

J. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc-rich primer to welding.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories for finish painting.

L. Install bell and spigot pipe with bell end upstream.

M. Install valves with stems upright or horizontal, not inverted. Refer to Section 22 0523.

N. Install water piping to ASME B31.9.

O. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813; in potable water systems use flux also complying with NSF 61 and NSF 372.

P. PVC Pipe: Make solvent-welded joints in accordance with ASTM D2855.

Q. Sleeve pipes passing through partitions, walls, and floors.

R. Inserts:

1. Provide inserts for placement in concrete formwork.

S. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
7. Provide copper plated hangers and supports for copper piping.
8. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
9. Provide hangers adjacent to motor-driven equipment with vibration isolation; refer to Section 22 0548.
10. Support cast iron drainage piping at every joint.

T. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a watertight seal.
6. Install in accordance with manufacturer's recommendations.

U. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install globe valves for throttling, bypass, or manual flow control services.

E. Provide flow controls in water recirculating systems where indicated.

3.05 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/4 inch per foot slope.

3.06 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Disinfect water distribution system in accordance with Section 33 0110.58.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.07 SERVICE CONNECTIONS

A. Provide new sanitary sewer services. Before commencing work, check invert elevations required for sewer connections, confirm inverts and ensure that these can be properly connected with slope for drainage and cover to avoid freezing.

B. Provide new water service complete with approved reduced pressure backflow preventer and water meter with by-pass valves, pressure reducing valve.

3.08 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:
   a. Pipe Size: 1/2 inches to 1-1/4 inches:
      1) Maximum Hanger Spacing: 6.5 ft.
      2) Hanger Rod Diameter: 3/8 inches.
   b. Pipe Size: 1-1/2 inches to 2 inches:
      1) Maximum Hanger Spacing: 10 ft.
      2) Hanger Rod Diameter: 3/8 inch.
   c. Pipe Size: 2-1/2 inches to 3 inches:
      1) Maximum Hanger Spacing: 10 ft.
      2) Hanger Rod Diameter: 1/2 inch.
2. Plastic Piping:
   a. All Sizes:
      1) Maximum Hanger Spacing: 6 ft.
      2) Hanger Rod Diameter: 3/8 inch.

END OF SECTION

SECTION 22 1006
PLUMBING PIPING SPECIALTIES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Refrigerator valve and recessed box.

B. Backflow preventers.

C. Double check valve assemblies.

D. Water hammer arrestors.

E. Mixing valves.

1.02 RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

B. Section 22 3000 - Plumbing Equipment.

C. Section 22 4000 - Plumbing Fixtures.

D. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

A. NSF 61 - Drinking Water System Components - Health Effects 2021.

B. NSF 372 - Drinking Water System Components - Lead Content 2022.

C. PDI-WH 201 - Water Hammer Arresters 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

C. Shop Drawings: Indicate dimensions, weights, and placement of openings and holes.

D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

E. Manufacturer's Qualification Statement.

F. Operation Data: Indicate frequency of treatment required for interceptors.

G. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

H. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, water hammer arrestors.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.02 REFRIGERATOR VALVE AND RECESSED BOX

2.03 WATER HAMMER ARRESTORS

A. Water Hammer Arrestors:

1. Stainless steel construction, bellows type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range minus 100 to 300 degrees F and maximum 250 psi working pressure.

2.04 MIXING VALVES

A. Thermostatic Mixing Valves:

1. Valve: Chrome plated cast brass body, stainless steel or copper alloy bellows, integral temperature adjustment.
2. Accessories:
   a. Check valve on inlets.
   b. Volume control shut-off valve on outlet.
   c. Stem thermometer on outlet.
   d. Strainer stop checks on inlets.
3. Cabinet: 16 gage, 0.0598 inch prime coated steel, for recessed mounting with keyed lock.

2.05 RELIEF VALVES

A. Bronze body, teflon seat, stainless steel stem and springs, automatic, direct pressure actuated, capacities ASME certified and labelled.

2.06 AIR VENTS

A. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.

B. Float Type:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.

C. Washer Type:

1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

C. Encase exterior cleanouts in concrete flush with grade.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, janitor rooms, fire sprinkler systems, premise isolation, irrigation systems, flush valves, interior and exterior hose bibbs.

F. Pipe relief from backflow preventer to nearest drain.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to fixture..

END OF SECTION

SECTION 22 4000
PLUMBING FIXTURES

PART 1 - GENERAL

1.01 RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Owner-furnished fixtures.

B. Section 07 9200 - Joint Sealants: Sealing joints between fixtures and walls and floors.

C. Section 22 1005 - Plumbing Piping.

D. Section 22 1006 - Plumbing Piping Specialties.

E. Section 22 3000 - Plumbing Equipment.

F. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.02 REFERENCE STANDARDS

A. NSF 61 - Drinking Water System Components - Health Effects 2021.

B. NSF 372 - Drinking Water System Components - Lead Content 2022.

C. UL (DIR) - Online Certifications Directory Current Edition.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

C. Manufacturer's Instructions: Indicate installation methods and procedures.

D. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

E. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for electric water cooler.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Potable Water Systems: Provide plumbing fittings and faucets that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

B. Refer to plumbing schedules on drawings for fixture requirements.

2.02 REGULATORY REQUIREMENTS

A. Comply with applicable codes for installation of plumbing systems.

B. Comply with UL (DIR) requirements.

C. Perform work in accordance with local health department regulations.

D. Provide certificate of compliance from Authority Having Jurisdiction indicating approval of installation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.02 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.03 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Solidly attach water closets to floor with lag screws. Lead flashing is not intended hold fixture in place.

3.04 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.05 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.06 CLEANING

A. Clean plumbing fixtures and equipment.

B. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

3.07 PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Do not permit use of fixtures by construction personnel.

C. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 23 0000
SUPPLEMENTARY HVAC GENERAL CONDITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes supplementary general requirements for the following :

1. Codes and Standards
2. Conflicting Requirements
3. Specifications and Drawing Conventions
4. Fees, Permits, and Inspection
5. Submittals
6. Closeout Submittals
7. Quality Assurance
8. Product Delivery, Storage, and Handling
9. Product Warranties
10. Product Selection Procedures
11. Delegated Design
12. Coordination Drawings
13. Emergency, Operation, and Maintenance Manuals
14. Record Drawings
15. Construction Waste
16. General Coordination for HVAC Work
17. Cutting and Patching
18. Excavation and Trenching
19. Painting

1.03 DEFINITIONS

A. "Action Submittals": Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

B. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the

Conditions of the Contract.

C. "Basis-of-Design Product": A product in which a specific manufacturer's product is named on the drawings or is accompanied by the words "basis-of-design product" in the specifications, including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

D. "Construction Waste": Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

E. "Cutting": Removal of in-place construction necessary to permit installation or performance of other work.

F. "Directed": A command or instruction by Architect. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

G. "Disposal": Removal off-site of construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

H. "File Transfer Protocol (FTP)": Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.

I. "Furnish": To supply, deliver, unload, and inspect for damage.

J. "General": Basic Contract definitions are included in the Conditions of the Contract.

K. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

L. "Informational Submittals": Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

M. "Install": To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.

N. "Patching": Fitting and repair work required to restore construction to original conditions after installation of other work.

O. "Portable Document Format (PDF)": An open standard file format licensed by Adobe Systems used for representing documents in a device-independent and display resolution-independent fixed-layout document format.

P. "Product": Material, machinery, components, equipment, fixtures,and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Product may be new, never before used, or re-used materials or equipment.

Q. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

R. "Provide": Furnish and install, complete and ready for the intended use.

S. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

T. "Salvage": Recovery of construction waste and subsequent sale or reuse in another facility.

U. "Salvage and Reuse": Recovery of construction waste and subsequent incorporation into the Work.

V. "System": An organized collection of parts, equipment, or subsystems united by regular interaction.

W. "Subsystem": A portion of a system with characteristics similar to a system.

1.04 ABBREVIATIONS AND ACRONYMS

A. Industry Organizations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

AABC	Associated Air Balance Council	(202) 737-0202
	www.aabchq.com	
AHRI	Air Conditioning, Heating, and Refrigeration Institute	(703) 524-8800
	www.ahrinet.org	
AIA	American Institute of Architects (The)	(800) 242-3837
	www.aia.org	(202) 626-7300
AMCA	Air Movement and Control Association International, Inc.	(847) 394-0150
	www.amca.org	
ANSI	American National Standards Institute	(202) 293-8020
	www.ansi.org	
ARI	Air-Conditioning & Refrigeration Institute	(703) 524-8800
	www.ari.org	
ASCE	American Society of Civil Engineers	(800) 548-2723
	www.asce.org	(703) 295-6300
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers	(800) 527-4723
	www.ashrae.org	(404) 636-8400
ASME	ASME International	(800) 843-2763
	(American Society of Mechanical Engineers International)	(973) 882-1170
	www.asme.org	

ASTM	ASTM International	(610) 832-9500
	(American Society for Testing and Materials International)	
	www.astm.org	
AWS	American Welding Society	(800) 443-9353
	www.aws.org	(305) 443-9353
CGA	Compressed Gas Association	(703) 788-2700
	www.cganet.com	
CIMA	Cellulose Insulation Manufacturers Association	(888) 881-2462
	www.cellulose.org	(937) 222-2462
CSI	Construction Specifications Institute (The)	(800) 689-2900
	www.csinet.org	(703) 684-0300
EJMA	Expansion Joint Manufacturers Association, Inc.	(914) 332-0040
	www.ejma.org	
HI	Hydronics Institute	(908) 464-8200
	www.gamanet.org	
HI/GAMA	Hydronics Institute/Gas Appliance Manufacturers Association	(908) 464-8200
	Division of Air-Conditioning, Heating, and Refrigeration Institute (AHRI)	
	www.ahrinet.org	
IGMA	Insulating Glass Manufacturers Alliance	(613) 233-1510
	www.igmaonline.org	
ISA	Instrumentation, Systems, and Automation Society, The	(919) 549-8411
	www.isa.org	
ISO	International Organization for Standardization	41 22 749 01 11
	www.iso.ch	
MSS	Manufacturers Standardization Society of The Valve and Fittings Industry Inc.	(703) 281-6613
	www.mss-hq.com	

NADCA	National Air Duct Cleaners Association	(202) 737-2926
	www.nadca.com	
NEBB	National Environmental Balancing Bureau	(301) 977-3698
	www.nebb.org	
NEMA	National Electrical Manufacturers Association	(703) 841-3200
	www.nema.org	
NFPA	NFPA	(800) 344-3555
	(National Fire Protection Association)	(617) 770-3000
	www.nfpa.org	
SMACNA	Sheet Metal and Air Conditioning Contractors' National Association	(703) 803-2980
	www.smacna.org	
UL	Underwriters Laboratories Inc.	(877) 854-3577
	www.ul.com	(847) 272-8800

B. Code Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ICC	International Code Council	(888) 422-7233
	www.iccsafe.org	

C. Federal Government Agencies: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the entities in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

DOE	Department of Energy	(202) 586-9220
	www.energy.gov	

EPA	Environmental Protection Agency	(202) 272-0167
	www.epa.gov	
FCC	Federal Communications Commission	(888) 225-5322
	www.fcc.gov	
OSHA	Occupational Safety & Health Administration	(800) 321-6742
	www.osha.gov	(202) 693-1999
PHS	Office of Public Health and Science	(202) 690-7694
	http://www.hhs.gov/ophs/	

USP	U.S. Pharmacopeia	(800) 227-8772
	www.usp.org	

USPS	Postal Service	(202) 268-2000
	www.usps.com	

D. Standards and Regulations: Where abbreviations and acronyms are used in Specifications or other Contract Documents, they shall mean the recognized name of the standards and regulations in the following list. Names, telephone numbers, and Web sites are subject to change and are believed to be accurate and up-to-date as of the date of the Contract Documents.

ADAAG	Americans with Disabilities Act (ADA)	(800) 872-2253

1.05 CODES AND STANDARDS

A. All materials and workmanship shall comply with all applicable codes, specifications, local ordinances, industry standards and utility company regulations. Where specific code requirements apply, they shall be included in the job, whether or not specifically shown or elsewhere specified.

B. Applicable codes and standards shall include all state laws, local ordinances, utility company regulations, and the applicable requirements of the following adopted codes and standards.

1. Building Codes for Arkansas
    a. International Building Code 2006
    b. Arkansas Fire Prevention Code 2007

c. National Electrical Code 2017
d. Arkansas Fuel Gas Code 2006 (International Fuel Gas Code 2006)
e. International Existing Building Code 2006
f. Arkansas Energy Code 2011 (based on ANSI/ASHRAE/IESNA Standard 90.1-2007)
g. Arkansas State Plumbing Code 2006
h. Arkansas Mechanical Code 2010
i. Accessibility Code ICC/ANSI A117.1 2003

1.06 CONFLICTING REQUIREMENTS

A. Conflicting requirements: If compliance with standards, codes, regulations, and specifications establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Engineer for a decision before proceeding.

1.07 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.
2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Division 01 General Requirements: Requirements of Sections in Division 01 apply to the Work of all Sections in the Specifications.

C. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.
4. The HVAC Drawings show the general arrangement of all piping, equipment and appurtenances and shall be followed as closely as actual building construction and the work of other trades will permit. The work shall conform to the requirements shown on all of the drawings. General and Structural Drawings shall take precedence over HVAC Drawings. Because of the small scale of the HVAC Drawings, it is not possible to indicate all offsets, fittings, and accessories, which may be required. The Contractor shall investigate the structural and finish conditions affecting the work and shall arrange his work accordingly, providing such fittings, offsets, valves and accessories as may be required to meet such conditions.

1.08 FEES, PERMITS, AND INSPECTIONS

A. All required fees, permits and inspections of all kind shall be obtained and paid for by the Contractor under the section of the specifications for which they are required.

B. Certificate of Final Inspection: Under each applicable section of the specifications, the Contractor shall, upon completion of the work under that section, furnish a certificate of final inspection to the Engineer from the inspection department having jurisdiction.

1.09 SUBMITTALS

A. Submittal Schedule

1. Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Engineer and additional time for handling and reviewing submittals required by those corrections.
   a. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
   b. Initial Submittal: Submit concurrently with startup construction schedule. Include submittals required during the first 60 days of construction. List those submittals

required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.

c. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule.
   1) Submit revised submittal schedule to reflect changes in current status and timing for submittals.

d. Format: Arrange the following information in a tabular format:
   1) Scheduled date for first submittal.
   2) Specification Section number and title.
   3) Submittal category: Action; informational.
   4) Name of subcontractor.
   5) Description of the Work covered.
   6) Scheduled date for Engineer's final release or approval.

B. Submittal Administrative Requirements

1. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
   a. Submit submittals to Engineer through the Architect.
   b. Engineer, through Architect, will return annotated file.
2. Digital Data Files:
   a. Electronic digital data files of the Project drawings may be provided by Engineer for Contractor's use in preparing submittals.
   b. Electronic digital data files supplied for use in submittal preparation will be subject to terms and conditions of the Engineer’s Release Form. A signed release form and any payment required must be returned to the Engineer prior to the transmission of an electronic digital data files.
   c. Electronic digital data file formats may include AutoCAD drawings or Revit converted to AutoCAD drawings.
3. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
   a. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
   b. Submit all submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
   c. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
   d. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
      1) Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

4. Processing Time: Allow time for submittal review, including time for resubmittals, as follows. Time for review shall commence on Engineer's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
    a. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
    b. Intermediate Review: If intermediate submittal is necessary, process it in same manner as initial submittal.
    c. Resubmittal Review: Allow 14 days for review of each resubmittal.
5. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:
    a. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
    b. Name file with submittal number or other unique identifier, including revision identifier.
        1) File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).
    c. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Engineer.
    d. Transmittal Form for Electronic Submittals: Use electronic form containing the following information:
        1) Project name.
        2) Name and address of Architect.
        3) Name and address of Engineer.
        4) Name of Construction Manager.
        5) Name of Contractor.
        6) Name of firm or entity that prepared submittal.
        7) Names of subcontractor, manufacturer, and supplier.
        8) Category and type of submittal.
        9) Submittal purpose and description.
        10) Specification Section number and title.
        11) Specification paragraph number or drawing designation and generic name for each of multiple items.
        12) Drawing number and detail references, as appropriate.
        13) Location(s) where product is to be installed, as appropriate.
        14) Related physical samples submitted directly.
        15) Indication of full or partial submittal.
        16) Transmittal number.
        17) Submittal and transmittal distribution record.

18) Other necessary identification.
19) Remarks.

e. Metadata: Include the following information as keywords in the electronic submittal file metadata:
1) Project name.
2) Number and title of appropriate Specification Section.
3) Manufacturer name.
4) Product name.

6. Options: Identify options requiring selection by Engineer.
7. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
8. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
a. Note date and content of previous submittal.
b. Note date and content of revision in label or title block and clearly indicate extent of revision.
c. Resubmit submittals until they are marked with approval notation from Engineer's action stamp.
9. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.
10. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Engineer's action stamp.
11. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
a. Include data to indicate compliance with the requirements specified in "Comparable Products" Article.
b. Engineer’s Action: If necessary, Engineer will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Engineer will notify Contractor through Architect of approval or rejection of proposed comparable product request within 14 days of receipt of request, or 7 days of receipt of additional information or documentation, whichever is later.
1) Use product specified if Engineer does not issue a decision on use of a comparable product request within time allocated.

1.10 CLOSEOUT SUBMITTALS

A. Closeout submittals shall include, but not limited to, the following:

1. Operation and Maintenance Materials
2. Record Drawings
3. Demonstration and Training Materials

4. Final Approved Submittals

B. Operation and Maintenance Materials Submittals

1. Manual Content: Operations and maintenance manual content is specified in individual Specification Sections to be reviewed at the time of Section submittals. Submit reviewed manual content formatted and organized as required by this Section.
   a. Engineer will comment on whether content of operations and maintenance submittals are acceptable.
   b. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.
2. Format: Submit operations and maintenance manuals in the following format:
   a. PDF electronic file. Assemble each manual into a composite electronically indexed file. Submit on digital media acceptable to Engineer.
      1) Name each indexed document file in composite electronic index with applicable item name. Include a complete electronically linked operation and maintenance directory.
      2) Enable inserted reviewer comments on draft submittals.
   b. In addition to the electronic submit provide two paper copies of the corrected final submittal as part of the "Closeout Documents". Include a complete operation and maintenance directory. Enclose title pages and directories in clear plastic sleeves. Engineer, through Architect, will return two copies. The two paper copies will be provided to the Owner as part of the "Closeout Documents"
3. Final Manual Submittal: Submit each manual in final form prior to requesting inspection for Substantial Completion and at least 30 days before commencing demonstration and training. Engineer will return copy with comments.
   a. Correct or revise each manual to comply with Engineer's comments. Submit copies of each corrected manual within 15 days of receipt of Engineer's comments and prior to commencing demonstration and training.

C. Training Submittals

1. Demonstration to the Owner personnel of the HVAC products and systems to be utilized on the project is required.
2. Training of Owner personnel in operation and maintenance is required for:
   a. HVAC systems and equipment.
   b. All software-operated systems.
   c. Items specified in individual product Sections
3. Demonstration and Training Video Recordings: Submit two copies within seven days of end of each training module.
   a. Identification: On each copy, provide an applied label with the following information:
      1) Name of Project.
      2) Name and address of videographer.
      3) Name of Engineer.
      4) Name of Construction Manager.

5) Name of Contractor.

b. At completion of training, submit complete training manual(s) for Owner's use prepared and bound in format matching operation and maintenance manuals in PDF electronic file format on compact disc.

D. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
2. Mark each copy of each submittal to show which products and options are applicable.
3. Include the following information, as applicable:
   a. Manufacturer's catalog cuts.
   b. Manufacturer's product specifications.
   c. Standard color charts.
   d. Statement of compliance with specified referenced standards.
   e. Testing by recognized testing agency.
   f. Application of testing agency labels and seals.
   g. Notation of coordination requirements.
   h. Availability and delivery time information.
4. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring.
   b. Printed performance curves.
   c. Operational range diagrams.
   d. Clearances required to other construction, if not indicated on accompanying Shop Drawings.

E. Shop Drawings: Prepare Project-specific information, drawn accurately to scale and sufficiently large to show all pertinent features of the item, method of connections, and notations clearly legible. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Engineer's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.
   e. Notation of dimensions established by field measurement.
   f. Relationship and attachment to adjoining construction clearly indicated.
   g. Seal and signature of professional engineer if specified.

2. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.

F. Coordination Drawing Submittals: Comply with requirements specified in Section 01 3100 "Project Management and Coordination."

G. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Section 01 4000 "Quality Requirements."

H. Closeout Submittals and Maintenance Material Submittals: Comply with requirements specified in Section 01 7700 "Closeout Procedures."

I. Maintenance Data: Comply with requirements specified in Section 01 7823 "Operation and Maintenance Data."

J. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of Engineers and owners, and other information specified.

K. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

L. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.

M. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.

N. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.

O. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with

requirements in the Contract Documents.

P. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.

Q. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:

1. Name of evaluation organization.
2. Date of evaluation.
3. Time period when report is in effect.
4. Product and manufacturers' names.
5. Description of product.
6. Test procedures and results.
7. Limitations of use.

R. Pre-construction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.

S. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.

T. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.

1.11 QUALITY ASSURANCE

A. Products:

1. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
    a. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
    b. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

1.12 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project Site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation or moisture damage..
4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.

1.13 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on

product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Special Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.

1. Manufacturer's Standard Form: Modified to include Project-specific information and properly executed.
2. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
3. See other Sections for specific content requirements and particular requirements for submitting special warranties.

C. Submit warranties in accordance with “Closeout Procedures.”

1.14 FIELD CONDITIONS

A. The Contractor shall visit the site of the building before submitting a proposal on this work, and shall thoroughly familiarize himself with the existing conditions and operations. Failure on his part to do this will not be cause of extras after the contract is signed, by reason of unforeseen conditions.

1.15 WARRANTY

A. The Contractor shall, after completion of the original test of the installation, and acceptance by the Engineer, provide any service incidental to the proper performance of the HVAC under guarantees outlined above for a period of 1 full year after acceptance by the Engineer and Owner. Regardless of anything to the contrary in warranties by the equipment manufacturer involved, the Contractor's warranty shall run for 1 full year after final acceptance by the Engineer.

PART 2 - PRODUCTS

2.01 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Were two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
4. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
5. Where products are accompanied by the term "as selected," Architect will make selection.
6. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
7. Products containing asbestos shall not be used.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Selection Procedure: Where Specifications include the phrase "as selected by Architect" or similar phrase, select a product that complies with requirements. Architect will select option from manufacturer's product line that includes both standard and premium items.

D. Comparable Products

1. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:

a. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
b. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
c. Evidence that proposed product provides specified warranty.
d. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
e. Contractor is responsible for any modification required by products other than the basis of design product at no additional cost to the owner including but not limited to modifications to supports and connections,

2.02 COORDINATION DRAWINGS

A. Coordination Drawings, General: Prepare coordination drawings according to requirements in individual Sections, and additionally where installation is not completely shown on Shop Drawings, where limited space availability necessitates coordination, or if coordination is required to facilitate integration of products and materials fabricated or installed by more than one entity.

1. Content: Project-specific information, drawn accurately to a scale large enough to indicate and resolve conflicts. Do not base coordination drawings on standard printed data. Include the following information, as applicable:
   a. Use applicable Drawings as a basis for preparation of coordination drawings. Prepare sections, elevations, and details as needed to describe relationship of various systems and components.
   b. Coordinate the addition of trade-specific information to the coordination drawings by multiple contractors in a sequence that best provides for coordination of the information and resolution of conflicts between installed components before submitting for review.
   c. Indicate functional and spatial relationships of components of architectural, structural, civil, mechanical, and electrical systems.
   d. Indicate space requirements for routine maintenance and for anticipated replacement of components during the life of the installation.
   e. Show location and size of access doors required for access to concealed valves and other controls.
   f. Indicate required installation sequences.
   g. Indicate dimensions shown on the Drawings. Specifically note dimensions that appear to be in conflict with submitted equipment and minimum clearance requirements. Provide alternate sketches to Architect indicating proposed resolution

of such conflicts. Minor dimension changes and difficult installations will not be considered changes to the Contract.

B. Coordination Drawing Organization: Organize coordination drawings as follows:

1. Floor Plans and Reflected Ceiling Plans: Show architectural and structural elements, and mechanical, plumbing, fire-protection, low voltage, and electrical work. Show locations of visible ceiling mounted devices relative to acoustical ceiling grid. Supplement plan drawings with section drawings where required to adequately represent the work.
2. Plenum Space: Indicate subframing for support of ceiling and wall systems, mechanical, plumbing,fire protection, low voltage, and electrical equipment, and related work.
3. Mechanical Rooms: Provide coordination drawings for mechanical rooms showing plans and elevations of mechanical, plumbing, fire-protection, low voltage, and electrical equipment.
4. Structural Penetrations: Indicate penetrations and openings required for all disciplines.
5. Mechanical and Plumbing Work: Show the following:
   a. Sizes and bottom elevations of ductwork, piping, and conduit runs, including insulation, bracing, flanges, and support systems.
   b. Dimensions of major components, such as dampers, valves, diffusers, access doors, cleanouts and electrical distribution equipment.
   c. Fire-rated enclosures around ductwork.
6. Electrical Work: Show the following:
   a. Runs of vertical and horizontal conduit 1-1/4 inches in diameter and larger.
   b. Light fixture, exit light, emergency battery pack, smoke detector, and other fire-alarm locations.
   c. Panel board, switch board, switchgear, transformer, busway, generator, and motor control center locations.
   d. Location of pull boxes and junction boxes, dimensioned from column center lines.
7. Fire-Protection System: Show the following:
   a. Locations of standpipes, mains piping, branch lines, pipe drops, and sprinkler heads.
8. Review: Architect will review coordination drawings to confirm that the Work is being coordinated, but not for the details of the coordination, which are Contractor's responsibility. If Architect determines that coordination drawings are not being prepared in sufficient scope or detail, or are otherwise deficient, Architect will so inform Contractor, who shall make changes as directed and resubmit.

C. Coordination Digital Data Files: Prepare coordination digital data files according to the following requirements:

1. File Preparation Format: DXF operating in Microsoft Windows operating system.
2. File Submittal Format: Submit or post coordination drawing files using format same as file preparation format and supply Portable Data File (PDF) format.
3. BIM File Incorporation: Provide coordination drawing files into Building Information Model established for Project.

a. Provide three-dimensional component conflict analysis as part of preparation of coordination drawings. Resolve component conflicts prior to submittal. Indicate where conflict resolution requires modification of design requirements by Architect.

2.03 EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of systems.
3. List of equipment.
4. Table of contents.

B. List of Systems and Subsystems: List systems alphabetically. Include references to operation and maintenance manuals that contain information about each system.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Identification: In the documentation directory and in each operation and maintenance manual, identify each system, subsystem, and piece of equipment with same designation used in the Contract Documents. If no designation exists, assign a designation according to ASHRAE Guideline 4, "Preparation of Operating and Maintenance Documentation for Building Systems."

F. Manual Contents: Organize into sets of manageable size. Arrange contents alphabetically by system, subsystem, and equipment. If possible, assemble instructions for subsystems, equipment, and components of one system into a single binder.

G. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily navigated file tree. Configure electronic manual to display bookmark panel on opening file.

H. Operation Manual

1. Content: In addition to requirements in this Section, include operation data required in individual Specification Sections and the following information:
   a. System, subsystem, and equipment descriptions. Use designations for systems and equipment indicated on Contract Documents.
   b. Performance and design criteria if Contractor has delegated design responsibility.
   c. Operating standards.
   d. Operating procedures.
   e. Operating logs.
   f. Wiring diagrams.
   g. Control diagrams.
   h. Piped system diagrams.
   i. Precautions against improper use.
   j. License requirements including inspection and renewal dates.
2. Descriptions: Include the following:
   a. Product name and model number. Use designations for products indicated on Contract Documents.
   b. Manufacturer's name.
   c. Equipment identification with serial number of each component.
   d. Equipment function.
   e. Operating characteristics.
   f. Limiting conditions.
   g. Performance curves.
   h. Engineering data and tests.
   i. Complete nomenclature and number of replacement parts.
3. Operating Procedures: Include the following, as applicable:
   a. Startup procedures.
   b. Equipment or system break-in procedures.
   c. Routine and normal operating instructions.
   d. Regulation and control procedures.
   e. Instructions on stopping.
   f. Normal shutdown instructions.
   g. Seasonal and weekend operating instructions.

h. Required sequences for electric or electronic systems.
i. Special operating instructions and procedures.

4. Systems and Equipment Controls: Describe the sequence of operation, and diagram controls as installed.
5. Piped Systems: Diagram piping as installed, and identify color-coding where required for identification.

I. Maintenance Manuals

1. Content: Organize manual into a separate section for each product, system, subsystem, material, and finish. Include source information, product information, maintenance procedures, repair materials and sources, and warranties and bonds, as described below.
2. Source Information: List each product, system, or subsystem included in manual, identified by product name and arranged to match manual's table of contents. For each product, list name, address, and telephone number of Installer or supplier and maintenance service agent, and cross-reference Specification Section number and title in Project Manual and drawing or schedule designation or identifier where applicable.
3. Product Information: Include the following, as applicable:
   a. Product name and model number.
   b. Manufacturer's name.
   c. Color, pattern, and texture.
   d. Material and chemical composition.
   e. Reordering information for specially manufactured products.
   f. Standard maintenance instructions and bulletins.
   g. Drawings, diagrams, and instructions required for maintenance, including disassembly and component removal, replacement, and assembly.
   h. Identification and nomenclature of parts and components.
   i. List of items recommended to be stocked as spare parts.
4. Maintenance Procedures: Include manufacturer's written recommendations and the following:
   a. Inspection procedures.
   b. Types of cleaning agents to be used and methods of cleaning.
   c. List of cleaning agents and methods of cleaning detrimental to product.
   d. Schedule for routine cleaning and maintenance.
   e. Repair instructions.
   f. Test and inspection instructions.
   g. Troubleshooting guide.
   h. Precautions against improper maintenance.
   i. Disassembly; component removal, repair, and replacement; and reassembly instructions.
   j. Aligning, adjusting, and checking instructions.
   k. Demonstration and training video recording, if available.
5. Repair Materials and Sources: Include lists of materials and local sources of materials and related services.

6. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
    a. Include procedures to follow and required notifications for warranty claims.
7. Maintenance and Service Schedules: Include service and lubrication requirements, list of required lubricants for equipment, and separate schedules for preventive and routine maintenance and service with standard time allotment.
    a. Scheduled Maintenance and Service: Tabulate actions for daily, weekly, monthly, quarterly, semiannual, and annual frequencies.
    b. Maintenance and Service Record: Include manufacturers' forms for recording maintenance.
8. Spare Parts List and Source Information: Include lists of replacement and repair parts, with parts identified and cross-referenced to manufacturers' maintenance documentation and local sources of maintenance materials and related services.
9. Maintenance Service Contracts: Include copies of maintenance agreements with name and telephone number of service agent.
10. Warranties and Bonds: Include copies of warranties and bonds and lists of circumstances and conditions that would affect validity of warranties or bonds.
    a. Include procedures to follow and required notifications for warranty claims.

2.04 RECORD DRAWINGS

A. Record Prints: Maintain one set of marked-up paper copies of the Contract Drawings and Shop Drawings, incorporating new and revised drawings as modifications are issued.

1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked-up record prints.
    a. Give particular attention to information on concealed elements that would be difficult to identify or measure and record later.
    b. Accurately record information in an acceptable drawing technique.
    c. Record data as soon as possible after obtaining it.
    d. Record and check the markup before enclosing concealed installations.
    e. Cross-reference record prints to corresponding archive photographic documentation.
2. Content: Types of items requiring marking include, but are not limited to, the following:
    a. Dimensional changes to Drawings.
    b. Revisions to details shown on Drawings.
    c. Locations and depths of underground utilities.
    d. Revisions to routing of piping and conduits.
    e. Revisions to electrical circuitry.
    f. Actual equipment locations.
    g. Duct size and routing.
    h. Locations of concealed internal utilities.
    i. Changes made by Change Order or Change Directive.

j. Changes made following Architect's written orders.
k. Details not on the original Contract Drawings.
l. Field records for variable and concealed conditions.
m. Record information on the Work that is shown only schematically.

3. Mark the Contract Drawings and Shop Drawings completely and accurately. Use personnel proficient at recording graphic information in production of marked-up record prints.
4. Mark important additional information that was either shown schematically or omitted from original Drawings.
5. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.

PART 3 - EXECUTION

3.01 CONTRACTOR'S SUBMITTAL REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ENGINEER'S SUBMITTAL ACTION

A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it. Engineer will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.

B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to the Architect to forward to the appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Engineer without action.

3.03 CONSTRUCTION WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Disposal: Remove waste materials from Owner's property and legally dispose of them

3.04 GENERAL COORDINATION FOR HVAC WORK

A. The Contractor shall compare the HVAC Drawings and Specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the HVAC Work. The HVAC Work shall be installed in cooperation with other trades installing related work. Before installation, the Contractor shall make proper provision to avoid interferences. All changes required in the work of the Contractor caused by a failure to coordinate the work with other trades shall be made by the Contractor at his own expense.

B. Anchor bolts, sleeves, inserts and supports that may be required for the HVAC Work shall be furnished under the same section of the specifications as the respective items to be supported, and they shall be installed, except as otherwise specified, by the trade furnishing and installing the material in which they are to be located. Location of anchor bolts, sleeves, inserts and supports shall be directed by the trade requiring them, which trade shall also insure that they are properly installed. Any expense resulting from the improper location or installation of anchor

bolts, sleeves, inserts and supports shall be paid for by the Contractor under the section of the specifications for the trade with the responsibility for directing their proper location.

C. Slots, chases, openings and recesses through floors, walls, ceilings and roofs as specified will be provided by the various trades in their respective materials, but the trade requiring them shall see that they are properly located, and shall do any cutting and patching caused by the neglect to do so. Slots, chases, openings and recesses in existing structure shall be cut by the trade requiring them and patched and repaired by that trade.

D. Locations of pipes, ductwork, equipment, etc. shall be adjusted to accommodate the work and to avoid interferences anticipated and encountered. The Contractor shall determine the exact route and location of each pipe and duct prior to fabrication.

1. Right-of-Way: Lines which pitch shall have the right of way over those which do not pitch. For example: plumbing drains shall normally have right of way. Lines whose elevations cannot be changed shall have the right of way over lines whose elevations can be changed.
2. Offsets, transitions and changes in direction in pipes and ducts shall be made as required to maintain proper head room and pitch of sloping lines whether or not indicated on the drawings. The Contractor shall furnish and install all traps, air vents, sanitary vents, etc., as required to effect these offsets, transitions and changes in direction.
3. Installation and Arrangement: The Contractor shall install all HVAC Work to permit removal (without damage to other parts) of coils, heat exchanger bundles, fan shafts and wheels, filters, belt guards, sheaves and drives, and all other parts requiring periodic replacement or maintenance. The Contractor shall arrange pipes, ducts, and equipment to permit ready access to valves, cocks, control components and to clear the openings of swinging and overhead doors and of access panels.
4. Ductwork: The Contractor shall change the cross-sectional dimensions of ductwork when required to meet job conditions but shall maintain at least the same equivalent cross-sectional area. The Contractor shall secure the approval of the Engineer prior to fabrication of ductwork requiring such changes.
5. Access: The Contractor shall provide all necessary access panels in walls, ceilings, equipment, ducts. etc., as required for inspection of interiors and for proper maintenance and or installation of equipment valves. Where changes from the plans are made by the Contractor in the installation of his work, he shall provide any and all access panels required as a result of these changes.

E. Connections Different From Those Shown: Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly with the intent of the drawings and specifications. When directed, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes in piping, ductwork, supports, insulation, etc. The Contractor shall provide any additional valves, fittings, and other additional equipment required for the proper operation of the system resulting from the selection of equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing in and connections by other trades. All changes shall be made at no increase in the contract amount or additional cost to the other trades.

F. Connections: All piping connecting to equipment shall be installed without strain at the piping connection

G. Inaccessible Equipment

1. Where the Engineer or Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action (such as providing access panels) performed as directed at no additional cost to the Owner.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

H. Electrical Coordination

1. Power: All power and motor wiring shall be performed under Division 26 unless otherwise noted for specific items. Control and interlock wiring shall be done by the Contractor of this Division.
2. Starters and Drives: All motor starters and drives unless included in other sections of the specifications shall be by Division 26. Furnish auxiliary contacts on magnetic starters to permit interlocking of starting circuits.
3. Disconnects: All equipment furnished under this Division required to have a means of disconnect shall be supplied with a disconnect or a disconnect shall be furnished and installed by Division 26. The Contractor shall coordinate between this Division and Division 26 to ensure that all disconnects required for the Project are furnished and

installed.

4. The Contractor of this Division shall furnish and install any low voltage relays, pressure switches, and similar items required for the proper operation of the HVAC equipment.

I. Dedicated Electrical Space: The space equal to the width and depth of the equipment and extending from the floor to a height of 6 feet above the equipment or to the structural ceiling, whichever is lower, shall be dedicated to the electrical installation. No piping, ducts, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in this zone. The area above the dedicated space shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks or breaks in foreign systems. Every effort shall be made to eliminate foreign systems above equipment to the structural ceiling. If this is not possible, the Contractor shall encase any pipe in a second pipe with a minimum number of joints. Provide 18 gauge (minimum) galvanized, 4 inch (minimum) deep drain pans under piping and ductwork located or passing over electrical equipment. Pipe 1" drain from pan to nearest floor drain. Drain pan shall be adequately supported and constructed to hold 4 inches of water without collapse.

J. Lubrication: The Contractor shall be held responsible for all damage to bearings while the equipment is being operated up to the date of acceptance of the equipment. The Contractor shall be required to protect all bearings during installation and shall thoroughly grease steel shafts to prevent corrosion. All motors and other equipment shall be provided with covers as required for proper protection during construction. Pump shafts, fan shafts, motor shafts, etc. shall be coated to prevent deterioration in moist or wet atmospheres.

3.05 CUTTING AND PATCHING

A. General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Under each section of the specifications, the Contractor shall be responsible for all required cutting, etc., incident to his work under that section, and shall make all satisfactory repairs, but in no case shall the Contractor cut into any major structural element, beam or column.

2. Each trade shall bear the expense of all cutting, patching, repairing or replacing of the work of other trades because of fault, error or tardiness or because of any damage done by own workmanship.
3. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Proceed with patching after construction operations requiring cutting are complete.

F. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.

2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    a. Clean piping and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until patch blends with adjacent surfaces.
4. Ceilings: Patch, repair, or rehang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

G. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.06 PAINTING

A. The Contractor shall remove all rust, oil and grease from exposed surfaces and clean all apparatus or materials specified to be painted under this section of the specifications.

Contractor shall paint equipment, piping, etc., in accordance with Division 9. Equipment specified to have factory finishes shall be protected until completion of the Contract, with Contractor being responsible for maintaining finishes.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Interior, Ferrous Piping: Use semi-gloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
2. Interior, Galvanized-Steel Piping: Use semi-gloss, acrylic-enamel finish. Include 2 finish coats over galvanized metal primer.
3. Interior, Ferrous Supports: Use semi-gloss, acrylic-enamel finish. Include finish coat over enamel undercoat and primer.
4. Exterior, Ferrous Piping: Use semi-gloss, acrylic-enamel finish. Include 2 finish coats over rust-inhibitive metal primer.
5. Exterior, Galvanized-Steel Piping: Use semi-gloss, acrylic-enamel finish. Include 2 finish coats over galvanized metal primer.

6. Exterior, Ferrous Supports: Use semi-gloss, acrylic-enamel finish. Include 2 finish coats over rust-inhibitive metal primer.
7. Do not paint piping specialties with factory-applied finish.
8. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
9. Galvanized surfaces damaged during installation shall be repaired with a galvanized repair compound complying with Mil Spec DOD-P-21035B. Any equipment scratched, marred or damaged will be repainted to the original condition.

END OF SECTION

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SECTION 23 0513
COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

E. Electronically Commutated Motors (ECM).

1.02 RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

B. Section 26 2913 - Enclosed Controllers.

1.03 REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators 2021.

B. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

C. Operation Data: Include instructions for safe operating procedures.

D. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.05 QUALITY ASSURANCE

A. Comply with NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

PART 2 - PRODUCTS

2.01 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:

1. Motors 1/2 HP and Smaller: 115 or 208 volts, single phase, 60 Hz.
2. Motors Larger than 1/2 Horsepower: 460 volts, three phase, 60 Hz.

B. Construction:

1. Open drip-proof type except where specifically noted otherwise.
2. Design for continuous operation in 104 degrees F environment.
3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

C. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

D. Wiring Terminations:

1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.
2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.02 APPLICATIONS

A. Exception: Motors less than 250 watts, for intermittent service may be the equipment manufacturer's standard and need not comply with these specifications.

B. Single phase motors for shaft mounted fans: Split phase type.

2.03 SINGLE PHASE POWER - SPLIT PHASE MOTORS

2.04 ELECTRONICALLY COMMUTATED MOTORS (ECM)

A. Applications:

1. Commercial:
   a. DX Fan Coil Unit:
      1) Operating Mode: Constant cfm.
      2) Input: Motor manufacturer to coordinate control requirements with the control board of the DX fan coil unit and/or specified sequence of operation.
      3) Shaft Extension: Single.
      4) Options: Remote mount control/User-Interface.
      5) RPM: 300 through 1250.
   b. Fan Filter Unit:
      1) Operating Mode: Constant cfm.
      2) Input: Motor manufacturer to coordinate control requirements with the control board of the fan filter unit and/or specified sequence of operation.
      3) Shaft Extension: Single.
      4) Options: Remote mount control.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

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SECTION 23 0517
SLEEVES AND SLEEVE SEALS FOR HVAC PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe sleeves.

B. Manufactured sleeve-seal systems.

1.02 RELATED REQUIREMENTS

A. Section 22 0553 - Identification for Plumbing Piping and Equipment: Piping identification.

B. Section 22 0719 - Plumbing Piping Insulation.

1.03 REFERENCE STANDARDS

A. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type) 2016.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems 2013a (Reapproved 2017).

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.05 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 this section.

C. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store sleeve and sleeve seals in shipping containers, with labeling in place.

B. Provide temporary protective coating on cast iron and steel sleeves if shipped loose.

1.07 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 PIPE SLEEVES

A. Vertical Piping:

1. Sleeve Length: 1 inch above finished floor.
2. Provide sealant for watertight joint.
3. Blocked Out Floor Openings: Provide 1-1/2 inch angle set in silicon adhesive around opening.
4. Drilled Penetrations: Provide 1-1/2 inch angle ring or square set in silicone adhesive around penetration.

B. Pipe Passing Through Below Grade Exterior Walls:

1. Zinc coated or cast iron pipe.
2. Provide watertight space with link rubber or modular seal between sleeve and pipe on both pipe ends.

C. Pipe Passing Through Concrete Beam Flanges, except where Brass Pipe Sleeves are Specified:

1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

D. Pipe Passing Through MechanicalRoom Floors above Basement:

1. Galvanized steel pipe or black iron pipe with asphalt coating.
2. Connect sleeve with floor plate except in mechanical rooms.

E. Penetrations in concrete beam flanges are permitted but are prohibited through ribs or beams without prior approval from the Architect.

F. Clearances:

1. Provide allowance for insulated piping.

2. Wall, Floor, Floor, Partitions, and Beam Flanges: 1 inch greater than external; pipe diameter.
3. All Rated Openings: Caulked tight with fire stopping material in compliance with ASTM E814 in accordance with Section 07 8400 to prevent the spread of fire, smoke, and gases.

2.02 MANUFACTURED SLEEVE-SEAL SYSTEMS

A. Modular/Mechanical Seal:

1. Synthetic rubber interlocking links continuously fill annular space between pipe and wall/casing opening.
2. Provide watertight seal between pipe and wall/casing opening.
3. Elastomer element size and material in accordance with manufacturer's recommendations.
4. Glass reinforced plastic pressure end plates.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

B. Install piping to conserve building space, to not interfere with use of space and other work.

C. Install piping and pipe sleeves to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

D. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

E. Structural Considerations:

1. Do not penetrate building structural members unless indicated.

F. Provide sleeves when penetrating footings, floors, walls, and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. Underground Piping: Caulk pipe sleeve watertight with lead and oakum or mechanically expandable chloroprene inserts with bitumen sealed metal components.
2. Aboveground Piping:
   a. Pack solid using mineral fiber in compliance with ASTM C592.
   b. Fill space with an elastomer caulk to a depth of 0.50 inch where penetrations occur between conditioned and unconditioned spaces.

3. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

G. Manufactured Sleeve-Seal Systems:

1. Install manufactured sleeve-seal systems in sleeves located in grade slabs and exterior concrete walls at piping entrances into building.
2. Provide sealing elements of the size, quantity, and type required for the piping and sleeve inner diameter or penetration diameter.
3. Locate piping in center of sleeve or penetration.
4. Install field assembled sleeve-seal system components in annular space between sleeve and piping.
5. Tighten bolting for a water-tight seal.
6. Install in accordance with manufacturer's recommendations.

H. When installing more than one piping system material, ensure system components are compatible and joined to ensure the integrity of the system. Provide necessary joining fittings. Ensure flanges, union, and couplings for servicing are consistently provided.

3.02 CLEANING

A. Upon completion of work, clean all parts of the installation.

B. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

END OF SECTION

SECTION 23 0519
METERS AND GAUGES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

1.02 RELATED REQUIREMENTS

A. Section 23 0923 - Direct-Digital Control System for HVAC.

B. Section 23 2113 - Hydronic Piping.

1.03 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers 2014 (Reapproved 2020).

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers 2014 (Reapproved 2021).

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

C. Project Record Documents: Record actual locations of components and instrumentation.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 FIELD CONDITIONS

A. Do not install instrumentation when areas are under construction, except for required rough-in, taps, supports and test plugs.

PART 2 PRODUCTS

2.01 PRESSURE GAUGES

A. Pressure Gauges: ASME B40.100, UL 393 drawn steel case, phosphor bronze bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background.

1. Case: Steel with brass bourdon tube.
2. Size: 4-1/2 inch diameter.
3. Mid-Scale Accuracy: One percent.
4. Scale: Psi and KPa.

2.02 PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

B. Needle Valve: Brass, 1/4 inch NPT for minimum 150 psi.

C. Pulsation Damper: Pressure snubber, brass with 1/4 inch connections.

D. Syphon: Steel, Schedule 40, 1/4 inch angle or straight pattern.

2.03 STEM TYPE THERMOMETERS

A. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 9 inch scale.
2. Window: Clear Lexan.
3. Accuracy: 2 percent, per ASTM E77.
4. Calibration: Degrees F.

2.04 TEST PLUGS

A. Test Plug: 1/4 inch or 1/2 inch brass fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F.

B. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gauges, one gauge adapters with 1/8 inch probes, two 1 inch dial thermometers.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install thermometers in piping systems in sockets in short couplings. Enlarge pipes smaller than 2-1/2 inch for installation of thermometer sockets. Ensure sockets allow clearance from insulation.

C. Provide instruments with scale ranges selected according to service with largest appropriate scale.

D. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

E. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

F. Locate test plugs adjacent thermometers and thermometer sockets.

END OF SECTION

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SECTION 23 0523
GENERAL-DUTY VALVES FOR HVAC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Applications.

B. General requirements.

C. Angle valves.

D. Globe valves.

E. Ball valves.

F. Butterfly valves.

G. Check valves.

H. Gate valves.

I. Plug valves.

1.02 RELATED REQUIREMENTS

A. Section 23 0548 - Vibration and Seismic Controls for HVAC.

B. Section 23 0553 - Identification for HVAC Piping and Equipment.

C. Section 23 0719 - HVAC Piping Insulation.

D. Section 23 2113 - Hydronic Piping.

1.03 ABBREVIATIONS AND ACRONYMS

A. CWP: Cold working pressure.

B. EPDM: Ethylene propylene copolymer rubber.

C. NBR: Acrylonitrile-butadiene, Buna-N, or nitrile rubber.

D. NRS: Nonrising stem.

E. OS&Y: Outside screw and yoke.

F. PTFE: Polytetrafluoroethylene.

G. RS: Rising stem.

H. SWP: Steam working pressure.

I. TFE: Tetrafluoroethylene.

1.04 REFERENCE STANDARDS

A. API STD 594 - Check Valves: Flanged, Lug, Wafer, and Butt-Welding 2022.

B. ASME B1.20.1 - Pipe Threads, General Purpose, Inch 2013 (Reaffirmed 2018).

C. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250 2015.

D. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard 2020.

E. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.

F. ASME B31.9 - Building Services Piping 2020.

G. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

H. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings 2004 (Reapproved 2019).

I. ASTM A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).

J. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings 2017.

K. AWWA C606 - Grooved and Shouldered Joints 2015.

L. MSS SP-45 - Drain and Bypass Connections 2020.

M. MSS SP-70 - Gray Iron Gate Valves, Flanged and Threaded Ends 2011.

N. MSS SP-72 - Ball Valves with Flanged or Butt-Welding Ends for General Service 2010a.

O. MSS SP-80 - Bronze Gate, Globe, Angle, and Check Valves 2019.

P. MSS SP-85 - Gray Iron Globe and Angle Valves, Flanged and Threaded Ends 2011.

Q. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .

1.05 QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.
2. Company must specialize in manufacturing products specified in this section, with not less than three years of documented experience.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Prepare valves for shipping as follows:

1. Minimize exposure of operable surfaces by setting plug and ball valves to open position.
2. Protect valve parts exposed to piped medium against rust and corrosion.
3. Protect valve piping connections such as grooves, weld ends, threads, and flange faces.
4. Adjust globe, gate, and angle valves to the closed position to avoid clattering.
5. Secure check valves in either the closed position or open position.
6. Adjust butterfly valves to closed or partially closed position.

B. Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.
   a. Provide temporary inlet and outlet caps.
   b. Maintain caps in place until installation.
2. Store valves in shipping containers and maintain in place until installation.
   a. Store valves indoors in dry environment.
   b. Store valves off the ground in watertight enclosures when indoor storage is not an option.

PART 2 PRODUCTS

2.01 APPLICATIONS

A. See drawings for specific valve locations.

B. Provide the following valves for the applications if not indicated on drawings:

1. Isolation (Shutoff): Butterfly, Gate, Ball, and Plug.
2. Dead-End: Butterfly, single-flange (lug) type.

C. Substitutions of valves with higher CWP classes or SWP ratings for same valve types are permitted when specified CWP ratings or SWP classes are not available.

D. Required Valve End Connections for Non-Wafer Types:

1. Steel Pipe:
   a. 2 NPS and Smaller: Threaded ends.
   b. 2-1/2 NPS and Larger: Grooved ends.
2. Copper Tube:
   a. 2-1/2 NPS and Larger: Grooved ends.

2.02 GENERAL REQUIREMENTS

A. Valve Pressure and Temperature Ratings: No less than rating indicated; as required for system pressures and temperatures.

B. Valve Sizes: Match upstream piping unless otherwise indicated.

C. Valve Actuator Types:

1. Handwheel: Valves other than quarter-turn types.
2. Hand Lever: Quarter-turn valves 6 NPS and smaller [_____].

D. Valves in Insulated Piping: Provide 2 NPS stem extensions and the following features:

1. Gate Valves: Rising stem.
2. Ball Valves: Extended operating handle of non-thermal-conductive material, and protective sleeve that allows operation of valve without breaking the vapor seal or disturbing insulation.
3. Butterfly Valves: Extended neck.
4. Memory Stops: Fully adjustable after insulation is installed.

E. Memory Stops: Fully adjustable after insulation is installed.

F. Valve-End Connections:

1. Threaded End Valves: ASME B1.20.1.
2. Flanges on Iron Valves: ASME B16.1 for flanges on iron valves.
3. Pipe Flanges and Flanged Fittings 1/2 NPS through 24 NPS: ASME B16.5.
4. Solder Joint Connections: ASME B16.18.
5. Grooved End Connections: AWWA C606.

G. General ASME Compliance:

1. Building Services Piping Valves: ASME B31.9.

H. Bronze Valves:

1. Fabricate from dezincification resistant material.
2. Copper alloys containing more than 15 percent zinc are not permitted.

I. Valve Bypass and Drain Connections: MSS SP-45.

J. Source Limitations: Obtain each valve type from a single manufacturer.

2.03 BRONZE ANGLE VALVES

A. Class 125: CWP Rating: 200 psig: and Class 150: CWP Rating: 300 psig:.

1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. Ends: Threaded.
4. Stem: Bronze.
5. Disc: Bronze, PTFE, or TFE.
6. Packing: Asbestos free.
7. Handwheel: Bronze or aluminum.

2.04 BRONZE GLOBE VALVES

A. Class 125: CWP Rating: 200 psig:.

1. Comply with MSS SP-80, Type 1.
2. Body: Bronze; ASTM B62, with integral seat and screw in bonnet.
3. Ends: Threaded or solder joint.
4. Packing: Asbestos free.
    a. Handwheel: Malleable iron.

2.05 IRON GLOBE VALVES

A. Class 125: CWP Rating: 200 psig: and Class 250: CWP Rating: 500 psig:.

1. Comply with MSS SP-85, Type I.
2. Body: Gray iron; ASTM A126, with bolted bonnet.
3. Ends: Flanged.
4. Trim: Bronze.
5. Packing and Gasket: Asbestos free.
6. Operator: Handwheel or chainwheel.

2.06 BRONZE BALL VALVES

A. One Piece, Reduced Port with Bronze Trim:

1. Comply with MSS SP-110.
2. CWP Rating: 400 psig.
3. Body: Bronze.
4. Ends: Threaded.
5. Seats: PTFE.

B. Two Piece, Standard Port and Full Port with Bronze or Brass Trim:

2.07 IRON BALL VALVES

A. Split Body, Full Port:

1. Comply with MSS SP-72.

2. CWP Rating: 200 psig.
3. Body: ASTM A126, gray iron.
4. Ends: Flanged.
5. Seats: PTFE.
6. Stem: Stainless steel.
7. Ball: Stainless steel.

2.08 IRON, GROOVED-END BALL VALVES

A. Class 200:

1. CWP Rating: 600 psig.
2. Body: Ductile iron; ASTM A536, Grade 65-45-12.
3. Ends: Grooved.
4. Seats: Teflon.
5. Stem: Nickel plated carbon steel.

2.09 BRONZE LIFT CHECK VALVES

A. Class 125:

1. Comply with MSS SP-80, Type 1, Metal Disc to Metal Seat and Type 2, Nonmetallic Disc to Metal Seat.
2. CWP Rating: 200 psig.
3. Design: Vertical flow.
4. Body: Bronze.
5. Ends: Threaded.
6. Disc (Type 1): Bronze.
7. Disc (Type 2): NBR or PTFE.

2.10 BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 kPa) and Class 150: CWP Rating: 300 psig (2070 kPa).

1. Comply with MSS SP-80, Type 3.
2. Body Design: Horizontal flow.
3. Body Material: Bronze, ASTM B62.
4. Ends: Threaded.
5. Disc: Bronze.

2.11 IRON, PLATE-TYPE CHECK VALVES

A. Class 125 Single-Plate:

1. Comply with API STD 594.
2. 2-1/2 NPS to 12 NPS, CWP Rating: 200 psig.
3. Body Design: Wafer, spring-loaded plate.
4. Body Material: ASTM A126, gray iron.

2.12 BRONZE GATE VALVES

A. Non-Rising Stem (NRS) or Rising Stem (RS):

1. Comply with MSS SP-80, Type I.
2. Class125: CWP Rating: 200 psig.
3. Class 150: CWP Rating: 300 psig.
4. Body Material: Bronze with integral seat and union-ring bonnet.
5. Ends: Threaded.
6. Stem: Bronze.
7. Disc: Solid wedge; bronze.
8. Packing: Asbestos free.
9. Handwheel: Malleable iron, bronze, or aluminum.

2.13 IRON GATE VALVES

A. NRS or OS & Y:

1. Comply with MSS SP-70, Type I.
2. Class 125: 2-1/2 NPS to 12 NPS, CWP Rating: 200 psig.
3. Class 250: 2-1/2 NPS to 12 NPS, CWP Rating: 500 psig.
4. Body Material: Gray iron with bolted bonnet.
5. Ends: Flanged.
6. Trim: Bronze.
7. Disc: Solid wedge.
8. Packing and Gasket: Asbestos free.

PART 3 EXECUTION

3.01 EXAMINATION

A. Discard all packing materials and verify that valve interior, including threads and flanges, are completely clean without signs of damage or degradation that could result in leakage.

B. Verify valve parts to be fully operational in all positions from closed to fully open.

C. Confirm gasket material to be suitable for the service, to be of correct size, and without defects that could compromise effectiveness.

D. Should valve is determined to be defective, replace with new valve.

3.02 INSTALLATION

A. Provide unions or flanges with valves to facilitate equipment removal and maintenance while maintaining system operation and full accessibility for servicing.

B. Provide separate valve support as required and locate valve with stem at or above center of piping, maintaining unimpeded stem movement.

C. Install check valves where necessary to maintain direction of flow as follows:

1. Lift Check: Install with stem plumb and vertical.
2. Swing Check: Install horizontal maintaining hinge pin level.

END OF SECTION

SECTION 23 0529
HANGERS AND SUPPORTS FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other HVAC/hydronic work.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 23 0548 - Vibration and Seismic Controls for HVAC.

1.03 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 2016a.

C. ASTM A181/A181M - Standard Specification for Carbon Steel Forgings, for General-Purpose Piping 2022.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel 2019.

E. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings 1999, with Editorial Revision (2018).

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

G. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.

H. MFMA-4 - Metal Framing Standards Publication 2004.

I. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

J. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems and thermal insulated pipe supports.

C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.

D. Installer's Qualifications: Include evidence of compliance with specified requirements.

E. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

C. Installer Qualifications for Field-Welding: As specified in Section 05 5000.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Comply with MSS SP-58.
2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of plumbing work.
3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
   a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
   b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Comply with MFMA-4.

C. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

D. Steel Cable:

1. Manufacturers:
   a. Source Limitations: Furnish associated fittings, accessories, and hardware produced by a single manufacturer.

E. Thermal Insulated Pipe Supports:

1. General Construction and Requirements:
    a. Insulated pipe supports to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.
    b. Surface Burning Characteristics: Flame spread index/smoke developed index of 5/30, maximum, when tested in accordance with ASTM E84 or UL 723.
    c. Pipe supports to be provided for nominally sized, 1/2 inch to 30 inch iron pipes.
    d. Insulation inserts to consist of rigid polyisocyanurate (urethane) insulation surrounded by a 360 degree, PVC jacketing.
2. PVC Jacket:
    a. Pipe insulation protection shields to be provided with a ball bearing hinge and locking seam.
    b. Moisture Vapor Transmission: 0.0071 perm inch, when tested in accordance with ASTM E96/E96M.
    c. Thickness: 60 mil.
3. Pipe insulation protection shields to be provided at the hanger points and guide locations on pipes requiring insulation as indicated on drawings.

F. Pipe Supports:

1. Liquid Temperatures Up To 122 degrees F:
    a. Overhead Support: MSS SP-58 Types 1, 3 through 12.
    b. Support From Below: MSS SP-58 Types 35 through 38.

G. Pipe Stanchions: For pipe runs, use stanchions of same type and material where vertical adjustment is required for stationary pipe.

1. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
2. Provide coated or plated saddles to isolate steel hangers from dissimilar metal tube or pipe.

H. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.

1. Material: ASTM A36/A36M carbon steel or ASTM A181/A181M forged steel.
2. Provide clamps with hardened steel cup-point set screws and lock-nuts for anchoring in place.

I. Riser Clamps:

1. Provide copper plated clamps for copper tubing support.
2. For insulated pipe runs, provide two bolt-type clamps designed for installation under insulation.

J. Offset Pipe Clamps: Double-leg design two-piece pipe clamp.

1. Manufacturers:
    a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

K. Strut Clamps: Two-piece pipe clamp.

1. Manufacturers:
    a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

L. Insulation Clamps: Two bolt-type clamps designed for installation under insulation.

1. Manufacturers:
    a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

M. Pipe Hangers: For a given pipe run, use hangers of the same type and material.

1. Manufacturers:
    a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Material: Malleable iron, ASTM A47/A47M; or carbon steel, ASTM A36/A36M.
3. Provide coated or plated hangers to isolate steel hangers from dissimilar metal tube or pipe.

N. Intermediate Pipe Guides: Use pipe clamps with oversize pipe sleeve that provides clearance around pipe.

1. Manufacturers:
    a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Pipe Diameter 6 inches and Smaller: Provide minimum clearance of 0.16 inch.
3. Pipe Diameter 8 inches: Provide U-bolts with double nuts providing minimum clearance of 0.28 inch.

O. Pipe Alignment Guides: Galvanized steel.

1. Manufacturers:
    a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. Pipe Diameter 8 inches and Smaller: Spider or sleeve type.
3. Pipe Diameter 10 inches and Larger: Roller type.

P. Dielectric Barriers: Provide between metallic supports and metallic piping and associated items of dissimilar type; acceptable dielectric barriers include rubber or plastic sheets or coatings attached securely to pipe or item.

1. Manufacturers:
    a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

Q. Nonpenetrating Rooftop Supports for Low-Slope Roofs:

1. Manufacturers:
2. Provide steel pedestals with thermoplastic or rubber base that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.
3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.

R. Pipe Shields for Insulated Piping:

1. Manufacturers:
   a. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.
2. General Construction and Requirements:
   a. Surface Burning Characteristics: Comply with ASTM E84 or UL 723.
   b. Shields Material: UV-resistant polypropylene with glass fill.
   c. Maximum Insulated Pipe Outer Diameter: 12-5/8 inch.
   d. Minimum Service Temperature: Minus 40 degrees F.
   e. Maximum Service Temperature: 178 degrees F.
   f. Pipe shields to be provided at hanger, support, and guide locations on pipe requiring insulation or additional support.

S. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.
2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Stud Walls: Use toggle bolts.
5. Steel: Use beam clamps, machine bolts, or welded threaded studs.
6. Sheet Metal: Use sheet metal screws.
7. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
   a. Comply with MFMA-4.
   b. Channel Material: Use galvanized steel.
   c. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
8. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

T. Pipe Installation Accessories:

1. Copper Pipe Supports:
   a. Manufacturers:

1) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.

2. Thermal Insulated Pipe Supports:
   a. Manufacturers:
      1) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
3. Overhead Pipe Supports:
   a. Manufacturers:
      1) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
4. Telescoping Pipe Supports:
   a. Manufacturers:
      1) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
5. Inserts and Clamps:
   a. Manufacturers:
      1) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, conduit, or other systems.

D. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

G. Provide thermal insulated pipe supports complete with hangers and accessories. Install thermal insulated pipe supports during the installation of the piping system.

H. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

I. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

J. Secure fasteners according to manufacturer's recommended torque settings.

K. Remove temporary supports.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 23 0548
VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Seismic control requirements.

1. Includes requirements for seismic qualification of equipment not specified in this section.

C. Vibration-isolated equipment support bases.

D. Vibration isolators.

E. External seismic snubber assemblies.

F. Seismic restraint systems.

G. Vibration-isolated and/or seismically engineered roof curbs.

1.02 RELATED REQUIREMENTS

A. Section 01 4533 - Code-Required Special Inspections and Procedures.

B. Section 03 3000 - Cast-in-Place Concrete.

1.03 DEFINITIONS

A. HVAC Component: Where referenced in this section in regards to seismic controls, applies to any portion of the HVAC system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., ductwork, piping).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures Most Recent Edition Cited by Referring Code or Reference Standard.

B. ASCE 19 - Structural Applications of Steel Cables for Buildings 2016.

C. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

D. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment 2014.

E. FEMA 413 - Installing Seismic Restraints for Electrical Equipment 2004.

F. FEMA 414 - Installing Seismic Restraints for Duct and Pipe 2004.

G. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage 2012.

H. ICC-ES AC156 - Acceptance Criteria for Seismic Certification by Shake-Table Testing of Nonstructural Components 2010, with Editorial Revision (2015).

I. MFMA-4 - Metal Framing Standards Publication 2004.

J. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems 2008.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Seismic Controls:
    a. Coordinate the arrangement of seismic restraints with piping, conduit, equipment, and other potential conflicts installed under other sections or by others.
    b. Coordinate the work with other trades to accommodate relative positioning of essential and nonessential components in consideration of seismic interaction.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Design Documents: Prepare and submit all information required for plan review and permitting by authorities having jurisdiction, including but not limited to floor plans, details, and calculations.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for products, including materials, fabrication details, dimensions, and finishes.

1. Vibration Isolators: Include rated load capacities and deflections; include information on color coding or other identification methods for spring element load capacities.
2. Seismic Controls: Include seismic load capacities.

D. Shop Drawings - Vibration Isolation Systems:

1. Include dimensioned plan views and sections indicating proposed arrangement of vibration isolators; indicate equipment weights and static deflections.
2. Vibration-Isolated Equipment Support Bases: Include base weights, including concrete fill where applicable; indicate equipment mounting provisions.

E. Shop Drawings - Seismic Controls:

1. Include dimensioned plan views and sections indicating proposed HVAC component locations and distributed system routing, with locations and details of gravity supports and seismic restraints and associated attachments.
2. Identify mounting conditions required for equipment seismic qualification.
3. Identify anchor manufacturer, type, minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
4. Indicate proposed arrangement of distributed system trapeze support groupings.
5. Indicate proposed locations for distributed system flexible fittings and/or connections.
6. Indicate locations of seismic separations where applicable.

F. Seismic Design Data:

1. Compile information on project-specific characteristics of actual installed HVAC components necessary for determining seismic design forces required to design appropriate seismic controls, including but not limited to the following.
   a. Component operating weight and center of gravity.
   b. Component elevation in the building in relation to the roof elevation (z/h).
   c. Component importance factor (Ip).
   d. For distributed systems, component materials and connection methods.
   e. Component amplification factor (ap) and component response modification factor (Rp), determined in accordance with ASCE 7 tables.
   f. Applicability of overstrength factor (for certain anchorage in concrete and masonry).
2. Include structural calculations, stamped or sealed by seismic controls designer, demonstrating suitability of seismic controls for seismic design forces.

G. Certification for seismically qualified equipment; identify basis for certification.

H. Evaluation Reports: For products specified as requiring evaluation and recognition by a qualified evaluation service, provide current evaluation reports.

I. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

J. Evidence of qualifications for seismic controls designer.

K. Evidence of qualifications for manufacturer.

L. Manufacturer's detailed field testing and inspection procedures.

M. Field quality control test reports.

1.07 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Seismic Controls Designer Qualifications: Registered professional engineer licensed in the State in which the Project is located and with minimum five years experience designing seismic restraints for nonstructural components.

1. Designer may be employed by the manufacturer of the seismic restraint products.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing HVAC equipment and/or HVAC connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:

1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.
3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
4. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

D. Piping Isolation:

1. Provide vibration isolators for piping supports:
   a. Located in equipment rooms.
   b. Located within 50 feet of connected vibration-isolated equipment and pressure-regulating valve (PRV) stations.
   c. For piping over 2 inch located below or within 50 feet of noise-sensitive areas indicated.
2. Minimum Static Deflection:
   a. First Three Supports Closest to Isolated Equipment: Same as static deflection of equipment; maximum of 2 inch deflection required.
   b. Remainder of Supports: 0.75 inch deflection unless otherwise indicated.
3. Suspended Piping, Nonseismic Applications: Use resilient material isolator hangers, spring isolator hangers, or combination resilient material/spring isolator hangers.
4. Suspended Piping, Seismic Applications: Use seismic type resilient material isolator hangers, seismic type spring isolator hangers, or seismic type combination resilient material/spring isolator hangers.
5. Floor-Mounted Piping, Seismic Applications: Use seismic type restrained spring isolators.
6. Use modular seal or approved resilient material where vibration-isolated piping penetrates building elements (e.g., walls, floors) arranged to prevent vibration transmission to structure.

2.02 SEISMIC CONTROL REQUIREMENTS

A. Design and provide HVAC component restraints, supports, and attachments suitable for seismic loads determined in accordance with applicable codes, as well as gravity and operating loads and other structural design considerations of the installed location. Consider wind loads for outdoor HVAC components.

B. Seismic Design Criteria: As indicated on drawings.

C. Component Importance Factor (Ip): HVAC components essential to life safety to be assigned a component importance factor (Ip) of 1.5 as indicated or as required. This includes but is not limited to:

1. HVAC components required to function for life safety purposes after an earthquake.
2. HVAC components that support or otherwise contain hazardous substances.

D. Seismic Qualification of Equipment:

1. Provide special certification for HVAC equipment furnished under other sections and assigned a component importance factor (Ip) of 1.5, certifying that equipment will remain operable following a design level earthquake.
2. Seismic qualification to be by shake table testing in accordance with recognized testing standard procedure, such as ICC-ES AC156, acceptable to authorities having jurisdiction.
3. Notify Architect and obtain direction where mounting restrictions required by conditions of seismic certification conflict with specified requirements.
4. Seismically qualified equipment to be furnished with factory-installed labels referencing certificate of compliance and associated mounting restrictions.

E. Seismic Restraints:

1. Provide seismic restraints for HVAC components except where exempt according to applicable codes and specified seismic design criteria, as approved by authorities having jurisdiction.
2. Seismic Restraint Exemptions:
    a. Exemptions for Seismic Design Category D, E, and F:
        1) HVAC components with component importance factor (Ip) of 1.0 where all of the following apply:
            (a) The component is positively attached to the structure.
            (b) Flexible connections are provided between the component and associated ductwork, piping, and conduit.
            (c) Either:
                (1) The component weighs 400 pounds or less and has a center of mass located 4 feet or less above the adjacent floor level.
                (2) The component weighs 20 pounds or less or, in the case of a distributed system, 5 pounds per foot or less.
        2) HVAC piping with component importance factor (Ip) of 1.0 and nominal pipe size of 3 inch or less, or with component importance factor (Ip) of 1.5 and nominal pipe size of 1 inch or less; exemption does not apply to piping constructed of low-deformability materials (e.g., cast iron, glass, nonductile plastics).
    b. Ductwork Exemptions, All Seismic Design Categories:

1) Ductwork not designed to carry toxic, highly toxic, or flammable gases and not used for smoke control where any of the following apply:
   (a) Trapeze supported ductwork weighing less than 10 pounds per foot.
   (b) Hanger supported ductwork where each hanger in the duct run is 12 inches or less in length from the duct support to the supporting structure; rod hangers, where used, to be equipped with swivels.
   (c) Ductwork having a cross sectional area of less than 6 square feet or weighing 17 pounds per foot or less, and where there are provisions to avoid impact with other ducts or mechanical components or to protect ducts in the event of such impact.

c. HVAC Piping Exemptions, All Seismic Design Categories:
   1) Trapeze supported piping weighing less than 10 pounds per foot, where all pipes supported meet requirements for exemption as single pipes described under specific seismic design category exemptions above.
   2) Hanger supported piping where each hanger in the piping run is 12 inches or less in length from the pipe support to the supporting structure; rod hangers, where used, to be equipped with swivels.

3. Comply with applicable general recommendations of the following, where not in conflict with applicable codes, seismic design criteria, or other specified requirements:
   a. ASHRAE (HVACA).
   b. FEMA 412.
   c. FEMA 413.
   d. FEMA 414.
   e. FEMA E-74.
   f. SMACNA (SRM).
4. Seismic restraint capacities to be verified by a Nationally Recognized Testing Laboratory (NRTL) or certified by an independent third-party registered professional engineer acceptable to authorities having jurisdiction.
5. Seismic Type Vibration Isolators:
   a. Comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
6. External Seismic Snubber Assemblies:
   a. Provide quantity and arrangement of external seismic snubber assemblies as required to restrain equipment in all directions (both lateral and vertical).
   b. Do not use external seismic snubber assemblies that restrain equipment only in one or more lateral directions (but not vertical) except where uplift forces are zero or are addressed by other restraints.
7. Seismic Restraint Systems:
   a. Except where otherwise restricted, use of either cable or rigid restraints is permitted.
   b. Use only cable restraints to restrain vibration-isolated HVAC components, including distributed systems.
   c. Use only one restraint system type for a given HVAC component or distributed system (e.g., ductwork, piping) run; mixing of cable and rigid restraints on a given

component/run is not permitted.

d. Size restraint elements, including anchorage, to resist seismic loads as necessary to restrain HVAC component in all lateral directions; consider bracket geometry in anchor load calculations.
e. Use rod stiffener clips to attach bracing to hanger rods as required to prevent rod buckling from vertical (upward) compressive load introduced by cable or rigid restraints loaded in tension, in excess of downward tensile load due to supported HVAC component weight.
f. Select hanger rods and associated anchorage as required to accommodate vertical (downward) tensile load introduced by rigid restraints loaded in compression, in addition to downward tensile load due to supported HVAC component weight.
g. Clevis hangers may only be used for attachment of transverse restraints; do not use for attachment of longitudinal restraints.
h. Where seismic restraints are attached to clevis hangers, provide clevis bolt reinforcement accessory to prevent clevis hanger deformation.
i. Do not introduce lateral loads on open bar joist chords or the weak axis of beams, or loads in any direction at other than panel points unless approved by project Structural Engineer of Record.
j. Manufacturer's certified seismic restraint design may be submitted as an alternative to project-specific design and documentation, subject to approval of authorities having jurisdiction.

8. Ductwork Applications:
   a. Provide independent support and seismic restraint for in-line components (e.g., fans, heat exchangers, humidifiers) having an operating weight greater than 75 pounds.
   b. Positively attach appurtenances (e.g., dampers, louvers, diffusers) with mechanical fasteners.

F. Seismic Attachments:

1. Attachments to be bolted, welded, or otherwise positively fastened without consideration of frictional resistance produced by the effects of gravity.
2. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) or qualified evaluation service acceptable to authorities having jurisdiction for compliance with applicable building code, and qualified for seismic applications; concrete anchors to be qualified for installation in both cracked and uncracked concrete.
3. Do not use power-actuated fasteners.
4. Do not use friction clips (devices that rely on mechanically applied friction to resist loads). Beam clamps may be used for supporting sustained loads where provided with restraining straps.
5. Comply with anchor minimum embedment, minimum spacing, minimum member thickness, and minimum edge distance requirements.
6. Concrete Housekeeping Pads:
   a. Increase size of pad as required to comply with anchor requirements.

b. Provide pad reinforcement and doweling to ensure integrity of pad and connection and to provide adequate load path from pad to supporting structure.

G. Seismic Interactions:

1. Include provisions to prevent seismic impact between HVAC components and other structural or nonstructural components.
2. Include provisions such that failure of a component, either essential or nonessential, does not cause the failure of an essential component.

H. Seismic Relative Displacement Provisions:

1. Use suitable fittings or flexible connections to accommodate:
   a. Relative displacements at connections between components, including distributed systems (e.g., ductwork, piping); do not exceed load limits for equipment utility connections.
   b. Relative displacements between component supports attached to dissimilar parts of structure that may move differently during an earthquake.
   c. Design displacements at seismic separations.
   d. Anticipated drifts between floors.

2.03 VIBRATION-ISOLATED EQUIPMENT SUPPORT BASES

A. Manufacturers:

1. Vibration-Isolated Equipment Support Bases:
2. Source Limitations: Furnish vibration-isolated equipment support bases and associated components and accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

2.04 VIBRATION ISOLATORS

A. General Requirements:

1. Resilient Materials for Vibration Isolators: Oil, ozone, and oxidant resistant.
2. Spring Elements for Spring Isolators:
   a. Color code or otherwise identify springs to indicate load capacity.
   b. Lateral Stability: Minimum lateral stiffness to vertical stiffness ratio of 0.8.
   c. Designed to operate in the linear portion of their load versus deflection curve over deflection range of not less than 50 percent above specified deflection.
   d. Designed to provide additional travel to solid of not less than 50 percent of rated deflection at rated load.
   e. Selected to provide designed deflection of not less than 75 percent of specified deflection.
   f. Selected to function without undue stress or overloading.
3. Seismic Snubbing Elements for Seismic Isolators:
   a. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
   b. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

B. Vibration Isolators for Nonseismic Applications:

1. Resilient Material Isolator Pads:
   a. Description: Single or multiple layer pads utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material.
   b. Pad Thickness: As required for specified minimum static deflection; minimum 0.25 inch thickness.
   c. Multiple Layer Pads: Provide bonded, galvanized sheet metal separation plate between each layer.
2. Resilient Material Isolator Mounts, Nonseismic:
   a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material; fail-safe type.
3. Open (Unhoused) Spring Isolators:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) without a housing.
   b. Bottom Load Plate: Nonskid, molded, elastomeric isolator material or steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
4. Housed Spring Isolators:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing.
   b. Furnished with integral elastomeric snubbing elements, nonadjustable type, for limiting equipment movement and preventing metal-to-metal contact between housing elements.
   c. Bottom Load Plate: Steel with nonskid, elastomeric isolator pad with provisions for bolting to supporting structure as required.
   d. Furnished with integral leveling device for positioning and securing supported equipment.
5. Restrained Spring Isolators, Nonseismic:
   a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop.
   b. Bottom Load Plate: Steel with nonskid elastomeric isolator pad with provisions for bolting to supporting structure as required.
   c. Furnished with integral leveling device for positioning and securing supported equipment.
   d. Provides constant free and operating height.
6. Resilient Material Isolator Hangers, Nonseismic:
   a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the lower hanger rod connection.

7. Spring Isolator Hangers, Nonseismic:
    a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection.
    b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
8. Combination Resilient Material/Spring Isolator Hangers, Nonseismic:
    a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) or fiberglass isolator material for the upper hanger rod connection.
    b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

C. Vibration Isolators for Seismic Applications:

1. Resilient Material Isolator Mounts, Seismic:
    a. Description: Mounting assemblies for bolting equipment to supporting structure utilizing elastomeric (e.g., neoprene, rubber) isolator material; specifically designed and rated for seismic applications with integral snubbing in all directions.
2. Restrained Spring Isolators, Seismic:
    a. Description: Isolator assembly consisting of single or multiple free-standing, laterally stable steel spring(s) in series with elastomeric (e.g., neoprene, rubber) isolator material within a metal housing designed to prevent movement of supported equipment above an adjustable vertical limit stop; specifically designed and rated for seismic applications with integral snubbing in all directions.
    b. Bottom Load Plate: Steel with provisions for bolting to supporting structure as required.
    c. Furnished with integral leveling device for positioning and securing supported equipment.
    d. Provides constant free and operating height.
3. Resilient Material Isolator Hangers, Seismic:
    a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing elastomeric (e.g., neoprene, rubber) isolator material for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
4. Spring Isolator Hangers, Seismic:
    a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) in series with an elastomeric element for the lower hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
    b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.
5. Combination Resilient Material/Spring Isolator Hangers, Seismic:

a. Description: Isolator assembly designed for installation in hanger rod suspension system utilizing single or multiple free-standing, laterally stable steel spring(s) for the lower hanger rod connection and elastomeric (e.g., neoprene, rubber) isolator material for the upper hanger rod connection; specifically designed and rated for seismic applications with vertical limit stop to prevent upward travel of hanger rod and cushion impact.
b. Designed to accommodate misalignment of bottom hanger rod up to 30 degrees (plus/minus 15 degrees) without short-circuiting of isolation.

2.05 ACOUSTICAL AND VIBRATION ISOLATORS

A. General Requirements:

1. Acoustical Isolation System: Through-stud isolators, pipe clamps, riser clamp pads, neoprene and felt lining material and associated support brackets.

2.06 EXTERNAL SEISMIC SNUBBER ASSEMBLIES

A. Description: Steel snubbing assemblies designed for external attachment to both equipment and supporting structure that, as part of a complete system, restrain equipment motion in all directions during a seismic event while maintaining vibration isolation during normal operation.

B. Seismic Snubbing Elements:

1. Air Gap: Between 0.125 inches and 0.25 inches unless otherwise indicated.
2. Points of Contact: Cushioned with resilient material, minimum 0.25 inch thick; capable of being visually inspected for damage and replaced.

2.07 SEISMIC RESTRAINT SYSTEMS

A. Description: System components and accessories specifically designed for field assembly and attachment of seismic restraints.

B. Cable Restraints:

1. Comply with ASCE 19.
2. Cables: Pre-stretched, galvanized steel wire rope with certified break strength.
3. Cable Connections: Use only swaged end fittings. Cable clips and wedge type end fittings are not permitted in accordance with ASCE 19.
4. Use protective thimbles for cable loops where potential for cable damage exists.

C. Rigid Restraints: Use MFMA-4 steel channel (strut), steel angle, or steel pipe for structural element; suitable for both compressive and tensile design loads.

2.08 VIBRATION-ISOLATED AND/OR SEISMICALLY ENGINEERED ROOF CURBS

A. Manufacturers:

1. Vibration-Isolated and/or Seismically Engineered Roof Curbs:
2. Source Limitations: Furnish vibration-isolated roof curbs and associated accessories produced by the same manufacturer as the vibration isolators and obtained from a single supplier.

B. Vibration Isolation Curbs:

1. Nonseismic Curb Rail:
   a. Location: Between existing roof curb and rooftop equipment.
   b. Construction: Aluminum.
   c. Integral vibration isolation to comply with requirements of this section.
   d. Weather exposed components consist of corrosion resistant materials.
2. Nonseismic Curb:
   a. Location: Between structure and rooftop equipment.
   b. Construction: Aluminum.
   c. Integral vibration isolation to comply with requirements of this section.
   d. Weather exposed components consist of corrosion resistant materials.
3. Seismic Curb:
   a. Location: Between structure and rooftop equipment.
   b. Construction: Steel.
   c. Integral vibration isolation to comply with requirements of this section.
   d. Snubbers consist of minimum 0.25 inch thick resilient pads to avoid metal-to-metal contact without compromising vibration isolating capabilities.
   e. Weather exposed components consist of corrosion resistant materials.

C. Seismic Type Nonisolated Curb and Fabricated Equipment Piers:

1. Location: Between structure and rooftop equipment.
2. Construction: Steel.
3. Weather exposed components consist of corrosion resistant materials.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 CODE-REQUIRED SPECIAL INSPECTIONS

A. Arrange work to accommodate tests and/or inspections performed by Special Inspection Agency employed by Owner or Architect in accordance with Section 01 4533 and statement of special inspections as required by applicable building code.

B. Frequency of Special Inspections: Where special inspections are designated as continuous or periodic, arrange work accordingly.

1. Continuous Special Inspections: Special Inspection Agency to be present in the area where the work is being performed and observe the work at all times the work is in progress.
2. Periodic Special Inspections: Special Inspection Agency to be present in the area where work is being performed and observe the work part-time or intermittently and at the completion of the work.

C. Seismic special inspections include, but are not limited to:

1. Seismically Qualified Equipment: Verification that label, anchorage, and mounting comply with the certificate of compliance.
2. Installation and anchorage of piping systems designed to carry hazardous materials and their associated mechanical units for Seismic Design Categories C, D, E, and F; periodic inspection.
3. Installation and anchorage of ductwork designed to carry hazardous materials for Seismic Design Categories C, D, E and F; periodic inspection.
4. Installation and anchorage of vibration isolation systems for Seismic Design Categories C, D, E, and F where the approved Contract Documents require a nominal clearance of 1/4 inch or less between equipment support frame and seismic restraint; periodic inspection.

D. Prior to starting work, Contractor to submit written statement of responsibility to authorities having jurisdiction and to Owner acknowledging awareness of special requirements contained in the statement of special inspections.

E. Special Inspection Agency services do not relieve Contractor from performing inspections and testing specified elsewhere.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

C. Secure fasteners according to manufacturer's recommended torque settings.

D. Install flexible piping connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

E. Vibration Isolation Systems:

1. Vibration-Isolated Equipment Support Bases:
    a. Provide specified minimum clearance beneath base.
2. Spring Isolators:
    a. Position equipment at operating height; provide temporary blocking as required.
    b. Lift equipment free of isolators prior to lateral repositioning to avoid damage to isolators.
    c. Level equipment by adjusting isolators gradually in sequence to raise equipment uniformly such that excessive weight or stress is not placed on any single isolator.
3. Isolator Hangers:
    a. Use precompressed isolator hangers where required to facilitate installation and prevent damage to equipment utility connection provisions.
    b. Locate isolator hangers at top of hanger rods in accordance with manufacturer's instructions.
4. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.
5. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
6. Adjust isolators to be free of isolation short circuits during normal operation.
7. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

F. Seismic Controls:

1. Provide specified snubbing element air gap; remove any factory-installed spacers, debris, or other obstructions.
2. Use only specified components, anchorage, and hardware evaluated by seismic design. Comply with conditions of seismic certification where applicable.
3. Where mounting hole diameter exceeds bolt diameter by more than 0.125 inch, use epoxy grout, elastomeric grommet, or welded washer to reduce clearance to 0.125 inch or less.
4. Equipment with Sheet Metal Housings:
    a. Use Belleville washers to distribute stress over a larger surface area of the sheet metal connection interface as approved by manufacturer.
    b. Attach additional steel as approved by manufacturer where required to transfer loads to structure.
    c. Where mounting surface is irregular, do not shim housing; reinforce housing with additional steel as approved by manufacturer.
5. Concrete Housekeeping Pads:
    a. Size in accordance with seismic design to meet anchor requirements.

b. Install pad reinforcement and doweling in accordance with seismic design to ensure integrity of pad and associated connection to slab.

6. Seismic Restraint Systems:
   a. Do not attach seismic restraints and gravity supports to dissimilar parts of structure that may move differently during an earthquake.
   b. Install restraints within permissible angles in accordance with seismic design.
   c. Install cable restraints straight between component/run and structural attachment; do not bend around other nonstructural components or structural elements.
   d. Install cable restraints for vibration-isolated components slightly slack to prevent short-circuiting of isolation.
   e. Install hanger rod stiffeners where indicated using only specified clamps; do not weld stiffeners to hanger rod.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect vibration isolation and/or seismic control components for damage and defects.

C. Vibration Isolation Systems:

1. Verify isolator static deflections.
2. Verify vibration isolation performance during normal operation; investigate sources of isolation short circuits.

D. Seismic Controls:

1. Verify snubbing element air gaps.

E. Correct deficiencies and replace damaged or defective vibration isolation and/or seismic control components.

END OF SECTION

SECTION 23 0553
IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Stencils.

D. Pipe markers.

E. Ceiling tacks.

1.02 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

1.03 REFERENCE STANDARDS

A. ASTM D709 - Standard Specification for Laminated Thermosetting Materials 2017.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers catalog literature for each product required.

C. Project Record Documents: Record actual locations of tagged valves.

PART 2 - PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

A. Air Handling Units: Nameplates.

B. Air Terminal Units: Tags.

C. Automatic Controls: Tags. Key to control schematic.

D. Control Panels: Nameplates.

E. Dampers: Ceiling tacks, where located above lay-in ceiling.

F. Ductwork: Nameplates.

G. Piping: Tags.

H. Small-sized Equipment: Tags.

I. Thermostats: Nameplates.

J. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.02 NAMEPLATES

A. Letter Color: White.

B. Letter Height: 1/4 inch.

C. Background Color: Black.

D. Plastic: Comply with ASTM D709.

2.03 TAGS

A. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

B. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.

2.04 STENCILS

A. Stencils: With clean cut symbols and letters of following size:

1. 3/4 to 1-1/4 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 1/2 inch high letters.
2. 1-1/2 to 2 inch Outside Diameter of Insulation or Pipe: 8 inch long color field, 3/4 inch high letters.
3. 2-1/2 to 6 inch Outside Diameter of Insulation or Pipe: 12 inch long color field, 1-1/4 inch high letters.

2.05 PIPE MARKERS

A. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

B. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

C. Color code as follows:

2.06 CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags with corrosion resistant chain.

C. Apply stencil painting in accordance with Section 09 9123.

D. Install plastic pipe markers in accordance with manufacturer's instructions.

E. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

F. Install ductwork with plastic nameplates. Identify with air handling unit identification number and area served. Locate identification at air handling unit, at each side of penetration of structure or enclosure, and at each obstruction.

G. Locate ceiling tacks to locate valves or dampers above lay-in panel ceilings. Locate in corner of panel closest to equipment.

END OF SECTION

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SECTION 23 0593
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic and refrigerating systems.

C. Measurement of final operating condition of HVAC systems.

1.02 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Employment of testing agency and payment for services.

1.03 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition 2016.

B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems 2008, with Errata (2019).

C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems 2015, with Errata (2017).

D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing 2002.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Submit to Architect.
2. Submit six weeks prior to starting the testing, adjusting, and balancing work.

3. Include certification that the plan developer has reviewed Contract Documents, the equipment and systems, and the control system with the Architect and other installers to sufficiently understand the design intent for each system.
4. Include at least the following in the plan:
    a. List of all air flow, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
    b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
    c. Identification and types of measurement instruments to be used and their most recent calibration date.
    d. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
    e. Final test report forms to be used.
    f. Detailed step-by-step procedures for TAB work for each system and issue, including:
        1) Terminal flow calibration (for each terminal type).
        2) Diffuser proportioning.
        3) Branch/submain proportioning.
        4) Total flow calculations.
        5) Rechecking.
        6) Diversity issues.
    g. Expected problems and solutions, etc.
    h. Criteria for using air flow straighteners or relocating flow stations and sensors.
    i. Specific procedures that will ensure that both air are operating at the lowest possible pressures and methods to verify this.
    j. Method of verifying and setting minimum outside air flow rate will be verified and set and for what level (total building, zone, etc.).
    k. Method of checking building static and exhaust fan and/or relief damper capacity.
    l. Time schedule for deferred or seasonal TAB work, if specified.
    m. False loading of systems to complete TAB work, if specified.
    n. Exhaust fan balancing and capacity verifications, including any required room pressure differentials.
    o. Procedures for field technician logs of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests (scope and frequency).
    p. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Field Logs: Submit at least twice a week to the Commissioning Authority.

E. Control System Coordination Reports: Communicate in writing to the controls installer all setpoint and parameter changes made or problems and discrepancies identified during TAB that affect, or could affect, the control system setup and operation.

F. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Revise TAB plan to reflect actual procedures and submit as part of final report.
2. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect and for inclusion in operating and maintenance manuals.
3. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
4. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
5. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.
6. Include the following on the title page of each report:
   a. Name of Testing, Adjusting, and Balancing Agency.
   b. Address of Testing, Adjusting, and Balancing Agency.
   c. Telephone number of Testing, Adjusting, and Balancing Agency.
   d. Project name.
   e. Project location.
   f. Project Architect.
   g. Project Engineer.
   h. Project Contractor.
   i. Report date.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.01 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC (NSTSB), AABC National Standards for Total System Balance.
2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
3. SMACNA (TAB).

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.

D. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
2. Having minimum of three years documented experience.
3. Certified by one of the following:
    a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.
    b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.
    c. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org/#sle.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.
2. Temperature control systems are installed complete and operable.
3. Proper thermal overload protection is in place for electrical equipment.
4. Final filters are clean and in place. If required, install temporary media in addition to final filters.
5. Duct systems are clean of debris.
6. Fans are rotating correctly.
7. Fire and volume dampers are in place and open.
8. Air coil fins are cleaned and combed.
9. Access doors are closed and duct end caps are in place.
10. Air outlets are installed and connected.
11. Duct system leakage is minimized.
12. Hydronic systems are flushed, filled, and vented.
13. Pumps are rotating correctly.
14. Proper strainer baskets are clean and in place.
15. Service and balance valves are open.

B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.

C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

A. Hold a pre-balancing meeting at least one week prior to starting TAB work.

1. Require attendance by all installers whose work will be tested, adjusted, or balanced.

B. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to Architect to facilitate spot checks during testing.

C. Provide additional balancing devices as required.

3.04 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 10 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

A. Field Logs: Maintain written logs including:

1. Running log of events and issues.
2. Discrepancies, deficient or uncompleted work by others.
3. Contract interpretation requests.
4. Lists of completed tests.

B. Ensure recorded data represents actual measured or observed conditions.

C. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

D. Mark on drawings the locations where traverse and other critical measurements were taken and cross reference the location in the final report.

E. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

F. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.06 AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities.

B. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct.

C. Measure air quantities at air inlets and outlets.

D. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

E. Use volume control devices to regulate air quantities only to extend that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

F. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

G. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

H. Measure static air pressure conditions on air supply units, including filter and coil pressure drops, and total pressure across the fan. Make allowances for 50 percent loading of filters.

I. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

J. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

K. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

L. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain approximately 0.05 inches positive static pressure near the building entries.

3.07 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

C. Effect system balance with automatic control valves fully open to heat transfer elements.

D. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

E. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.08 SCOPE

A. Test, adjust, and balance the following:

1. Air Cooled Water Chillers.
2. Air Cooled Refrigerant Condensers.
3. Packaged Roof Top Heating/Cooling Units.
4. Unit Air Conditioners.
5. Terminal Heat Transfer Units.
6. Air Handling Units.
7. Fans.
8. Air Filters.
9. Air Terminal Units.
10. Air Inlets and Outlets.

3.09 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. Air Cooled Condensers:

1. Identification/number.
2. Location.
3. Manufacturer.

4. Model number.
5. Serial number.
6. Entering DB air temperature, design and actual.
7. Leaving DB air temperature, design and actual.
8. Number of compressors.

C. Chillers:

1. Identification/number.
2. Manufacturer.
3. Capacity.
4. Model number.
5. Serial number.
6. Evaporator entering water temperature, design and actual.
7. Evaporator leaving water temperature, design and actual.
8. Evaporator pressure drop, design and actual.
9. Evaporator water flow rate, design and actual.
10. Condenser entering water temperature, design and actual.
11. Condenser pressure drop, design and actual.
12. Condenser water flow rate, design and actual.

D. Return Air/Outside Air:

1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

E. Exhaust Fans:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.

9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.

F. Duct Leak Tests:

1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.
4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
    a. Blower.
    b. Orifice, tube size.
    c. Orifice size.
    d. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

END OF SECTION

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SECTION 23 0713
DUCT INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Duct insulation.

B. Insulation jackets.

1.02 RELATED REQUIREMENTS

A. Section 23 3100 - HVAC Ducts and Casings

1.03 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus 2021.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications 2013 (Reapproved 2019).

C. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation 2014 (Reapproved 2019).

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

E. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.

F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, FLEXIBLE

A. Manufacturer:

B. Insulation: ASTM C553; flexible, noncombustible blanket.

1. K value: 0.36 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 1200 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.

3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Indoor Vapor Barrier Mastic:

1. Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

F. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.03 GLASS FIBER, RIGID

A. Insulation: ASTM C612; rigid, noncombustible blanket.

1. K Value: 0.24 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent.
4. Maximum Density: 8.0 lb/cu ft.

B. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.
2. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
3. Secure with pressure sensitive tape.

C. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

D. Indoor Vapor Barrier Finish:

1. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.04 JACKETS

A. Canvas Jacket: UL listed 6 oz/sq yd plain weave cotton fabric treated with dilute fire retardant lagging adhesive.

1. Lagging Adhesive:
   a. Compatible with insulation.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Test ductwork for design pressure prior to applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Insulated Ducts Conveying Air Below Ambient Temperature:

1. Provide insulation with vapor barrier jackets.
2. Finish with tape and vapor barrier jacket.
3. Continue insulation through walls, sleeves, hangers, and other duct penetrations.
4. Insulate entire system, including fittings, joints, flanges, fire dampers, flexible connections, and expansion joints.

D. Insulated Ducts Conveying Air Above Ambient Temperature:

1. Provide with or without standard vapor barrier jacket.
2. Insulate fittings and joints. Where service access is required, bevel and seal ends of insulation.

E. Ducts Exposed in Mechanical Equipment Rooms or Finished Spaces (below 10 feet above finished floor): Finish with canvas jacket sized for finish painting or aluminum jacket.

F. External Duct Insulation Application:

1. Secure insulation with vapor barrier with wires and seal jacket joints with vapor barrier adhesive or tape to match jacket.
2. Secure insulation without vapor barrier with staples, tape, or wires.
3. Install without sag on underside of duct. Use adhesive or mechanical fasteners where necessary to prevent sagging. Lift duct off trapeze hangers and insert spacers.
4. Seal vapor barrier penetrations by mechanical fasteners with vapor barrier adhesive.
5. Stop and point insulation around access doors and damper operators to allow operation without disturbing wrapping.

3.03 SCHEDULES

A. All supply, outside air, and return air ductwork above ceilings shall be insulated with 2" thick glass fiber duct wrap.

B. The top of all supply grilles shall be insulated with 2" thick glass fiber duct wrap.

C. Ducts Exposed to Outdoors: 2" weather proof rigid board insulation

END OF SECTION

SECTION 23 0719
HVAC PIPING INSULATION

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Jackets and accessories.

1.02 RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping: Placement of hangers and hanger inserts.

B. Section 23 2300 - Refrigerant Piping: Placement of inserts.

1.03 REFERENCE STANDARDS

A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form 2020a.

B. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation 2022.

C. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation 2022.

D. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel 2008 (Reapproved 2018).

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

F. ASTM E96/E96M - Standard Test Methods for Gravimetric Determination of Water Vapor Transmission Rate of Materials 2022.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.07 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 - PRODUCTS

2.01 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, RIGID

A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.

1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.

1. K Value: ASTM C177, 0.24 at 75 degrees F.
2. Maximum Service Temperature: 650 degrees F.
3. Maximum Moisture Absorption: 0.2 percent by volume.

C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

G. Fibrous Glass Fabric:

1. Cloth: Untreated; 9 oz/sq yd weight.
2. Blanket: 1.0 lb/cu ft density.
3. Weave: 5 by 5.

H. Indoor Vapor Barrier Finish:

1. Cloth: Untreated; 9 oz/sq yd weight.
2. Vinyl emulsion type acrylic, compatible with insulation, black color.

I. Outdoor Vapor Barrier Mastic: Vinyl emulsion type acrylic or mastic, compatible with insulation, black color.

2.03 CELLULAR GLASS

A. Pipe and Tubing Insulation: ASTM C552, Type II, Grade 6.

1. K Value: 0.35 at 100 degrees F.
2. Service Temperature Range: From 250 degrees F to 800 degrees F.
3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
4. Water Absorption: 0.5 percent by volume, maximum.
5. Density: A minimum of 6.12 lb/cu ft.

B. Block Insulation: ASTM C552, Type I, Grade 6.

1. K Value: 0.35 at 100 degrees F.
2. Service Temperature: 800 degrees F, maximum.
3. Water Vapor Permeability: 0.005 perm inch maximum per inch.
4. Water Absorption: 0.5 percent by volume, maximum.

2.04 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1; use molded tubular material wherever possible.

1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 180 degrees F.
3. Connection: Waterproof vapor barrier adhesive.

2.05 JACKETS

A. PVC Plastic.

1. Jacket: One piece molded type fitting covers and sheet material, off-white color.

a. Minimum Service Temperature: 0 degrees F.
b. Maximum Service Temperature: 150 degrees F.
c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
d. Thickness: 10 mil.
e. Connections: Brush on welding adhesive.

B. ABS Plastic:

1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
a. Minimum Service Temperature: Minus 40 degrees F.
b. Maximum Service Temperature: 180 degrees F.
c. Moisture Vapor Permeability: 0.012 perm inch, when tested in accordance with ASTM E96/E96M.
d. Thickness: 30 mil.
e. Connections: Brush on welding adhesive.

C. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.

1. Thickness: 0.016 inch sheet.
2. Finish: Smooth.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Test piping for design pressure, liquid tightness, and continuity prior to applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Exposed Piping: Locate insulation and cover seams in least visible locations.

C. Insulated Pipes Conveying Fluids Below Ambient Temperature:

1. Insulate entire system, including fittings, valves, unions, flanges, strainers, flexible connections, pump bodies, and expansion joints.

D. Glass Fiber Insulated Pipes Conveying Fluids Below Ambient Temperature:

1. Provide vapor barrier jackets, factory-applied or field-applied; secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples and vapor barrier mastic.

2. Insulate fittings, joints, and valves with molded insulation of like material and thickness as adjacent pipe. Finish with glass cloth and vapor barrier adhesive or PVC fitting covers.

E. Inserts and Shields:

1. Application: Piping 1-1/2 inches diameter or larger.

F. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with aluminum jacket.

G. Exterior Applications: Provide vapor barrier jacket. Insulate fittings, joints, and valves with insulation of like material and thickness as adjoining pipe, and finish with glass mesh reinforced vapor barrier cement. Cover with aluminum jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

3.03 SCHEDULE

A. Cooling Systems:

1. Chilled Water:
   a. 1" pipe and smaller: 1" i
   b. 1-1/2" to 3" pipe: 1-1/2"
2. Condensate Drains from Cooling Coils: 1"
3. Refrigerant Suction and Liquid: 1"
4. Refrigerant Hot Gas: 1"

END OF SECTION

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SECTION 23 0923
DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 - GENERAL

1.01 ALLOWANCES

A. Contractor shall include a lump sum allowance of $10,000 for integration services. Integration services to include all labor, materials, taxes, overhead and profit, required to integrate HVAC controls at El Dorado Campus (as detailed on “EMS Architecture Riser” (Sheet M401, Detail 1) into the existing Siemen’s system at CARTI Little Rock campus located at 8901 Carti Way, Little Rock, AR 72205. Integration shall include, but not limited to, custom and standard programming, custom floor plan and equipment graphics, custom schedules, and training to enable CARTI staff at Little Rock campus to monitor, control, and receive alarms for the El Dorado facility via their existing Siemens system.

1.02 SECTION INCLUDES

A. System description.

B. Controllers.

C. Power supplies and line filtering.

D. Controller software.

1.03 RELATED REQUIREMENTS

A. Section 23 0913 - Instrumentation and Control Devices for HVAC.

B. Section 23 0993 - Sequence of Operations for HVAC Controls.

C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.04 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. Shop Drawings:

1. Indicate trunk cable schematic showing programmable control unit locations, and trunk data conductors.
2. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration digital media containing graphics.
3. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.
4. Indicate description and sequence of operation of operating, user, and application software.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

F. Operation and Maintenance Data:

1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.
2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.
3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner s name and registered with manufacturer.

1.07 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified and with minimum three years of documented experience.

D. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer's warranty for field programmable micro-processor based units.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Schneider Electric; [_____]: www.schneider-electric.us/#sle.

B. Substitutions: Not Permitted

2.02 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit.

C. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

D. Controls for air valves, reheat coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 0913.

E. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.03 CONTROLLERS

A. Building Controllers:

1. General:
   a. Manage global strategies by one or more, independent, standalone, microprocessor based controllers.
   b. Provide sufficient memory to support controller's operating system, database, and programming requirements.
   c. Share data between networked controllers.
   d. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
   e. Utilize real-time clock for scheduling.
   f. Continuously check processor status and memory circuits for abnormal operation.
   g. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
   h. Communication with other network devices to be based on assigned protocol.
2. Communication:
   a. Controller to reside on a BACnet network using ISO 8802-3 (ETHERNET) Data Link/Physical layer protocol.
   b. Perform routing when connected to a network of custom application and application specific controllers.
   c. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. External Input-Output (I-O) Data Bus:
   a. Universal I-O module (configurable).
   b. Access control module for single door.
   c. Specific wired and wireless data integration modules.
4. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 40 to 150 degrees F.
   b. Conditioned Space:
      1) Mount within dustproof enclosures.
      2) Rated for operation at 32 to 120 degrees F.
5. Provisions for Serviceability:
   a. Diagnostic LEDs for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
6. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
7. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.

b. Perform orderly shutdown below 80 percent of nominal voltage.
c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

B. Custom Application Controller:

1. General:
   a. Provide sufficient memory to support controller's operating system, database, and programming requirements.
   b. Share data between networked, microprocessor based controllers.
   c. Controller operating system manages input and output communication signals allowing distributed controllers to share real and virtual object information and allowing for central monitoring and alarms.
   d. Utilize real-time clock for scheduling.
   e. Continuously check processor status and memory circuits for abnormal operation.
   f. Controller to assume predetermined failure mode and generate alarm notification upon detection of abnormal operation.
   g. Communication with other network devices to be based on assigned protocol.
2. Communication:
   a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
   b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 40 to 150 degrees F.
   b. Conditioned Space:
      1) Mount within dustproof enclosures.
      2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
   a. Diagnostic LED's for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W. at 3 feet.

C. Application Specific Controllers:

1. General:

a. Not fully user programmable, microprocessor based controllers dedicated to control specific equipment.
b. Customized for operation within the confines of equipment served.
c. Communication with other network devices to be based on assigned protocol.

2. Communication:
   a. Controller to reside on a BACnet network using MS/TP Data Link/Physical layer protocol.
   b. Provide service communication port for connection to a portable operator's terminal or hand held device with compatible protocol.
3. Anticipated Environmental Ambient Conditions:
   a. Outdoors and/or in Wet Ambient Conditions:
      1) Mount within waterproof enclosures.
      2) Rated for operation at 40 to 150 degrees F.
   b. Conditioned Space:
      1) Mount within dustproof enclosures.
      2) Rated for operation at 32 to 120 degrees F.
4. Provisions for Serviceability:
   a. Diagnostic LEDs for power, communication, and processor.
   b. Make all wiring connections to field removable, modular terminal strips, or to a termination card connected by a ribbon cable.
5. Memory: In the event of a power loss, maintain all BIOS and programming information for a minimum of 72 hours.
6. Power and Noise Immunity:
   a. Maintain operation at 90 to 110 percent of nominal voltage rating.
   b. Perform orderly shutdown below 80 percent of nominal voltage.
   c. Operation protected against electrical noise of 5 to 120 Hz and from keyed radios up to 5 W at 3 feet.

D. Input/Output Interface:

1. Hardwired inputs and outputs tie into the DDC system through building, custom application, or application specific controllers.
2. All Input/Output Points:
   a. Protect controller from damage resulting from any point short-circuiting or grounding and from voltage up to 24 volts of any duration.
   b. Provide universal type for building and custom application controllers where input or output is software designated as either binary or analog type with appropriate properties.
3. Binary Inputs:
   a. Allow monitoring of On/Off signals from remote devices.
   b. Provide wetting current of 12 mA minimum, compatible with commonly available control devices and protected against the effects of contact bounce and noise.
   c. Sense dry contact closure with power provided only by the controller.
4. Pulse Accumulation Input Objects: Comply with all requirements of binary input objects and accept up to 10 pulses per second.

5. Analog Inputs:
    a. Allow for monitoring of low voltage 0 to 10 VDC, 4 to 20 mA current, or resistance signals (thermistor, RTD).
    b. Compatible with and field configurable to commonly available sensing devices.
6. Binary Outputs:
    a. Used for On/Off operation or a pulsed low-voltage signal for pulse width modulation control.
    b. Outputs provided with three position (On/Off/Auto) override switches.
    c. Status lights for building and custom application controllers to be selectable for normally open or normally closed operation.
7. Analog Outputs:
    a. Monitoring signal provides a 0 to 10 VDC or a 4 to 20 mA output signal for end device control.
    b. Provide status lights and two position (AUTO/MANUAL) switch for building and custom application controllers with manually adjustable potentiometer for manual override on building and custom application controllers.
    c. Drift to not exceed 0.4 percent of range per year.
8. Tri State Outputs:
    a. Coordinate two binary outputs to control three point, floating type, electronic actuators without feedback.
    b. Limit the use of three point, floating devices to the following zone and terminal unit control applications:
    c. Control algorithms run the zone actuator to one end of its stroke once every 24 hours for verification of operator tracking.
9. System Object Capacity:
    a. System size to be expandable to twice the number of input output objects required by providing additional controllers, including associated devices and wiring.
    b. Hardware additions or software revisions for the installed operator interfaces are not to be required for future, system expansions.

2.04 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:

1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.
2. Limit connected loads to 80 percent of rated capacity.
3. Match DC power supply to current output and voltage requirements.
4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.
5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.
6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.
7. Operational Ambient Conditions: 32 to 120 degrees F.

8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD-810 for shock and vibration.
9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:

1. Provide external or internal transient voltage and surge suppression component for all controllers.
2. Minimum surge protection attributes:
   a. Dielectric strength of 1000 volts minimum.
   b. Response time of 10 nanoseconds or less.
   c. Transverse mode noise attenuation of 65 dB or greater.
   d. Common mode noise attenuation of 150 dB or greater at 40 to 100 Hz.

2.05 CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers.

B. System Security:

1. User access secured via user passwords and user names.
2. Passwords restrict user to the objects, applications, and system functions as assigned by the system manager.

C. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

D. Alarms:

1. Binary object is set to alarm based on the operator specified state.
2. Analog object to have high/low alarm limits.
3. All alarming is capable of being automatically and manually disabled.
4. Alarm Reporting:
   a. Operator determines action to be taken for alarm event.
   b. Alarms to be routed to appropriate workstation.

E. Sequencing: Application software based upon specified sequences of operation in Section 23 0993.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that conditioned power supply is available to the control units. Verify that field end devices, and wiring is installed prior to installation proceeding.

3.02 INSTALLATION

A. Install control units and other hardware in position on permanent walls where not subject to excessive vibration.

B. Install software in control units. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 0993.

C. Provide conduit and electrical wiring in accordance with Section 26 0583. Electrical material and installation shall be in accordance with appropriate requirements of Division 26.

3.03 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

END OF SECTION

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SECTION 23 1123
FACILITY NATURAL-GAS PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Pipe, pipe fittings, valves, and connections for natural gas piping systems.

1.02 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.

B. Section 09 9113 - Exterior Painting.

C. Section 09 9123 - Interior Painting.

D. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.

E. Section 22 0548 - Vibration and Seismic Controls for Plumbing Piping and Equipment.

F. Section 22 0719 - Plumbing Piping Insulation.

G. Section 31 2316 - Excavation.

H. Section 31 2323 - Fill.

I. Section 33 5216 - Gas Hydrocarbon Piping.

1.03 REFERENCE STANDARDS

A. ANSI Z21.18/CSA 6.3 - Gas Appliance Pressure Regulators 2019.

B. ANSI Z21.80/CSA 6.22 - Line Pressure Regulators 2019.

C. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

D. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.

E. ASME B31.1 - Power Piping 2020.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service 2019.

H. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube 2016.

I. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings 2016.

J. ICC-ES AC193 - Acceptance Criteria for Mechanical Anchors in Concrete Elements 2015.

K. ICC-ES AC308 - Acceptance Criteria for Post-Installed Adhesive Anchors in Concrete Elements 2016.

L. MSS SP-78 - Gray Iron Plug Valves, Flanged and Threaded Ends 2011.

M. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends 2010, with Errata .

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Welder Certificate: Include welders certification of compliance with ASME BPVC-IX.

D. Project Record Documents: Record actual locations of valves.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.05 QUALITY ASSURANCE

A. Perform work in accordance with applicable codes.

B. Valves: Manufacturer's name and pressure rating marked on valve body.

C. Welding Materials and Procedures: Comply with ASME BPVC-IX and applicable state labor regulations.

D. Welder Qualifications: Certified in accordance with ASME BPVC-IX.

E. Identify pipe with marking including size, ASTM material classification, and ASTM specification.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.07 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 - PRODUCTS

2.01 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A53/A53M, Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A234/A234M, wrought steel welding type.
2. Joints: Threaded or welded to ASME B31.1.

2.02 FLANGES, UNIONS, AND COUPLINGS

A. Unions for Pipe Sizes 3 Inches and Under:

1. Ferrous Pipe: Class 150 malleable iron threaded unions.

B. Flanges for Pipe Size Over 1 Inch:

1. Ferrous Pipe: Class 150 malleable iron threaded or forged steel slip-on flanges; preformed neoprene gaskets.

2.03 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.
2. Overhead Supports: Individual steel rod hangers attached to structure or to trapeze hangers.
3. Trapeze Hangers: Welded steel channel frames attached to structure.

4. Vertical Pipe Support: Steel riser clamp.
5. Floor Supports: Concrete pier or steel pedestal with floor flange; fixture attachment.

B. Hanger Fasteners: Attach hangers to structure using appropriate fasteners, as follows:

1. Concrete Wedge Expansion Anchors: Complying with ICC-ES AC193.
2. Concrete Screw Type Anchors: Complying with ICC-ES AC193.
3. Concrete Adhesive Type Anchors: Complying with ICC-ES AC308.

2.04 BALL VALVES

A. Construction, 4 Inches and Smaller: MSS SP-110, Class 150, 400 psi CWP, bronze or ductile iron body, 304 stainless steel or chrome plated brass ball, regular port, Teflon seats and stuffing box ring, blow-out proof stem, lever handle with balancing stops, solder, threaded, or grooved ends with union.

2.05 PLUG VALVES

A. Construction 2-1/2 Inches and Larger: MSS SP-78, 175 psi CWP, cast iron body and plug, pressure lubricated, Teflon or Buna N packing, flanged or grooved ends. Provide lever operator with set screw.

2.06 STRAINERS

A. Size 2 inch and Under:

1. Threaded brass body for 175 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.
2. Class 150, threaded bronze body 300 psi CWP, Y pattern with 1/32 inch stainless steel perforated screen.

B. Size 1-1/2 inch to 4 inch:

1. Class 125, flanged iron body, Y pattern with 1/16 inch stainless steel perforated screen.

C. Size 5 inch and Larger:

1. Class 125, flanged iron body, basket pattern with 1/8 inch stainless steel perforated screen.

2.07 LINE PRESSURE REGULATORS AND APPLIANCE REGULATORS INDICATORS

A. Compliance Requirements:

1. Appliance Regulator: ANSI Z21.18/CSA 6.3.
2. Line Pressure Regulator: ANSI Z21.80/CSA 6.22.

B. Materials in Contact With Gas:

1. Housing: Aluminum, steel (free of non-ferrous metals).
2. Seals and Diaphragms: NBR-based rubber.

C. Maximum Inlet Operating Pressure: 10 psi.

1. Appliance Regulator: 10 psi.
2. Line Pressure Regulator: 10 psi.

D. Maximum Body Pressure: 10 psi.

E. Output Pressure Range: 1 inch wc to 80 inch wc.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.02 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.03 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

C. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

D. Install piping to maintain headroom, conserve space, and not interfere with use of space.

E. Group piping whenever practical at common elevations.

F. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.

G. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

1. Refer to Section 22 0719.

H. Provide access where valves and fittings are not exposed.

1. Coordinate size and location of access doors with Section 08 3100.

I. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding.

J. Provide support for utility meters in accordance with requirements of utility companies.

K. Prepare exposed, unfinished pipe, fittings, supports, and accessories ready for finish painting.

1. Painting of interior piping systems and components is specified in Section 09 9123.
2. Painting of exterior piping systems and components is specified in Section 09 9113.

L. Excavate in accordance with Section 31 2316.

M. Backfill in accordance with Section 31 2323.

N. Pipe vents from gas pressure reducing valves to outdoors and terminate in weather proof hood.

O. Copper Pipe and Tube: Make soldered joints in accordance with ASTM B828, using specified solder, and flux meeting ASTM B813.

P. Sleeve pipes passing through partitions, walls and floors.

Q. Inserts:

1. Provide inserts for placement in concrete formwork.

R. Pipe Hangers and Supports:

1. Support horizontal piping as indicated.
2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
3. Place hangers within 12 inches of each horizontal elbow.
4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Prime coat exposed steel hangers and supports. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
   a. Painting of interior piping systems and components is specified in Section 09 9123.
   b. Painting of exterior piping systems and components is specified in Section 09 9113.
7. Provide hangers adjacent to motor driven equipment with vibration isolation; refer to Section 22 0548.

3.04 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install brass male adapters each side of valves in copper piped system. Solder adapters to pipe.

C. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers.

D. Install ball valves for throttling, bypass, or manual flow control services.

E. Provide plug valves in natural gas systems for shut-off service.

3.05 SERVICE CONNECTIONS

A. Provide new gas service complete with gas meter and regulators in accordance with Section 33 5216. Gas service distribution piping to have initial minimum pressure of 7 inch wg. Provide regulators on each line serving gravity type appliances, sized in accordance with equipment.

3.06 SCHEDULES

A. Pipe Hanger Spacing:

1. Metal Piping:
   a. Pipe Size: 1/2 inches to 1-1/4 inches:
      1) Maximum Hanger Spacing: 6.5 ft.
      2) Hanger Rod Diameter: 3/8 inches.
   b. Pipe Size: 1-1/2 inches to 2 inches:
      1) Maximum Hanger Spacing: 10 ft.
      2) Hanger Rod Diameter: 3/8 inch.
   c. Pipe Size: 2-1/2 inches to 3 inches:
      1) Maximum Hanger Spacing: 10 ft.
      2) Hanger Rod Diameter: 1/2 inch.

END OF SECTION

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SECTION 23 2113
HYDRONIC PIPING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hydronic system requirements.

B. Chilled water piping, buried.

C. Chilled water piping, above grade.

D. Equipment drains and overflows.

E. Pipe hangers and supports.

F. Unions, flanges, mechanical couplings, and dielectric connections.

G. Valves:

1. Ball valves.
2. Butterfly valves.
3. Check valves.

1.02 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.

B. Section 23 0516 - Expansion Fittings and Loops for HVAC Piping.

C. Section 23 0523 - General-Duty Valves for HVAC Piping.

D. Section 23 0548 - Vibration and Seismic Controls for HVAC.

E. Section 23 0553 - Identification for HVAC Piping and Equipment.

F. Section 23 0719 - HVAC Piping Insulation.

G. Section 23 2114 - Hydronic Specialties.

H. Section 23 2500 - HVAC Water Treatment: Pipe cleaning.

1.03 REFERENCE STANDARDS

A. ASME BPVC-IX - Qualification Standard for Welding, Brazing, and Fuzing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators - Welding Brazing and Fusing Qualifications 2019.

B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300 2021.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings 2021.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

E. ASME B31.9 - Building Services Piping 2020.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless 2020.

G. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service 2019a.

H. ASTM A536 - Standard Specification for Ductile Iron Castings 1984, with Editorial Revision (2019).

I. ASTM B32 - Standard Specification for Solder Metal 2020.

J. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.

K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.

L. ASTM F1476 - Standard Specification for Performance of Gasketed Mechanical Couplings for Use in Piping Applications 2007 (Reapproved 2019).

M. AWWA C606 - Grooved and Shouldered Joints 2015.

N. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation 2018, with Amendment (2019).

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.

C. Product Data:

1. Include data on pipe materials, pipe fittings, valves, and accessories.

2. Provide manufacturers catalog information.
3. Indicate valve data and ratings.
4. Show grooved joint couplings, fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.

D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.

E. Project Record Documents: Record actual locations of valves.

F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Valve Repacking Kits: One for each type and size of valve.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum five years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum three years of experience.

C. Provide all grooved joint couplings, fittings, valves, specialties, and grooving tools from a single manufacturer.

D. Date stamp all castings used for coupling housings, fittings, valve bodies, etc. for quality assurance and traceability.

E. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.08 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

A. Comply with ASME B31.9 and applicable federal, state, and local regulations.

B. Piping: Provide piping, fittings, hangers, and supports as required, as indicated, and as follows:

1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
3. Grooved mechanical joints may be used in accessible locations only.
    a. Accessible locations include those exposed on interior of building, in pipe chases, and in mechanical rooms, aboveground outdoors, and as approved by Architect.
    b. Grooved mechanical connections and joints comply with AWWA C606.
        1) Ductile Iron: Comply with ASTM A536, Grade 65-45-12.
        2) Steel: Comply with ASTM A106/A106M, Grade B or ASTM A53/A53M.
    c. Use rigid joints unless otherwise indicated.
4. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges, unions, or grooved couplings to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:

1. Provide drain valves where indicated, and if not indicated, provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.
2. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.
3. For throttling and isolation service in chilled water systems, use only butterfly valves.
4. In chilled water systems, butterfly valves may be used interchangeably with gate and globe valves.
5. For shut-off and to isolate parts of systems or vertical risers, use gate or butterfly valves.

E. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.02 CHILLED WATER PIPING, BURIED

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A) annealed.

1. Fittings: ASME B16.22, wrought copper.
2. Joints: Solder, lead-free, ASTM B32 HB alloy (95-5 tin-antimony), or tin and silver.
3. Casing: Closed glass cell insulation.

2.03 CHILLED WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), hard drawn; using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22, solder wrought copper fittings.
   a. Solder: ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
2. Grooved Joints: AWWA C606 grooved tube, fittings of same material, and copper-tube-dimension mechanical couplings.
3. Tee Connections: Mechanically extracted collars with notched and dimpled branch tube.

2.04 EQUIPMENT DRAINS AND OVERFLOWS

A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:

1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.
2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type K (A), drawn; using one of the following joint types:

1. Solder Joints: ASME B16.18 cast brass/bronze or ASME B16.22 solder wrought copper fittings; ASTM B32 lead-free solder, HB alloy (95-5 tin-antimony) or tin and silver.
2. Grooved Joints: AWWA C606 grooved pipe, fittings of same material, and mechanical couplings.

2.05 PIPE HANGERS AND SUPPORTS

A. Provide hangers and supports that comply with MSS SP-58.

1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

B. In grooved installations, use rigid couplings with offsetting angle-pattern bolt pads or with wedge-shaped grooves in header piping to permit support and hanging in accordance with ASME B31.9.

2.06 UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Less:

1. Ferrous Piping: 150 psig malleable iron, threaded.

B. Flanges for Pipe 2 Inches and Greater:

1. Ferrous Piping: 150 psig forged steel, slip-on.

C. Mechanical Couplings for Grooved and Shouldered Joints: Two or more curved housing segments with continuous key to engage pipe groove, circular C-profile gasket, and bolts to secure and compress gasket.

1. Dimensions and Testing: In accordance with AWWA C606.
2. Mechanical Couplings: Comply with ASTM F1476.
3. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
4. When pipe is field grooved, provide coupling manufacturer's grooving tools.

D. Dielectric Connections:

1. Waterways:
   a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
   b. Dry insulation barrier able to withstand 600-volt breakdown test.
   c. Construct of galvanized steel with threaded end connections to match connecting piping.
   d. Suitable for the required operating pressures and temperatures.
2. Flanges:
   a. Dielectric flanges with same pressure ratings as standard flanges.
   b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
   c. Dry insulation barrier able to withstand 600-volt breakdown test.
   d. Construct of galvanized steel with threaded end connections to match connecting piping.
   e. Suitable for the required operating pressures and temperatures.

2.07 BUTTERFLY VALVES

A. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck.

B. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, Buna-N encapsulation, or [_____].

C. Operator: 10 position lever handle.

2.08 SWING CHECK VALVES

A. Up To and Including 2 Inches:

1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

B. Over 2 Inches:

1. Iron body, bronze trim, stainless steel or bronze swing disc, renewable disc and seat, flanged or grooved ends.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.

C. Remove scale and dirt on inside and outside before assembly.

D. Prepare piping connections to equipment using jointing system specified.

E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

F. After completion, fill, clean, and treat systems. Refer to Section 23 2500 for additional requirements.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install chilled water piping to ASME B31.9 requirements.

C. Route piping in orderly manner, parallel to building structure, and maintain gradient.

D. Install piping to conserve building space and to avoid interference with use of space.

E. Group piping whenever practical at common elevations.

F. Sleeve pipe passing through partitions, walls, and floors.

G. Slope piping and arrange to drain at low points.

H. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.

I. Grooved Joints:

1. Install in accordance with the manufacturer's latest published installation instructions.

2. Gaskets to be suitable for the intended service, molded, and produced by the coupling manufacturer.

J. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

K. Pipe Hangers and Supports:

1. Install hangers to provide minimum 1/2-inch space between finished covering and adjacent work.
2. Place hangers within 12 inches of each horizontal elbow.
3. Use hangers with 1-1/2 inches minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
4. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

L. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 3100.

M. Use eccentric reducers to maintain top of pipe level.

END OF SECTION

SECTION 23 2300
REFRIGERANT PIPING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Piping.

B. Refrigerant.

C. Moisture and liquid indicators.

D. Valves.

E. Strainers.

F. Check valves.

G. Pressure regulators.

H. Pressure relief valves.

I. Filter-driers.

J. Solenoid valves.

K. Expansion valves.

L. Receivers.

M. Flexible connections.

N. Engineered wall seals and insulation protection.

O. Exterior penetration accessories.

1.02 RELATED REQUIREMENTS

A. Section 08 3100 - Access Doors and Panels.

B. Section 23 0719 - HVAC Piping Insulation.

1.03 REFERENCE STANDARDS

A. AHRI 495 - Performance Rating of Refrigerant Liquid Receivers 2005.

B. AHRI 710 - Performance Rating of Liquid-Line Driers 2009.

C. AHRI 750 - Thermostatic Refrigerant Expansion Valves 2007.

D. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.

E. ASHRAE Std 34 - Designation and Safety Classification of Refrigerants 2019.

F. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2021.

G. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings 2021.

H. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes 2018.

I. ASME B31.5 - Refrigeration Piping and Heat Transfer Components 2020.

J. ASTM B88 - Standard Specification for Seamless Copper Water Tube 2020.

K. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric) 2020.

L. ASTM B280 - Standard Specification for Seamless Copper Tube for Air Conditioning and Refrigeration Field Service 2020.

M. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding 2019.

N. ICC (IMC)-2018 - International Mechanical Code 2018.

O. UL 207 - Standard for Refrigerant-Containing Components and Accessories, Nonelectrical Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide general assembly of specialties, including manufacturers catalogue information. Provide manufacturers catalog data including load capacity.

C. Shop Drawings: Indicate schematic layout of system, including equipment, critical dimensions, and sizes.

D. Test Reports: Indicate results of leak test, acid test.

E. Manufacturer's Installation Instructions: Indicate support, connection requirements, and isolation for servicing.

F. Project Record Documents: Record exact locations of equipment and refrigeration accessories on record drawings.

G. Maintenance Data: Include instructions for changing cartridges, assembly views, spare parts lists.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store piping and specialties in shipping containers with labeling in place.

B. Protect piping and specialties from entry of contaminating material by leaving end caps and plugs in place until installation.

C. Dehydrate and charge components such as piping and receivers, seal prior to shipment, until connected into system.

PART 2 - PRODUCTS

2.01 PIPING

A. Copper Tube: ASTM B280, H58 hard drawn or O60 soft annealed.

1. Fittings: ASME B16.22 wrought copper.
2. Joints: Braze, AWS A5.8M/A5.8 BCuP silver/phosphorus/copper alloy.
3. Mechanical Press Sealed Fittings: Double pressed type complying with UL 207 and ICC (IMC)-2018.

B. Copper Tube to 7/8 inch OD: ASTM B88 (ASTM B88M), Type K (A), annealed.

1. Fittings: ASME B16.26 cast copper.
2. Joints: Flared.

2.02 REFRIGERANT

A. Refrigerant: R410-A as defined in ASHRAE Std 34.

2.03 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 temperature of 200 degrees F and maximum working pressure of 500 psi.

2.04 VALVES

A. Diaphragm Packless Valves:

1. 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:

1. Forged brass or nickel plated forged steel, 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.

C. Ball Valves:

1. Two piece bolted forged brass body with teflon ball seals and copper tube extensions, brass bonnet and seal cap, chrome plated ball, stem with neoprene ring stem seals; for maximum working pressure of 500 psi and maximum temperature of 300 degrees F.

D. Service Valves:

1. Forged brass body with copper stubs, brass caps, removable valve core, integral ball check valve, flared or solder ends, for maximum pressure of 500 psi.

2.05 STRAINERS

A. Straight Line or Angle Line Type:

1. Brass or steel shell, steel cap and flange, and replaceable cartridge, with screen of stainless steel wire or monel reinforced with brass; for maximum working pressure of 430 psi.

B. Straight Line, Non-Cleanable Type:

1. Steel shell, copper plated fittings, stainless steel wire screen, for maximum working pressure of [_____] psi.

2.06 CHECK VALVES

A. Globe Type:

1. 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 temperature of 300 degrees F and maximum working pressure of 425 psi.

B. Straight Through Type:

1. Brass body and disc, phosphor-bronze or stainless steel spring, neoprene seat; for maximum working pressure of 500 psi and maximum temperature of 200 degrees F.

2.07 PRESSURE REGULATORS

A. Brass body, stainless steel diaphragm, direct acting, adjustable over 0 to 80 psi range, for maximum working pressure of 450 psi.

2.08 PRESSURE RELIEF VALVES

A. Straight Through or Angle Type: Brass body and disc, neoprene seat, factory sealed and stamped with ASME UV and National Board Certification NB, selected to ASHRAE Std 15, with standard setting of 235 psi.

2.09 FILTER-DRIERS

A. Performance:

1. Flow Capacity - Liquid Line: [____] ton, minimum, rated in accordance with AHRI 710.
2. Pressure Drop: 2 psi, maximum, when operating at full connected evaporator capacity.
3. Design Working Pressure: 350 psi, minimum.

B. Cores: Molded or loose-fill molecular sieve desiccant compatible with refrigerant, activated alumina, activated charcoal, and filtration to 40 microns, with secondary filtration to 20 microns; of construction that will not pass into refrigerant lines.

C. Construction: UL listed.

1. Connections: As specified for applicable pipe type.

2.10 EXPANSION VALVES

A. Angle or Straight Through Type: AHRI 750; design suitable for refrigerant, brass body, internal or external equalizer, bleed hole, adjustable superheat setting, replaceable inlet strainer, with non-replaceable capillary tube and remote sensing bulb and remote bulb well.

B. Selection: Evaluate refrigerant pressure drop through system to determine available pressure drop across valve. 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.

2.11 RECEIVERS

A. Internal Diameter Over 6 inch:

1. AHRI 495, welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; 400 psi with tappings for liquid inlet and outlet valves, pressure relief valve, and magnetic liquid level indicator.

2.12 EXTERIOR PENETRATION ACCESSORIES

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.

PART 3 EXECUTION

3.01 PREPARATION

A. Ream pipe and tube ends. Remove burrs.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.02 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 avoid interference with use of space.

D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

E. Inserts:

1. Provide inserts for placement in concrete formwork.
2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.

F. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.5.
2. Support horizontal piping as indicated.
3. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
4. Place hangers within 12 inches of each horizontal elbow.
5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Provide copper plated hangers and supports for copper piping.

G. Arrange piping to return oil to compressor. Provide traps and loops in piping, and provide double risers as required. Slope horizontal piping 0.40 percent in direction of flow.

H. Provide clearance for installation of insulation and access to valves and fittings.

I. Provide access to concealed valves and fittings. Coordinate size and location of access doors with Section 08 3100.

J. Insulate piping and equipment; refer to Section and Section 23 0716.

K. Follow ASHRAE Std 15 procedures for charging and purging of systems and for disposal of refrigerant.

L. Install flexible connectors at right angles to axial movement of compressor, parallel to crankshaft.

M. Fully charge completed system with refrigerant after testing.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Test refrigeration system in accordance with ASME B31.5.

C. Pressure test system with dry nitrogen to 200 psi. Perform final tests at 27 inches vacuum and 200 psi using halide torch. Test to no leakage.

3.04 SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch, 5/8 inch, and 7/8 inch OD: Maximum span, 5 feet; minimum rod size, 1/4 inch.
2. 1-1/8 inch OD: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-3/8 inch OD: Maximum span, 7 feet; minimum rod size, 3/8 inch.
4. 1-5/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.
5. 2-1/8 inch OD: Maximum span, 8 feet; minimum rod size, 3/8 inch.

6. 2-5/8 inch OD: Maximum span, 9 feet; minimum rod size, 3/8 inch.

END OF SECTION

SECTION 23 3100
HVAC DUCTS AND CASINGS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Metal ductwork.

B. Duct cleaning.

1.02 RELATED REQUIREMENTS

1.03 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 2020.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate 2014.

D. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric) 2014.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

F. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

H. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual 2012.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for duct materials.

C. Manufacturer's Certificate: Certify that installation of glass fiber ductwork meet or exceed specified requirements.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).

E. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

PART 2 - PRODUCTS

2.01 DUCT ASSEMBLIES

A. Regulatory Requirements: Construct ductwork to comply with NFPA 90A standards.

B. Ducts: Galvanized steel, unless otherwise indicated.

C. Low Pressure Supply (System with Cooling Coils): 1/2 inch w.g. pressure class, galvanized steel.

D. Return and Relief: 1/2 inch w.g. pressure class, galvanized steel.

E. General Exhaust: 1/2 inch w.g. pressure class, galvanized steel.

2.02 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G60/Z180 coating.

B. Aluminum for Ducts: ASTM B209 (ASTM B209M); aluminum sheet, alloy 3003-H14.

Aluminum Connectors and Bar Stock: Alloy 6061-T651 or of equivalent strength.

C. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.
2. VOC Content: Not more than 250 g/L, excluding water.
3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.
4. For Use With Flexible Ducts: UL labeled.

D. Gasket Tape: Provide butyl rubber gasket tape for a flexible seal between transfer duct connector (TDC), transverse duct flange (TDF), applied flange connections, and angle rings connections.

E. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

F. Hanger Fasteners: Attach hangers to structure using appropriate fasteners.

2.03 DUCTWORK FABRICATION

A. Fabricate and support in accordance with SMACNA (DCS) and as indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

D. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

E. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

F. Where ducts are connected to exterior wall louvers and duct outlet is smaller than louver frame, provide blank-out panels sealing louver area around duct. Use same material as duct, painted

black on exterior side; seal to louver frame and duct.

2.04 MANUFACTURED DUCTWORK AND FITTINGS

A. Double Wall Insulated Round Ducts: Round spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.

1. Manufacture in accordance with SMACNA (DCS).
2. Insulation:
    a. Thickness: 1 inch.
    b. Material: Fiberglass.

B. Double Wall Insulated Rectangular Ducts: Rectangular spiral lockseam duct with galvanized steel outer wall, perforated galvanized steel inner wall; fitting with solid inner wall.

1. Manufacture in accordance with SMACNA (DCS).
2. Insulation:
    a. Thickness: 1 inch.
    b. Material: Fiberglass.

C. Round Ducts: Round lockseam duct with galvanized steel outer wall.

1. Manufacture in accordance with SMACNA (DCS).

D. Flexible Ducts: Two ply vinyl film supported by helically wound spring steel wire.

1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.
2. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.
3. Maximum Velocity: 4000 fpm.
4. Temperature Range: Minus 10 degrees F to 160 degrees F.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Flexible Ducts: Connect to metal ducts with adhesive.

E. Duct sizes indicated are inside clear dimensions. For lined ducts, maintain sizes inside lining.

F. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

G. Use crimp joints with or without bead for joining round duct sizes 8 inch and smaller with crimp in direction of air flow.

H. Use double nuts and lock washers on threaded rod supports.

I. Connect diffusers or light troffer boots to low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with strap or clamp.

J. At exterior wall louvers, seal duct to louver frame and install blank-out panels.

3.02 CLEANING

A. Clean duct systems with high power vacuum machines. Protect equipment that could be harmed by excessive dirt with filters, or bypass during cleaning. Provide adequate access into ductwork for cleaning purposes.

END OF SECTION

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SECTION 23 3300
AIR DUCT ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Backdraft dampers - metal.

B. Duct test holes.

C. Flexible duct connectors.

D. Volume control dampers.

E. Miscellaneous products:

1. Damper operators.
2. Duct opening closure film.

1.02 RELATED REQUIREMENTS

A. Section 23 3100 - HVAC Ducts and Casings.

B. Section 25 3513 - Integrated Automation Actuators and Operators: Damper operators.

C. Section 25 3523 - Integrated Automation Control Dampers: Product furnishing.

1.03 REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating 2018.

B. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

C. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems 2021.

D. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

C. Project Record Drawings: Record actual locations of access doors and test holes.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Fusible Links: One of each type and size.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 - PRODUCTS

2.01 BACKDRAFT DAMPERS - METAL

A. Gravity Backdraft Dampers, Size 24 by 24 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

2.02 DUCT TEST HOLES

A. Temporary Test Holes: Cut or drill in ducts as required. Cap with neat patches, neoprene plugs, threaded plugs, or threaded or twist-on metal caps.

2.03 FLEXIBLE DUCT CONNECTORS

A. Fabricate in accordance with SMACNA (DCS) and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.
   a. Net Fabric Width: Approximately 2 inches wide.
2. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

2.04 VOLUME CONTROL DAMPERS

A. Products furnished per Section 25 3523.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Splitter Dampers:

1. Material: Same gage as duct to 24 inches size in either direction, and two gages heavier for sizes over 24 inches.
2. Blade: Fabricate of single thickness sheet metal to streamline shape, secured with continuous hinge or rod.

3. Operator: Minimum 1/4 inch diameter rod in self aligning, universal joint action, flanged bushing with set screw .

D. Single Blade Dampers:

1. Fabricate for duct sizes up to 6 by 30 inch.
2. Blade: 24 gage, 0.0239 inch, minimum.

E. Multi-Blade Damper: Fabricate of opposed blade pattern with maximum blade sizes 8 by 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

F. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon, thermoplastic elastomer, or sintered bronze bearings.

G. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.
2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

2.05 MISCELLANEOUS PRODUCTS

A. Damper manual operators furnished per Section 25 3513.

B. Duct Opening Closure Film: Mold-resistant, self-adhesive film to keep debris out of ducts during construction.

1. Thickness: 2 mils.
2. High tack water based adhesive.
3. UV stable light blue color.
4. Elongation Before Break: 325 percent, minimum.

PART 3 - EXECUTION

3.01 PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.02 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.

B. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

C. Provide duct test holes where indicated and required for testing and balancing purposes.

D. At fans and motorized equipment associated with ducts, provide flexible duct connections immediately adjacent to the equipment.

E. At equipment supported by vibration isolators, provide flexible duct connections immediately adjacent to the equipment.

F. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

G. Use splitter dampers only where indicated.

H. Provide balancing dampers on duct take-off to diffusers, grilles, and registers, regardless of whether dampers are specified as part of the diffuser, grille, or register assembly.

END OF SECTION

SECTION 23 3416
CENTRIFUGAL HVAC FANS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Forward curved centrifugal fans.

B. Bearings and drives.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 23 0548 - Vibration and Seismic Controls for HVAC.

B. Section 23 0713 - Duct Insulation.

C. Section 23 3300 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings 2015 (Reaffirmed 2020).

B. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.

C. AMCA 99 - Standards Handbook 2016.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.

G. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible 2021.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on centrifugal fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels for both fan inlet and

outlet at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Include complete installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Fan Belts: One set for each individual fan.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Protect motors, shafts, and bearings from weather and construction dust.

1.07 FIELD CONDITIONS

A. Permanent fans may not be used for ventilation during construction.

PART 2 PRODUCTS

2.01 PERFORMANCE REQUIREMENTS

A. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

B. Sound Ratings: AMCA 301, tested to AMCA 300, and bear AMCA Certified Sound Rating Seal.

C. Fabrication: Comply with AMCA 99.

D. Performance Base: Sea level conditions.

E. Temperature Limit: Maximum 300 degrees F.

F. Static and Dynamic Balance: Eliminate vibration or noise transmission to occupied areas.

2.02 WHEEL AND INLET

A. Forward Curved: Galvanized steel construction with inlet flange, back plate, shallow blades with inlet and tip curved forward in direction of airflow, mechanically secured to flange and back plate; steel hub swaged to back plate and keyed to shaft with set screw.

2.03 HOUSING

A. Heavy gage steel, spot welded for AMCA 99 Class I and II fans, and continuously welded for Class III, adequately braced, designed to minimize turbulence with spun inlet bell and shaped cut.

2.04 BEARINGS AND DRIVES

A. Bearings: Heavy duty pillow block type, selfgreasing ball bearings, with ABMA STD 9 life at 50,000 hours.

B. Shafts: Hot rolled steel, ground and polished, with keyway, protectively coated with lubricating oil, and shaft guard.

C. Drive: Cast iron or steel sheaves, dynamically balanced, keyed. Variable and adjustable pitch sheaves for motors 15 hp and under, selected so required rpm is obtained with sheaves set at mid Fixed sheave for 20 hp and over, matched belts, and drive rated as recommended by manufacturer or minimum 1.5 times nameplate rating of the motor.

2.05 ACCESSORIES

A. Discharge Dampers: Parallel blade heavy duty steel damper assembly with blades constructed of two plates formed around and welded to shaft, channel frame, sealed ball bearings, with blades linked out of air stream to single control lever.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flexible connections between fan inlet and discharge ductwork; refer to Section 23 3300. Ensure metal bands of connectors are parallel with minimum one inch flex between ductwork and fan while running.

C. Install fan restraining snubbers; refer to Section 23 0548. Adjust snubbers to prevent tension in flexible connectors when fan is operating.

D. Provide fixed sheaves required for final air balance.

E. Provide backdraft dampers on discharge of exhaust fans and as indicated; refer to Section 23 3300.

END OF SECTION

SECTION 23 3423
HVAC POWER VENTILATORS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Roof exhausters.

B. Upblast roof exhausters.

1.02 RELATED REQUIREMENTS

A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.

B. Section 23 0548 - Vibration and Seismic Controls for HVAC.

C. Section 23 3300 - Air Duct Accessories: Backdraft dampers.

1.03 REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program 2015.

B. AMCA 99 - Standards Handbook 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans 2020.

D. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating 2016.

E. AMCA 300 - Reverberant Room Method for Sound Testing of Fans 2014.

F. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data 2014.

G. ANSI Z9.5 - Laboratory Ventilation 2022.

H. UL 705 - Power Ventilators Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and

electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.06 FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

PART 2 - PRODUCTS

2.01 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Comply with AMCA 99.

E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.02 ROOF EXHAUSTERS

A. Fan Unit: V-belt or direct driven as indicated, with spun aluminum housing; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb

with continuous curb gaskets.

B. Roof Curb: 8 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

C. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

D. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.03 UPBLAST ROOF EXHAUSTERS

A. Direct Drive Fan:

1. Fan Wheel:
   a. Type: Non-overloading, backward inclined centrifugal.
   b. Material: Aluminum.
2. Statically and dynamically balanced.
3. Motors:
   a. Open drip-proof (ODP).
   b. Heavy duty ball bearing type.
   c. Mount on vibration isolators or resilient cradle mounts, out of air stream.
   d. Fully accessible for maintenance.
4. Housing:
   a. Construct of heavy gage aluminum including curb cap, windband, and motor compartment.
   b. Rigid internal support structure.
   c. One-piece fabricated or fully welded curb-cap base to windband for leak proof construction.
   d. Construct drive frame assembly of heavy gage steel, mounted on vibration isolators.
   e. Provide breather tube for fresh air motor cooling and wiring.

B. Shafts and Bearings:

1. Fan Shaft:
   a. Ground and polished steel with anti-corrosive coating.
   b. First critical speed at least 25 percent over maximum cataloged operating speed.
2. Bearings:
   a. Permanently sealed or pillow block type.

b. Minimum L10 life in excess of 100,000 hours (equivalent to L50 average life of 500,000 hours), at maximum cataloged operating speed.
c. 100 percent factory tested.

C. Drive Assembly:

1. Belts, pulleys, and keys oversized for a minimum of 150 percent of driven horsepower.
2. Belts: Static free and oil resistant.
3. Fully machined cast iron type, keyed and securely attached to the wheel and motor shafts.
4. Motor pulley adjustable for final system balancing.
5. Readily accessible for maintenance.

D. Roof Curb: 8 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, curb bottom, ventilated double wall, and factory installed nailer strip.

E. Drain Trough: Allows for single-point drainage of water, grease, and other residues.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure roof exhausters with cadmium plated steel lag screws to roof curb.

C. Extend ducts to roof exhausters into roof curb. Counterflash duct to roof opening.

END OF SECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Single-duct terminal units.

1. Single-duct, variable-volume units.

1.02 REFERENCE STANDARDS

A. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addendum (2011).

B. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2017.

C. ASHRAE Std 130 - Methods of Testing Air Terminal Units; 2016.

D. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2019).

E. ASTM A603 - Standard Specification for Metallic-Coated Steel Structural Wire Rope; 2019.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

J. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.

D. Certificates: Certify that coils are tested and rated in accordance with AHRI 410.

E. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

F. Project Record Documents: Record actual locations of units and locations of access doors required for access of valving.

G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant-volume regulators.

H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.05 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for air terminal units.

PART 2 PRODUCTS

2.01 SINGLE-DUCT, VARIABLE-VOLUME AND CONSTANT-VOLUME UNITS

A. General:

1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.
2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

B. Unit Casing:

1. Minimum 22 gage, 0.0299 inch galvanized steel.
   a. Assembled with longitudinal lock seam construction.
   b. Casing leakage to meet ASHRAE Std 130.
2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
3. Unit Discharge: Rectangular, with slip-and-drive connections.
4. Acceptable Liners:
   a. 3/4 inch thick polyurethane foam adhesive complying with UL 181 erosion requirements in accordance with ASHRAE Std 62.1, and having a maximum smoke developed index of 50 for both insulation and adhesive, when tested in accordance with ASTM E84.
   b. Liner not to contain pentabrominated diphenyl ether (CAS #32534-81-9) or octabrominated diphenyl ether.

C. Damper Assembly:

1. Heavy-gage, galvanized steel or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.
2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.
3. Incorporate low leak damper blades for tight airflow shutoff.

D. Electric Heating Coil:

1. Listed and provided by the terminal unit manufacturer.
2. Heating Elements: Nickel chrome, supported by ceramic insulators.
3. Integral Control Panel: NEMA 250, Type 2 enclosure with hinged access door for access to all controls and safety devices.
4. Furnish a primary automatic reset thermal cutout and differential pressure airflow switch for proof of airflow.
5. Provide the following additional components, mounted and/or wired within the control enclosure:
   a. Fused or non-fused door interlocking disconnect switch.
   b. Mercury contactors.
   c. Fuse block.
6. Factory wired, including all limit switches and steps of control as indicated on the equipment schedule, with the SSR (solid-state relay) proportional heat control.

7. Provide SCR (Silicon Controlled Rectifier) controller.

E. Electrical Requirements:

1. Single-point power connection.
2. Equipment wiring to comply with requirements of NFPA 70.

F. Controls:

1. DDC (Direct-Digital Controls):
   a. Bi-directional Damper Actuator: 24 volt, powered closed, spring return open.
   b. Microprocessor-Based Controller: Air volume controller, pressure-independent with electronic airflow transducers, factory-calibrated maximum and minimum CFM's.
      1) Occupied and unoccupied operating mode.
      2) Remote reset of temperature or CFM set points.
      3) Proportional, plus integral control of room temperature.
      4) Monitoring and adjusting with portable terminal.
   c. Room Sensor:
      1) Compatible with temperature controls specified.
      2) Wall-mounted, system powered, with temperature set-point adjustment including connection access for portable operator terminal.
2. Control Sequence:
   a. Suitable for operation with duct pressures between 0.25 and 3.0 inch wg inlet static pressure.
   b. Include factory-mounted and piped, 5-micron filter; and adjustable, velocity-resetting, high-limit control with amplifying relay.
   c. See Section 23 0993.

PART 3 EXECUTION

3.01 EXAMINATION

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.

C. See drawings for the size(s) and duct location(s) of the air terminal units.

D. Provide ceiling access doors or locate units above easily removable ceiling components.

E. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.

F. Do not support from ductwork.

G. Connect to ductwork in accordance with Section 23 3100.

H. Provide strait line of ductwork downstream of units as recommended by manufacturer.

I. Install heating coils in accordance with Section 23 8200.

J. Verify that electric power is available and of the correct characteristics.

3.03 ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to zero percent full flow. Set units with heating coils for minimum 50 percent full flow.

END OF SECTION

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SECTION 23 3700
AIR OUTLETS AND INLETS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Diffusers: ceiling and wall mounted

1. Critical environment diffusers.

B. Registers/grilles: ceiling and wall mounted

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials 2022.

B. ISO 14644-1 - Cleanrooms and Associated Controlled Environments - Part 1: Classification of Air Cleanliness by Particle Concentration 2015.

C. UL 2518 - Standard for Safety Air Dispersion Systems Current Edition, Including All Revisions.

D. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials Current Edition, Including All Revisions.

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.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 PRODUCTS

2.01 CRITICAL ENVIRONMENTS DIFFUSERS

A. General Requirements:

1. Diffuser material to comply with ASTM E84, UL 723, UL 2518, NFPA 90A, and NFPA 90B.
2. Fabrics to comply with ISO 14644-1 for ISO Class 4 application (clean room, non-shedding material).

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to comply with architectural features, symmetry, and lighting arrangement.

C. Install diffusers to ductwork with air tight connection.

D. Provide balancing dampers on duct take-off to diffusers, and grilles and registers, despite whether dampers are specified as part of the diffuser, or grille and register assembly.

END OF SECTION

SECTION 23 6423
SCROLL WATER CHILLERS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Factory-assembled packaged chiller.

B. Charge of refrigerant and oil.

C. Controls and control connections.

D. Chilled water connections.

E. Electrical power connections.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete housekeeping pads.

B. Section 23 2113 - Hydronic Piping.

C. Section 23 2114 - Hydronic Specialties.

D. Section 26 0583 - Wiring Connections.

1.03 REFERENCE STANDARDS

A. AHRI 550/590 (I-P) - Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle 2020.

B. ASHRAE Std 15 - Safety Standard for Refrigeration Systems 2019, with All Amendments and Errata.

C. ASHRAE Std 90.1 I-P - Energy Standard for Buildings Except Low-Rise Residential Buildings Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels 2021.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

F. UL 1995 - Heating and Cooling Equipment Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide rated capacities, weights, specialties and accessories, electrical requirements and wiring diagrams.

PART 2 PRODUCTS

2.01 CHILLER APPLICATIONS

A. Chiller: Air-Cooled, see mechanical schedules.

1. Evaporator:
   a. Water Based Fouling Factor: 0.00010 sq ft hr degrees F per Btu.

2.02 CHILLERS

A. Chillers: Factory assemble and test chiller consisting of compressor(s), compressor motor(s), evaporator, condenser, enclosure, refrigeration circuits(s) and specialties, interconnecting piping, starters, and microprocessor-based controls.

1. Rating: AHRI 550/590 (I-P).
2. Safety: UL 1995 and ASHRAE Std 15.
3. Construction & Testing: ASME BPVC-VIII-1 as applicable for construction type.
4. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., testing firm acceptable to the Authority Having Jurisdiction, or [_____] as suitable for the purpose specified and indicated.
5. Energy Efficiency: ASHRAE Std 90.1.
6. Enclosures:
   a. Frame:
      1) Heavy-gauge steel.
      2) Factory apply hot-dipped galvanized or air-dried paint finish.
   b. Steel Chiller Cabinets:
      1) Factory apply baked on enamel, baked on powder paint, or [_____] finish.
   c. Electrical Equipment: NEMA 250 or UL 1995 as applicable.

2.03 COMPRESSORS AND EVAPORATOR

A. Compressors: Hermetic Compliant scroll type.

1. Unit: Fully hermetic type with single, direct drive compressors with discharge, suction, and shut-off service valves.
2. Vibration Control: Factory installed internal isolators or field installed external isolators.
3. Oil Lubrication System: Initial oil charge, oil sump, heater, oil level, and sight glass.

4. Capacity Reduction System: Compressor staging with control down to 12 percent of full load without the activation of hot gas by-bass.
5. Motor: 3600 rpm, suction gas-cooled, with thermal overload protection.

B. Evaporator: Provide brazed plate type.

1. Brazed plate type.
   a. Plate Material: 316 stainless steel.
   b. Refrigerant Working-Side Pressure Rating: 430 psig minimum.
   c. Water Working-Side Pressure Rating: 150 psig minimum.
   d. Provide with flanged or grooved connections.
   e. Insulation for all cold surfaces.
      1) Insulation is factory or field installed on evaporator, connections, suction piping, and [_____].
      2) 0.75 inches minimum thick, closed cell, expanded Armaflex II insulation with a maximum k value of 0.28.
   f. Provide factory installed vents and water drain connections on evaporator or piping.
   g. Provide factory or field installed fittings for temperature control sensors on evaporator, piping, or [_____].
   h. Freeze Protection for Outdoor Locations: Provide thermostatically controlled electric heater to protect from freezing at ambient temperatures down to minus 20 degrees F.

2.04 AIR-COOLED CONDENSER AND FANS

A. Provide brazed one-piece type.

1. Finned-tube type.
   a. Mechanically bond aluminum fins to copper tubing and protect with corrosion resistant materials or coatings.
   b. Clean, dehydrate and test.
   c. Leak Test: 650 psig minimum.
2. Brazed one-piece type.
   a. Construct of same material to avoid galvanic corrosion.
   b. Braze coils and headers as one assembly.
   c. Clean, dehydrate and test.
   d. Leak Test: 650 psig minimum.
3. Flat tube-plate-manifold type.
   a. Construct all components of same aluminum alloy to avoid galvanic corrosion.
   b. Braze manifolds, flat tubes and fin-plates together to form single coil assembly.
   c. Clean, dehydrate and test.
   d. Leak Test: 656 psig minimum.

B. Coil Guards: Provide corrosion proof, louvered panels, heavy gauge wire panels, grilles, or [_____], factory installed. Provide coil protection for shipping by enclosing entire condenser coil with heavy plastic to prevent coil damage during shipping or rigging.

C. Fans and Motors:

1. Fans: Dynamically balance shrouded-axial type fans of reinforced polymer, glass fiber reinforced composite, or [_____] corrosion resistant construction equipped with sealed, permanently lubricated ball bearings.
2. Discharge Fan Guards: Corrosion resistant, heavy gauge, steel wire.
3. Discharge Direction: Vertical.
4. Motors: Direct drive, totally enclosed for outdoor use with current overload protection.

2.05 REFRIGERATION CIRCUITS

A. Provide multiple independent refrigeration circuit(s) with multiple or one compressor(s) per circuit.

B. Provide liquid line shut-off valve, filter-drier, expansion valve, and refrigerant relief device for each independent circuit.

2.06 INTEGRATED MICROPROCESSOR BASED DDC CONTROLS PACKAGE

A. Pre-wire, assemble, factory mount, and test operating and safety control system consisting of a digital display or gauges, on-auto-off switch, motor starters, disconnect switches, power and control wiring. Provide controls, monitoring, programmable set-points, alarms, and BAS as defined below:

1. Chillers serving imaging equipment shall be controlled and operated per the imaging equipment instructions.
2. Building Automation System (BAS) Communications via Shielded Cable:
   a. Minimum Data Transmission to BAS:
      1) All system operating conditions.
      2) Capacity control information.
      3) Safety shutdown conditions.
   b. Minimum Operating Commands from BAS:
      1) Remote unit start/stop.
      2) Remote chilled water reset.

PART 3 EXECUTION

3.01 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Align chiller package on steel or concrete foundations.

C. Install units on vibration isolators.

D. Connect to electrical service.

E. Connect to chilled water piping.

F. Arrange piping for easy dismantling to permit tube cleaning and removal.

END OF SECTION

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PART 1 GENERAL

1.01 SECTION INCLUDES

A. Packaged, rooftop air-conditioning units.

B. Packaged, intermediate-capacity, rooftop air-conditioning units.

1.02 RELATED REQUIREMENTS

A. Section 23 0548 - Vibration and Seismic Controls for HVAC.

1.03 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Shop Drawings: Indicate capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements, and include start-up instructions.

E. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, installation instructions, maintenance and repair data, and parts listing.

F. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.04 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.05 DELIVERY, STORAGE, AND HANDLING

A. Protect units from physical damage by storing off site until roof mounting curbs are in place and ready for immediate installation of units.

1.06 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide a five year warranty to include coverage for refrigeration compressors.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aaon

2.02 PACKAGED, INTERMEDIATE-CAPACITY, ROOFTOP AIR-CONDITIONING UNITS

A. General: Roof mounted units having _____ electric refrigeration that are 7.5 tons to 25 tons in capacity.

B. Description: Self-contained, packaged, factory assembled and prewired, consisting of cabinet and frame, supply fan, controls, air filters, refrigerant cooling coil and compressor, condenser coil and condenser fan.

2.03 CASING

A. Cabinet: Galvanized steel with baked enamel finish, including access panels with screwdriver-operated flush, cam type fasteners. Double wall with R-13 Foam Insulation

2.04 FANS

A. Supply Fan: Direct drive backward curved steel, and rubber isolated hinge mounted. Provide with high efficiency motor or direct drive as indicated and VFD. Isolate complete fan assembly. See Section 23 0548.

2.05 EVAPORATOR COIL

A. Provide copper tube aluminum fin coil assembly with galvanized drain pan and connection.

B. Provide capillary tubes or thermostatic expansion valves for units of 6 tons capacity and less, and thermostatic expansion valves and alternate row circuiting for units 7.5 tons cooling capacity and larger.

2.06 CONDENSER COIL

A. Microchannel Air-Cooled and coil guard.

B. Provide direct drive propeller fans, resiliently mounted with fan guard, motor overload protection, wired to operate with compressor.VFD Condensor Fan Head Pressure Control _____ .

2.07 COMPRESSORS

A. Provide Variable Capacity Scroll _____ compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gauge ports, and filter drier.

2.08 AIR FILTERS:

A. 1-inch thick, permanent washable. MERV 13

2.09 OPERATING CONTROLS - VARIABLE VOLUME UNITS

A. Temperature transmitter located in supply air to signal electronic logic panel to control mixing dampers and cooling in sequence. Mixing section to operate as first stage of cooling and revert to minimum outside air above approximately 75 degrees F as determined by enthalpy of return and outdoor air.

2.10 ROOF CURBS

A. Roof Mounting Curb: 14 inches high, galvanized steel, channel frame with gaskets, nailer strips.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as required by manufacturer.

B. Verify that proper power supply is available.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services. Install roof mounting curb level.

3.03 SYSTEM STARTUP

A. Prepare and start equipment. Adjust for proper operation.

END OF SECTION

SECTION 26 0000
SUPPLEMENTARY ELECTRICAL GENERAL CONDITIONS

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections, apply to this Section.

1.02 SUMMARY

A. Section includes supplementary general requirements for the following:

1. Codes and Standards
2. Conflicting Requirements
3. Specifications and Drawing Conventions
4. Phased Construction
5. Coordination with Occupants
6. Work Restrictions
7. Fees, Permits, and Inspection
8. Submittals
9. Warranties
10. Electrical License Requirement
11. Operation and Maintenance Manuals
12. Demolition, Salvage, and Waste
13. General Coordination for Electrical Work
14. Cutting and Patching
15. Excavation and Trenching
16. Painting
17. Continuity Tests
18. Connection Torque Tests
19. Mechanical Operation Tests
20. Rotational Tests

1.03 DEFINITIONS

A. "Approved": When used to convey Engineer's action on Contractor's submittals, applications, and requests, "approved" is limited to Engineer's duties and responsibilities as stated in the Conditions of the Contract.

B. "Directed": A command or instruction by Engineer. Other terms including "requested," "authorized," "selected," "required," and "permitted" have the same meaning as "directed."

C. "Indicated": Requirements expressed by graphic representations or in written form on Drawings, in Specifications, and in other Contract Documents. Other terms including "shown," "noted," "scheduled," and "specified" have the same meaning as "indicated."

D. "Regulations": Laws, ordinances, statutes, and lawful orders issued by authorities having jurisdiction, and rules, conventions, and agreements within the construction industry that control performance of the Work.

E. "Furnish": Supply and deliver to Project site, ready for unloading, unpacking, assembly, installation, and similar operations.

F. "Install": Operations at Project site including unloading, temporarily storing, unpacking, assembling, erecting, placing, anchoring, applying, working to dimension, finishing, curing, protecting, cleaning, and similar operations.

G. "Provide": Furnish and install, complete and ready for the intended use.

H. "Project Site": Space available for performing construction activities. The extent of Project site is shown on Drawings and may or may not be identical with the description of the land on which Project is to be built.

I. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term "product" includes the terms "material," "equipment," "system," and terms of similar intent.

J. Basis-of-Design Product: A product in which a specific manufacturer's product is named on the drawings or is accompanied by the words "basis-of-design product" in the specifications, including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional

manufacturers named in the specification.

K. Action Submittals: Written and graphic information and physical samples that require Engineer's responsive action. Action submittals are those submittals indicated in individual Specification Sections as "action submittals."

L. Informational Submittals: Written and graphic information and physical samples that do not require Engineer's responsive action. Submittals may be rejected for not complying with requirements. Informational submittals are those submittals indicated in individual Specification Sections as "informational submittals."

M. Construction Waste: Building and site improvement materials and other solid waste resulting from construction, remodeling, renovation, or repair operations. Construction waste includes packaging.

N. Demolition Waste: Building and site improvement materials resulting from demolition or selective demolition operations.

O. Disposal: Removal off-site of demolition and construction waste and subsequent sale, recycling, reuse, or deposit in landfill or incinerator acceptable to authorities having jurisdiction.

P. Salvage: Recovery of demolition or construction waste and subsequent sale or reuse in another facility.

Q. Salvage and Reuse: Recovery of demolition or construction waste and subsequent incorporation into the Work.

R. System: An organized collection of parts, equipment, or subsystems united by regular interaction.

S. Cutting: Removal of in-place construction necessary to permit installation or performance of other work.

T. Patching: Fitting and repair work required to restore construction to original conditions after installation of other work.

1.04 CODES, STANDARDS, AND REFERENCES

A. The **latest applicable edition** of specifications and standards of issues listed below but referred to thereafter by basic designation only, form a part of these specifications:

1. National Electrical Code
2. National Fire Protection Association's Recommended Practices
3. Local, City & State Codes & Ordinances
4. National Electrical Safety Code
5. Underwriter's Laboratories, Inc.
6. Illumination Engineering Society
7. Insulated Power Cable Engineers Association
8. National Electrical Manufacturers Association
9. Earthquake Requirement of the International Building Code
10. American Society for Testing Materials
11. Occupational Safety & Health Act
12. Service requirements of serving utility company
13. Americans with Disabilities Act (ADA)
14. ASHRAE / IESNA Standard 90.1
15. Arkansas Energy Code

1.05 CONFLICTING REQUIREMENTS

A. Conflicting requirements: If compliance with standards, codes, regulations, and specifications establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Engineer for a decision before proceeding.

1.06 SPECIFICATION AND DRAWING CONVENTIONS

A. Specification Content: The Specifications use certain conventions for the style of language and the intended meaning of certain terms, words, and phrases when used in particular situations. These conventions are as follows:

1. Imperative mood and streamlined language are generally used in the Specifications. The words "shall," "shall be," or "shall comply with," depending on the context, are implied where a colon (:) is used within a sentence or phrase.

2. Specification requirements are to be performed by Contractor unless specifically stated otherwise.

B. Drawing Coordination: Requirements for materials and products identified on Drawings are described in detail in the Specifications. One or more of the following are used on Drawings to identify materials and products:

1. Terminology: Materials and products are identified by the typical generic terms used in the individual Specifications Sections.
2. Abbreviations: Materials and products are identified by abbreviations published as part of the U.S. National CAD Standard and scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

1.07 PHASED CONSTRUCTION

A. It will be the responsibility of the Contractor to carefully review the drawings, specifications and existing conditions with reference to these types of services so that the building may function normally during the construction process.

1.08 COORDINATION WITH OCCUPANTS

A. Partial Owner Occupancy: Owner will occupy the premises during entire construction period, with the exception of areas under construction. Cooperate with Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with Owner's operations. Maintain existing exits unless otherwise indicated.

1. Maintain access to existing walkways, corridors, and other adjacent occupied or used facilities. Do not close or obstruct walkways, corridors, or other occupied or used facilities without written permission from Owner and authorities having jurisdiction.
2. Provide not less than 72 hours' notice to Owner of activities that will affect Owner's operations.

1.09 WORK RESTRICTIONS

A. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:

1. Notify Owner not less than 7 days in advance of proposed utility interruptions.

1.10 FEES, PERMITS, AND INSPECTIONS

A. This Contractor shall be responsible for all costs incurred by any serving utility, municipal authority, and/or Owner for the relocation, removal, and installation of temporary or new services.

B. The Contractor shall be responsible for coordinating and providing the exact service equipment and installation methods with the serving utility, municipal authority, and/or Owner prior to bidding. Failure to do so will not constitute sufficient grounds for an authorized change order to the project.

1.11 PROJECT / SITE CONDITIONS:

A. Install Work in locations shown on Drawings, unless prevented by Project conditions. The Architect / Owner reserves the right to relocate any device a maximum distance of 6' - 0" at the time of installation without an extra cost being incurred.

B. Prepare drawings showing proposed rearrangement of Work to meet Project conditions, including changes to Work specified in other Sections. Obtain permission of Architect / Engineer before proceeding.

1.12 SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. The Contractor shall submit five (5) copies to the Architect for approval, a list of all equipment he proposes to furnish, together with descriptive literature, capacities, manufacturer's name, approximately delivery date and any other pertinent facts concerning the various items. The submittal shall consist of a tabulation of all items included, followed by catalog and data sheets, wiring diagrams, etc., all bound in one folder, loose leaf sheets will not be acceptable.
2. The equipment listed herein or on the drawings will be furnished as specified unless scheduled "or equal". If "or equal" is indicated, the product of any reputable manufacturer regularly engaged in the commercial production of the specified equipment will not be excluded on the basis of minor differences, provided all essential requirements of this specification relative to materials, limitations of available space for equipment, capacity, and performance are met. The Contractor shall be responsible for any and all

additional costs required by modifications to architectural, structural, mechanical or electrical facilities, devices, systems, etc. resulting from the approved substitution.

3. Wherever the substituted equipment actually furnished under these specifications requires the use of larger connections, more connections, or a different connection arrangement than indicated on the drawings or specified under these specifications, the Contractor shall furnish a scaled drawing showing how he proposes to install substituted equipment. Drawings shall show clearances and be coordinated with other mechanical and electrical equipment in the space. Should a substitution require the Architect or Engineer to provide additional services to accommodate it, the Contractor shall be responsible for costs incurred by the Architect or Engineer.
4. All equipment having motors 1-1/2 horsepower and larger shall include have as part of the submittal package, a written description of the motor, manufacturer, model number and motor efficiency at full load. Failure to include motor data in the equipment submittal shall result in the automatic rejection of the submittal.
5. The Contractor shall submit shop drawings to the Architect in accordance with the schedule prepared by the General Contractor but not later than 45 calendar days after the date of the agreement. Failure to submit shop drawings within 45 days, shall disqualify the Contractor from substituting specified equipment.
6. The contractor shall not install any equipment or materials until the shop drawings for the equipment or materials have been approved.
7. Engineer will return annotated file.

B. Digital Data Files:

1. Electronic digital data files of the Project drawings may be provided by Engineer for Contractor's use in preparing submittals.
2. Electronic digital data files supplied for use in submittal preparation will be subject to terms and conditions of the Engineer’s Release Form. A signed release form and any payment required must be returned to the Engineer prior to the transmission of an electronic digital data files.
3. Electronic digital data file formats may include AutoCAD drawings, Revit converted to AutoCAD drawings or Revit Model.

C. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.

1. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
   a. Engineer reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.

D. Processing Time: Allow time for submittal review, including time for resubmittals, as follows.

Time for review shall commence on Engineer's receipt of submittal. No extension of the

Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.

1. Initial Review: Allow 14 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Engineer will advise Contractor when a submittal being processed must be delayed for coordination.
2. Resubmittal Review: Allow 14 days for review of each resubmittal.

E. Electronic Submittals: Identify and incorporate information in each electronic submittal file as follows:

1. Name file with submittal number or other unique identifier, including revision identifier.
2. Transmittal Form for Electronic Submittals: Use electronic form containing the following information:
   a. Project name.
   b. Name and address of Engineer.
   c. Name of Construction Manager.
   d. Name of Contractor.
   e. Name of firm or entity that prepared submittal.
   f. Names of subcontractor, manufacturer, and supplier.
   g. Category and type of submittal.
   h. Specification Section number and title.
   i. Indication of full or partial submittal.
   j. Remarks.

F. Options: Identify options requiring selection by Engineer.

G. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Engineer on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.

H. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.

1. Note date and content of revision in label or title block and clearly indicate extent of revision.
2. Resubmit submittals until they are marked with approval notation from Engineer.

I. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance

of construction activities.

1.13 CLOSEOUT SUBMITTALS

A. Closeout submittals shall include, but not limited to, the following:

1. Operation and Maintenance Materials
2. Record Drawings
3. Demonstration and Training Materials

1.14 QUALITY ASSURANCE

A. Products:

1. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
   a. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
   b. If a dispute arises between contractors over concurrently selectable but incompatible products, Engineer will determine which products shall be used.

1.15 PRODUCT DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.

B. Delivery and Handling:

1. Schedule delivery to minimize long-term storage at Project site and to prevent overcrowding of construction spaces.
2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.

C. Storage:

1. Store products to allow for inspection and measurement of quantity or counting of units.
2. Store materials in a manner that will not endanger Project structure.
3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation or moisture

damage.

4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
6. Protect stored products from damage and liquids from freezing.
7. Provide a secure location and enclosure at Project site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

1.16 PRODUCT WARRANTIES

A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.

1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
2. Special Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.

B. Submit warranties in accordance with “Closeout Procedures.”

1.17 FIELD CONDITIONS

A. The Contractor shall visit the site of the building before submitting a proposal on this work, and shall thoroughly familiarize himself with the existing conditions and operations. Failure on his part to do this will not be cause of extras after the contract is signed, by reason of unforeseen conditions.

1.18 GUARANTEE/WARRANTY

A. The work herein specified shall be free from defects in workmanship and material under normal use and service. If, within twelve (12) months from date of substantial completion and Owner acceptance of the work herein described, any of the equipment or materials, or the installation thereof, is found to be defective in workmanship or material, it shall be replaced or repaired free of charge.

B. The Contractor shall, after completion of the original test of the installation, and acceptance by the Engineer, provide any service incidental to the proper performance of the electrical systems under guarantees outlined above for a period of 1 full year after acceptance by the Engineer and Owner. Regardless of anything to the contrary in warranties by the equipment manufacturer involved, the Contractor's warranty shall run for 1 full year after final acceptance by the Engineer.

1.19 ELECTRICAL LICENSE REQUIREMENT

A. No person shall perform electrical work on the contract without possessing a Master's or Journeyman's License from the State Electrical Examiners Board. All electrical work and apprentice electricians shall be supervised by a Master or Journeyman Electrician on a one to one ratio.

B. All electricians shall have a copy of their license with them and shall be required to show it to an appropriate inspector upon request.

PART 1 - PRODUCTS

2.01 SUBMITTAL PROCEDURES

A. General Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.

1. Submit electronic submittals to Architect.
    a. Engineer will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.

B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.

1. Mark each copy of each submittal to show which products and options are applicable.
2. Include the following information, as applicable:
    a. Manufacturer's catalog cuts.
    b. Manufacturer's product specifications.
    c. Standard color charts.

d. Statement of compliance with specified referenced standards.
e. Testing by recognized testing agency.
f. Application of testing agency labels and seals.

3. For equipment, include the following in addition to the above, as applicable:
   a. Wiring diagrams showing factory-installed wiring.

C. Shop Drawings: Prepare Project-specific information, drawn accurately to scale and sufficiently large to show all pertinent features of the item, method of connections, and notations clearly legible. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data, unless submittal based on Engineer's digital data drawing files is otherwise permitted.

1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
   a. Identification of products.
   b. Schedules.
   c. Compliance with specified standards.
   d. Notation of coordination requirements.

2.02 DELEGATED-DESIGN SERVICES

A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.

2.03 PRODUCT SELECTION PROCEDURES

A. General Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.

1. Provide products complete with accessories, trim, finish, fasteners, and other items needed for a complete installation and indicated use and effect.
2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
3. Where two or more units of materials or equipment of the same type or class are required, these units shall be products of one manufacturer.
4. Where products are accompanied by the term "as selected," Engineer will make selection.
5. Products containing asbestos shall not be used.
6. Or Equal: For products specified by name and accompanied by the term "or equal," or "or approved equal," or "or approved," comply with requirements in "Comparable Products"

Article to obtain approval for use of an unnamed product.

B. Product Selection Procedures:

1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
3. Products:
   a. Restricted List: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience shall be considered.
4. Basis-of-Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and other characteristics that are based on the product named. Comply with requirements in "Comparable Products" Article for consideration of an unnamed product by one of the other named manufacturers.

C. Visual Selection Specification: Where Specifications include the phrase "as selected by Engineer" or similar phrase, select a product that complies with requirements. Engineer will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

2.04 COMPARABLE PRODUCTS

A. Conditions for Consideration: Engineer will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Engineer may return requests without action, except to record noncompliance with these requirements:

1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.

3. Evidence that proposed product provides specified warranty.
4. Contractor is responsible for any modification required by products other than the basis of design product at no additional cost to the owner including but not limited to modifications to supports and connections.

2.05 OPERATION AND MAINTENANCE DOCUMENTATION DIRECTORY

A. After approval of materials and equipment for use in this project, a copy of an Operation and Maintenance Manual shall be submitted for approval.

B. Directory: Prepare a single, comprehensive directory of emergency, operation, and maintenance data and materials, listing items and their location to facilitate ready access to desired information. Include a section in the directory for each of the following:

1. List of documents.
2. List of equipment.
3. Table of contents.

C. List of Equipment: List equipment for each system, organized alphabetically by system. For pieces of equipment not part of system, list alphabetically in separate list.

D. Tables of Contents: Include a table of contents for each emergency, operation, and maintenance manual.

E. Upon final approval, submit one (1) bound copy of the approved Operation and Maintenance Manual to the Architect and hold two (2) copies for instruction of Owner as hereinafter specified.

2.06 REQUIREMENTS FOR EMERGENCY, OPERATION, AND MAINTENANCE MANUALS

A. Manuals, Electronic Files: Submit manuals in the form of a multiple file composite electronic PDF file for each manual type required.

1. Electronic Files: Use electronic files prepared by manufacturer where available. Where scanning of paper documents is required, configure scanned file for minimum readable file size.
2. File Names and Bookmarks: Enable bookmarking of individual documents based on file names. Name document files to correspond to system, subsystem, and equipment names used in manual directory and table of contents. Group documents for each system and subsystem into individual composite bookmarked files, then create composite manual, so that resulting bookmarks reflect the system, subsystem, and equipment names in a readily

navigated file tree. Configure electronic manual to display bookmark panel on opening file.

2.07 EQUIPMENT AND MATERIALS:

A. All materials shall be new and shall bear the manufacturer's name, trade name and the UL label in every case where a standard has been established for the particular material. The equipment to be furnished under each section of the specification shall be essentially the standard product of a manufacturer regularly engaged in the production of the required type of equipment, and shall be the manufacturer's latest approved design.

B. When 2 or more units of materials or equipment of the same type or class are required, these units shall be products of 1 manufacturer. Equipment and materials of the same general type shall be of the same make throughout the work to provide uniform appearance, operation and maintenance. Manufacturers of equipment assemblies, which use components made by others, assume complete responsibility for the final assembled product.

C. Nameplate bearing manufacturer's name or identifiable trademark shall be securely affixed in a conspicuous place on equipment, or name or trademark cast integrally with equipment, stamped or otherwise permanently marked on each item of equipment.

D. Asbestos products or equipment or materials containing asbestos shall not be used.

E. Equipment and materials shall be delivered to the site and stored in the original containers, suitably sheltered from the elements. Items subject to moisture damage (such as controls) shall be stored in dry, heated spaces.

F. Equipment shall be tightly covered and protected against dirt, water, and chemical or mechanical injury and theft. At the completion of the work, fixtures, equipment, and materials shall be cleaned and polished thoroughly. Damage or defects developing before acceptance of the work shall be made good at the Contractor's expense.

G. It shall be the responsibility of the Contractor to insure that items to be furnished fit the space available. The Contractor shall make necessary field measurements to ascertain space requirements, including those for connections, and shall furnish and install such sizes and shapes of equipment that the final installation shall suit the true intent and meaning of the Drawings and Specifications.

H. Manufacturer's directions shall be followed completely in the delivery, storage, protection, and installation of all equipment and materials. Should the Contractor perform any work that does not comply with the manufacturer's directions, he shall bear all costs arising in correcting the deficiencies.

2.08 EQUIPMENT ACCESSORIES:

A. The Contractor shall furnish and install all equipment, accessories, connections, and incidental items necessary to fully complete the work, ready for use, occupancy and operation by the Owner, whether or not specifically shown on the plans or herein specified.

B. Connections: All final connections to equipment shall be installed as required by the manufacturer and/or Vendor.

C. Connections Different From Those Shown: Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly with the intent of the drawings and specifications. When directed, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes. The Contractor shall provide any additional equipment required for the proper operation of the system resulting from the selection of equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing in and connections by other trades. All changes shall be made at no increase in the contract amount or additional cost to the other trades.

PART 1 - EXECUTION

3.01 CONTRACTOR'S SUBMITTAL REVIEW

A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Engineer.

B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

3.02 ENGINEER'S SUBMITTAL ACTION

A. Action Submittals: Engineer will review each submittal, make marks to indicate corrections or revisions required, and return it.

B. Informational Submittals: Engineer will review each submittal and will not return it, or will return it if it does not comply with requirements. Engineer will forward each submittal to the appropriate party.

C. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Engineer.

D. Incomplete submittals are unacceptable, will be considered nonresponsive, and will be returned for resubmittal without review.

E. Submittals not required by the Contract Documents may be returned by the Engineer without action.

3.03 DISPOSAL OF WASTE

A. General: Except for items or materials to be salvaged, recycled, or otherwise reused, remove waste materials from Project site and legally dispose of them in a landfill or incinerator acceptable to authorities having jurisdiction.

1. Except as otherwise specified, do not allow waste materials that are to be disposed of accumulate on-site.
2. Remove and transport debris in a manner that will prevent spillage on adjacent surfaces and areas.
3. Disposal: Remove waste materials from Owner's property and legally dispose of them

3.04 RECORD DRAWING RECORDING AND MAINTENANCE

A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.

3.05 COORDINATION OF WORK

A. The Contractor shall compare the Electrical Drawings and Specifications with the drawings and specifications for other trades and shall report any discrepancies between them to the Engineer and obtain written instructions for changes necessary in the Electrical Work. The Electrical Work shall be installed in cooperation with other trades installing related work. Before installation, the Contractor shall make proper provision to avoid interferences. All changes required in the work of the Contractor caused by a failure to coordinate the work with other trades shall be made by the Contractor at his own expense.

B. Anchor bolts, sleeves, inserts and supports that may be required for the Electrical Work shall be furnished under the same section of the specifications as the respective items to be supported, and they shall be installed, except as otherwise specified, by the trade furnishing and installing the material in which they are to be located. Location of anchor bolts, sleeves, inserts and supports shall be directed by the trade requiring them, which trade shall also insure that they are properly installed. Any expense resulting from the improper location or installation of anchor bolts, sleeves, inserts and supports shall be paid for by the Contractor under the section of the specifications for the trade with the responsibility for directing their proper location.

C. Slots, chases, openings and recesses through floors, walls, ceilings and roofs as specified will be provided by the various trades in their respective materials, but the trade requiring them shall

see that they are properly located, and shall do any cutting and patching caused by the neglect to do so. Slots, chases, openings and recesses in existing structure shall be cut by the trade requiring them and patched and repaired by that trade.

D. Locations of conduits, equipment, etc. shall be adjusted to accommodate the work and to avoid interferences anticipated and encountered. The Contractor shall determine the exact route and location of each pipe and duct prior to fabrication.

1. Installation and Arrangement: The Contractor shall install all Electrical Work to permit removal (without damage to other parts) of coils, heat exchanger bundles, belt guards, sheaves and drives, and all other parts requiring periodic replacement or maintenance. The Contractor shall arrange pipes and equipment to permit ready access to valves, cocks, control components and to clear the openings of swinging and overhead doors and of access panels.
2. Access: The Contractor shall provide all necessary access panels in walls, ceilings, equipment, etc., as required for inspection of interiors and for proper maintenance and or installation of equipment valves. Where changes from the plans are made by the Contractor in the installation of his work, he shall provide any and all access panels required as a result of these changes.

E. Connections Different From Those Shown: Where equipment requiring different arrangement or connections from those shown is approved, it shall be the responsibility of the Contractor to install the equipment to operate properly with the intent of the drawings and specifications. When directed, the Contractor shall submit drawings showing the proposed installation. If the proposed installation is approved, the Contractor shall make all incidental changes in conduit, back box, device locations, etc. The Contractor shall provide any additional conduit, fittings, and other additional equipment required for the proper operation of the system resulting from the selection of equipment, including all required changes in affected trades. The Contractor shall be responsible for the proper location of roughing in and connections by other trades. All changes shall be made at no increase in the contract amount or additional cost to the other trades.

F. Connections: All conduit connecting to equipment shall be installed without strain at the conduit connection

G. Inaccessible Equipment

1. Where the Engineer or Owner determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled or remedial action (such as providing access panels) performed as directed at no additional cost to the Owner.
2. The term "conveniently accessible" is defined as capable of being reached without the use of ladders, or without climbing or crawling under or over obstacles such as motors, fans, pumps, belt guards, transformers, high voltage lines, piping, and ductwork.

H. Electrical Coordination

1. Power: All power and motor wiring shall be performed under Division 26 unless otherwise noted for specific items. Control and interlock wiring shall be done by the Contractor of this Division.
2. Starters and Drives: All motor starters and drives unless included in other sections of the specifications shall be by Division 26. Furnish auxiliary contacts on magnetic starters to permit interlocking of starting circuits.
3. Disconnects: All equipment furnished under this Division required to have a means of disconnect shall be supplied with a disconnect or a disconnect shall be furnished and installed by Division 26.

I. Dedicated Electrical Space: The space equal to the width and depth of the equipment and extending from the floor to a height of 6 feet above the equipment or to the structural ceiling, whichever is lower, shall be dedicated to the electrical installation. No piping, leak protection apparatus, or other equipment foreign to the electrical installation shall be located in this zone. The area above the dedicated space shall be permitted to contain foreign systems, provided protection is installed to avoid damage to the electrical equipment from condensation, leaks or breaks in foreign systems. Every effort shall be made to eliminate foreign systems above equipment to the structural ceiling. If this is not possible, the Contractor shall encase any pipe in a second pipe with a minimum number of joints.

J. Lubrication: The Contractor shall be held responsible for all damage to bearings while the equipment is being operated up to the date of acceptance of the equipment. The Contractor

shall be required to protect all bearings during installation and shall thoroughly grease steel shafts to prevent corrosion. All motors and other equipment shall be provided with covers as required for proper protection during construction. Fan shafts, pump shafts, motor shafts, etc. shall be coated to prevent deterioration in moist or wet atmospheres.

3.06 CUTTING AND PATCHING

A. Cutting and Patching, General: Employ skilled workers to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time, and complete without delay.

1. Under each section of the specifications, the Contractor shall be responsible for all required cutting, etc., incident to his work under that section, and shall make all satisfactory repairs, but in no case shall the Contractor cut into any major structural element, beam or column.
2. Each trade shall bear the expense of all cutting, patching, repairing or replacing of the work of other trades because of fault, error or tardiness or because of any damage done by own workmanship.
3. Cut in-place construction to provide for installation of other components or performance of other construction, and subsequently patch as required to restore surfaces to their original condition.

B. Existing Warranties: Remove, replace, patch, and repair materials and surfaces cut or damaged during installation or cutting and patching operations, by methods and with materials so as not to void existing warranties.

C. Temporary Support: Provide temporary support of work to be cut.

D. Protection: Protect in-place construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

E. Adjacent Occupied Areas: Where interference with use of adjoining areas or interruption of free passage to adjoining areas is unavoidable, coordinate cutting and patching according to requirements the “Occupant Coordination” article.

F. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before

cutting to prevent interruption to occupied areas.

G. Cutting: Cut in-place construction by sawing, drilling, breaking, chipping, grinding, and similar operations, including excavation, using methods least likely to damage elements retained or adjoining construction. If possible, review proposed procedures with original Installer; comply with original Installer's written recommendations.

1. In general, use hand or small power tools designed for sawing and grinding, not hammering and chopping. Cut holes and slots neatly to minimum size required, and with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
2. Finished Surfaces: Cut or drill from the exposed or finished side into concealed surfaces.
3. Concrete and Masonry: Cut using a cutting machine, such as an abrasive saw or a diamond-core drill.
4. Excavating and Backfilling: Comply with requirements in applicable Sections where required by cutting and patching operations.
5. Mechanical and Electrical Services: Cut off pipe or conduit in walls or partitions to be removed. Cap, valve, or plug and seal remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after cutting.
6. Proceed with patching after construction operations requiring cutting are complete.

H. Patching: Patch construction by filling, repairing, refinishing, closing up, and similar operations following performance of other work. Patch with durable seams that are as invisible as practicable. Provide materials and comply with installation requirements specified in other Sections, where applicable.

1. Inspection: Where feasible, test and inspect patched areas after completion to demonstrate physical integrity of installation.
2. Exposed Finishes: Restore exposed finishes of patched areas and extend finish restoration into retained adjoining construction in a manner that will minimize evidence of patching and refinishing.
    a. Clean piping, conduit, and similar features before applying paint or other finishing materials.
    b. Restore damaged pipe covering to its original condition.
3. Floors and Walls: Where walls or partitions that are removed extend one finished area into another, patch and repair floor and wall surfaces in the new space. Provide an even surface of uniform finish, color, texture, and appearance. Remove in-place floor and wall coverings and replace with new materials, if necessary, to achieve uniform color and appearance.
    a. Where patching occurs in a painted surface, prepare substrate and apply primer and intermediate paint coats appropriate for substrate over the patch, and apply final paint coat over entire unbroken surface containing the patch. Provide additional coats until

patch blends with adjacent surfaces.

4. Ceilings: Patch, repair, or re-hang in-place ceilings as necessary to provide an even-plane surface of uniform appearance.
5. Exterior Building Enclosure: Patch components in a manner that restores enclosure to a weathertight condition and ensures thermal and moisture integrity of building enclosure.

I. Cleaning: Clean areas and spaces where cutting and patching are performed. Remove paint, mortar, oils, putty, and similar materials from adjacent finished surfaces.

3.07 EXCAVATION AND TRENCHING FOR ELECTRICAL CONDUIT

A. The Contractor shall perform all excavation of every description and of whatever substances encountered to the depths indicated on the drawings or as otherwise specified. During excavation, material suitable for backfilling shall be piled in an orderly manner a sufficient distance from the banks of the trench to avoid overloading and to prevent slides or cave-ins. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches or other excavations, and any water accumulating therein shall be removed by pumping or by other methods. Unless otherwise indicated, excavation shall be by open cut except that short sections of a trench may be tunneled if the conduit or sleeves can be safely and properly installed and backfill can be properly tamped in such tunnel sections.

B. Trench Excavation: Trenches shall be of necessary width for proper laying of the conduit, and the banks shall be as nearly vertical as practical. The bottom of the trenches shall be accurately graded to provide uniform bearing and support for the conduit on undisturbed soil at every point along its entire length. Except where rock is encountered, care shall be taken not to excavate below the depths indicated. Where rock excavations are required, the rock shall be excavated to a minimum overdepth of 4 inches below the trench depths indicated on the drawings, or specified. Overdepths in the rock excavation and unauthorized overdepths shall be backfilled with loose, granular, moist earth, thoroughly tamped. Whenever wet or otherwise unstable soil that is incapable of properly supporting the pipe is encountered in the bottom of the trench, such soil shall be removed to the depth required and the trench backfilled to the

proper grade coarse sand, fine gravel or other suitable materials, as hereinafter specified.

C. Depth of Cover: Trenches for utilities shall be of a depth that will provide the following minimum depths of cover from existing grade or from indicated finish grade, whichever is lower, unless otherwise specifically shown. Exact depth of cover by Utility.

D. Protection of Existing Utilities: Existing utility lines to be retained that are shown on the Drawings or the locations of which are made known to the Contractor prior to excavation, as well as all utility lines uncovered during excavation operations, shall be protected from damage during excavation and backfilling, and if damaged, shall be repaired by the Contractor at his expense.

3.08 BACKFILLING OF TRENCHES

A. Trenches shall not be backfilled until the utilities systems as installed confirm to the requirements of the drawings and specifications.

B. Normal Backfill: Where compacted backfill is not specified the trenches shall be carefully backfilled with the materials approved for backfilling (See appropriate section), deposited in 6" layers and thoroughly and carefully rammed until the pipe has a cover of not less than one foot. The remainder of the backfill material shall then be carefully placed in the trench in one foot layers and tamped. Settling the backfill with water will not be permitted. The surface shall be graded to a reasonable uniformity and the mounding over trenches left in a uniform and neat condition. Surface condition shall be equipment to match the existing condition prior to trenching (sod, asphalt, etc.).

C. Compacted backfill shall be used under slabs on grade, building structure, concrete paving and asphaltic concrete paving. The soils used in the fill shall be granular in nature and shall not contain roots, sod, rubbish or stones over 1-1/2" maximum dimension.

3.09 PAINTING

A. The Contractor shall remove all rust, oil and grease from exposed surfaces and clean all apparatus or materials specified to be painted under this section of the specifications.

Equipment specified to have factory finishes shall be protected until completion of the Contract, with Contractor being responsible for maintaining finishes.

B. Apply paint to exposed piping according to the following, unless otherwise indicated:

1. Damage and Touchup: Repair marred and damaged factory-painted finishes with materials and procedures to match original factory finish.
2. Galvanized surfaces damaged during installation shall be repaired with a galvanized repair compound. Any equipment scratched, marred or damaged will be repainted to the original condition.

3.10 CONTINUITY TEST:

A. The Contractor shall perform a continuity test on the affected portion of the electrical system prior to energizing the system to insure proper cable connections.

3.11 CONNECTION TORQUE TESTS:

A. All larger conductor bolted connections shall be torque tested using a torque wrench. Torque shall be to National Electrical Testing Association's (NETA) Standards.

3.12 MECHANICAL OPERATION TESTS:

A. All electrical equipment, such as switches, circuit breakers, etc., shall be tested by operating the device to verify that the mechanical portions of the device are functioning.

3.13 ROTATIONAL TESTS:

A. The Contractor shall assist all other trades in performing rotational tests on all motors provided under this contract. If rotational tests determine that conductors must be transposed to change direction of rotation, the conductors shall be changed at the make-up box on the motor; or if the change is made elsewhere, then the conductor's color coding shall be changed.

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SECTION 26 0505
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Electrical demolition.

1.02 RELATED REQUIREMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work specified in this section.

1.03 DESCRIPTION OF WORK

A. The extent of general building demolition work is shown on drawings. Coordinate the required electrical work with the general demolition.

B. Demolition includes complete wrecking of structures and removal and disposal of demolished materials, as shown on drawings and herein specified.

C. Interior demolition includes complete wrecking of interior partitions, work above ceilings, finishes, and structures and removal and disposal of demolished materials, as shown on drawings and herein specified.

D. The Owner shall have the option of retaining any items removed. The Contractor shall deliver these items to the Owner's designated storage area. Any items not retained by the Owner shall be disposed of off site by the Contractor.

E. Contractor shall be responsible for the protection of all existing spaces, materials, and equipment during all construction activities.

1.04 JOB CONDITIONS

A. Condition of Structures: The Owner assumes no responsibility for actual condition of structures to be demolished.

B. Conditions of the structure existing at time of inspection for bidding purposes will be maintained by owner in so far as practicable. However, variations within structure may occur by Owner's removal and salvage operations prior to start of demolition work. The drawings are schematic and provided as an aid in bidding. The contractor shall visit the site and determine the actual conditions prior to bidding.

C. Partial Removal: Items of salvable value to Contractor may be removed from structure as work progresses. Salvaged items must be transported from site as they are removed.

D. Storage or sale of removed items on site will not be permitted.

E. Traffic: Conduct demolition operations and removal of debris to ensure minimum interference with roads, streets, walks, occupied areas, and other adjacent occupied or used facilities.

F. Protections: Ensure safe passage of persons around or through area of demolition. Conduct operations to prevent injury to adjacent buildings, structures, other facilities, and persons.

G. Install temporary electrical services, lighting, etc., as required by the Owner or authorities having jurisdiction.

H. Damages: Promptly repair damages caused to adjacent facilities by demolition operations at no cost to Owner.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Report discrepancies to Architect before disturbing existing installation.

D. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with utility company.

C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.

1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. Minimize outage duration.

1. Notify Owner before partially or completely disabling system.
2. Notify local fire service.
3. Make notifications at least 24 hours in advance.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

E. Disconnect and remove abandoned panelboards and distribution equipment.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 DISPOSAL OF DEMOLISHED MATERIALS

A. General: Remove from site debris, rubbish, and other materials resulting from demolition operations. Pay all fees related to removal and dumping.

1. Remove and dispose of interior demolition debris only.
2. Burning of removed materials from demolished structures will not be permitted on site.

B. Removal:

1. Transport materials removed from demolished structures and dispose of off site.

3.05 CLEANING AND REPAIR

A. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.

B. Clean and repair existing materials and equipment that remain or that are to be reused.

C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

D. Luminaires: Remove existing luminaires for cleaning. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. Replace lamps, ballasts and broken electrical parts.

END OF SECTION

SECTION 26 0519
LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Single conductor building wire.

B. Underground feeder and branch-circuit cable.

C. Service entrance cable.

D. Power and control tray cable.

E. Wiring connectors.

F. Electrical tape.

G. Heat shrink tubing.

H. Oxide inhibiting compound.

I. Wire pulling lubricant.

J. Cable ties.

K. Firestop sleeves.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

1.03 REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire 2013 (Reapproved 2018).

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft 2011 (Reapproved 2017).

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes 2010, with Editorial Revision (2020).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation 2004 (Reapproved 2020).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape 2017.

F. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

G. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy 2021.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 44 - Thermoset-Insulated Wires and Cables Current Edition, Including All Revisions.

K. UL 83 - Thermoplastic-Insulated Wires and Cables Current Edition, Including All Revisions.

L. UL 486A-486B - Wire Connectors Current Edition, Including All Revisions.

M. UL 486C - Splicing Wire Connectors Current Edition, Including All Revisions.

N. UL 486D - Sealed Wire Connector Systems Current Edition, Including All Revisions.

O. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.08 FIELD CONDITIONS

A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect and obtain direction before proceeding with work.

PART 2 - PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

1. Exceptions:

C. Nonmetallic-sheathed cable is not permitted.

D. Armored cable is not permitted.

E. Metal-clad cable is not permitted.

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductors for Grounding and Bonding: Also comply with Section 26 0526.

H. Conductors and Cables Installed Where Exposed to Direct Rays of Sun: Listed and labeled as sunlight resistant.

I. Conductors and Cables Installed Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

J. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
3. Tinned Copper Conductors: Comply with ASTM B33.

K. Minimum Conductor Size:

1. Branch Circuits: 12 AWG.

L. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

M. Conductor Color Coding:

1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
2. Color Coding Method: Integrally colored insulation.
   a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
3. Color Code:
   a. 480Y/277 V, 3 Phase, 4 Wire System:
      1) Phase A: Brown.
      2) Phase B: Orange.
      3) Phase C: Yellow.
      4) Neutral/Grounded: Gray.
   b. 208Y/120 V, 3 Phase, 4 Wire System:
      1) Phase A: Black.
      2) Phase B: Red.
      3) Phase C: Blue.
      4) Neutral/Grounded: White.
   c. Equipment Ground, All Systems: Green.
   d. Travelers for 3-Way and 4-Way Switching: Pink.
   e. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
   f. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:

1. Copper Building Wire:
   a. Encore Wire Corporation:
   b. General Cable Technologies Corporation:
   c. Southwire Company:
   d. Advance Wire and Cable, Inc

B. Description: Single conductor insulated wire.

C. Conductor Stranding:

1. Feeders and Branch Circuits:
   a. Size 10 AWG and Smaller: Solid.
   b. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation:

1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

2.04 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

C. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

D. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

E. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

F. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

1. Manufacturers:
   a. 3M:
   b. Ideal Industries, Inc:
   c. NSI Industries LLC:

G. Mechanical Connectors: Provide bolted type.

1. Manufacturers:
   a. Burndy LLC
   b. Ilsco
   c. Thomas & Betts Corporation

H. Compression Connectors: Provide circumferential type or hex type crimp configuration.

1. Manufacturers:
   a. Burndy LLC
   b. Ilsco
   c. Thomas & Betts Corporation

2.05 ACCESSORIES

A. Electrical Tape:

1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.

C. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

D. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

1. Manufacturers:
    a. 3M
    b. American Polywater Corporation
    c. Ideal Industries, Inc

E. Cable Ties: Material and tensile strength rating suitable for application.

F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for cables and roofing system to be installed; designed to accommodate existing penetrations where applicable.

G. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

1. Products:
    a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built:

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that field measurements are as indicated.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

A. Circuiting Requirements:

1. When circuit destination is indicated without specific routing, determine exact routing required.

2. Arrange circuiting to minimize splices.
3. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
4. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
5. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
    a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.
    b. Increase size of conductors as required to account for ampacity derating.
    c. Size raceways, boxes, etc. to accommodate conductors.
6. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among up to three single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
7. Provide oversized neutral/grounded conductors where indicated and as specified below.
    a. Provide 200 percent rated neutral for feeders fed from K-rated transformers.
    b. Provide 200 percent rated neutral for feeders serving panelboards with 200 percent rated neutral bus.

B. Install products in accordance with manufacturer's instructions.

C. Perform work in accordance with NECA 1 (general workmanship).

D. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
2. Pull all conductors and cables together into raceway at same time.
3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.

G. Install conductors with a minimum of 12 inches of slack at each outlet.

H. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

J. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

K. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
3. Do not remove conductor strands to facilitate insertion into connector.
4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.
5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

M. Insulate ends of spare conductors using vinyl insulating electrical tape.

N. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

P. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

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SECTION 26 0526
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Ground rod electrodes.

F. Chemically-enhanced ground electrodes.

G. Ground enhancement material.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 0536 - Cable Trays for Electrical Systems: Additional grounding and bonding requirements for cable tray systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 5600 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.03 REFERENCE STANDARDS

A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings 2017.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 467 - Grounding and Bonding Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify exact locations of underground metal water service pipe entrances to building.
2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install ground rod electrodes until final backfill and compaction is complete.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Field quality control test reports.

E. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

D. ANSI/IEEE Compliance: Comply with C114.1 (IEEE Std 142) and IEEE Stds Nos. 241 and 242 pertaining to grounding and ground-fault protection of power systems.

E. ANSI/UL Compliance: Comply with requirements of ANSI/UL and UL standards pertaining to grounding and ground-fault protection equipment and devices. Provide products which have been UL-listed and labeled.

F. NEMA Compliance: Comply with NEMA Stds Pub Nos. PB 1.2 and AB 1, pertaining to construction and installation of ground-fault protection devices and molded-case circuit breakers.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Grounding System Resistance:

1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect. Precipitation within the previous 48 hours does not constitute normally dry conditions.

2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.

E. Grounding Electrode System:

1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
   a. Provide continuous grounding electrode conductors without splice or joint.
   b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
2. Metal Underground Water Pipe(s):
   a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
   b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.
   c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
3. Metal In-Ground Support Structure:
   a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
4. Concrete-Encased Electrode:
   a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
5. Ground Rod Electrode(s):
   a. Provide two electrodes unless otherwise indicated or required.
   b. Space electrodes not less than 10 feet from each other and any other ground electrode.
   c. Where location is not indicated, locate electrode(s) at least 5 feet outside building perimeter foundation as near as possible to electrical service entrance; where possible, locate in softscape (uncovered) area.
6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

F. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
    a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
8. Provide bonding for metal building frame.

G. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.
2. Provide bonding jumper in raceway from intersystem bonding termination to each communications room or backboard and provide ground bar for termination.
    a. Bonding Jumper Size: 6 AWG, unless otherwise indicated or required.
    b. Raceway Size: 3/4 inch trade size unless otherwise indicated or required.
    c. Ground Bar Size: 1/4 by 4 by 12 inches unless otherwise indicated or required.
    d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

H. Cable Tray Systems: Also comply with Section 26 0536.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 0526:

1. Use insulated copper conductors unless otherwise indicated.
    a. Exceptions:
        1) Use bare copper conductors where installed underground in direct contact with earth.
        2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
4. Manufacturers - Mechanical and Compression Connectors:
    a. Advanced Lightning Technology (ALT)
    b. Burndy LLC
    c. Thomas & Betts Corporation
5. Manufacturers - Exothermic Welded Connections:
    a. Burndy LLC
    b. Cadweld, a brand of Erico International Corporation
    c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

D. Ground Bars:

1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
    a. Advanced Lightning Technology (ALT)
    b. Erico International Corporation
    c. Harger Lightning & Grounding
    d. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

E. Ground Rod Electrodes:

1. Comply with NEMA GR 1.
2. Material: Copper-bonded (copper-clad) steel.
3. Size: 3/4 inch diameter by 10 feet length, unless otherwise indicated.
4. Manufacturers:
    a. Advanced Lightning Technology (ALT): www.altfab.com/#sle.
    b. Erico International Corporation: www.erico.com/#sle.
    c. Galvan Industries, Inc
    d. Harger Lightning & Grounding

F. Ground Enhancement Material:

1. Description: Factory-mixed conductive material designed for permanent and maintenance-free improvement of grounding effectiveness by lowering resistivity.
2. Manufacturers:
    a. Erico International Corporation
    b. Harger Lightning & Grounding
    c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as indicated.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.

1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.

D. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

E. Identify grounding and bonding system components in accordance with Section 26 0553.

F. Neutrals of lighting systems shall be grounded independently and in accordance with the National Electrical Code.

G. All metal raceway system, including cabinets, conduit and boxes, shall be grounded to a water pipe with UL approved grounding clamp in accordance with the National Electrical Code.

H. An equipment ground conductor shall be installed in all conduits.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.13.

D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.

E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

SECTION 26 0529
HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

D. Section 26 0536 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.

E. Section 26 0533.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.

F. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.

G. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

H. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.03 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 2016a.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel 2019.

D. MFMA-4 - Metal Framing Standards Publication 2004.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate sizes and arrangement of supports and bases with the actual equipment and components to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel (strut) framing systems, non-penetrating rooftop supports, and post-installed concrete and masonry anchors.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.
2. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.
3. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported. Include consideration for vibration, equipment operation, and shock loads where applicable.
4. Do not use products for applications other than as permitted by NFPA 70 and product listing.
5. Steel Components: Use corrosion resistant materials suitable for the environment where installed.
    a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
    c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
    d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
2. Conduit Clamps: Bolted type unless otherwise indicated.
3. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation:
    b. Erico International Corporation
    c. HoldRite, a brand of Reliance Worldwide Corporation:

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

1. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation
    b. Erico International Corporation

c. HoldRite, a brand of Reliance Worldwide Corporation

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Comply with MFMA-4.
2. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
3. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
4. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation
   b. Thomas & Betts Corporation
   c. Unistrut, a brand of Atkore International Inc

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

1. Minimum Size, Unless Otherwise Indicated or Required:
   a. Equipment Supports: 1/2 inch diameter.
   b. Busway Supports: 1/2 inch diameter.
   c. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
   d. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
   e. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
   f. Outlet Boxes: 1/4 inch diameter.
   g. Luminaires: 1/4 inch diameter.

F. Non-Penetrating Rooftop Supports for Low-Slope Roofs: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring any attachment to the roof structure and not penetrating the roofing assembly, with support fixtures as specified.

1. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
2. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
3. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
4. Manufacturers:
   a. Cooper B-Line, a division of Eaton Corporation
   b. Erico International Corporation
   c. PHP Systems/Design
   d. Unistrut, a brand of Atkore International Inc

G. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

2. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
3. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
4. Hollow Stud Walls: Use toggle bolts.
5. Steel: Use beam clamps, machine bolts, or welded threaded studs.
6. Sheet Metal: Use sheet metal screws.
7. Wood: Use wood screws.
8. Plastic and lead anchors are not permitted.
9. Powder-actuated fasteners are not permitted.
10. Hammer-driven anchors and fasteners are not permitted.
11. Preset Concrete Inserts: Continuous metal channel (strut) and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
    a. Comply with MFMA-4.
    b. Channel Material: Use galvanized steel.
    c. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch minimum base metal thickness.
    d. Manufacturer: Same as manufacturer of metal channel (strut) framing system.
12. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive support and attachment components.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

E. Unless specifically indicated or approved by Architect, do not provide support from suspended ceiling support system or ceiling grid.

F. Unless specifically indicated or approved by Architect, do not provide support from roof deck.

G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

H. Field-Welding (where approved by Architect):

I. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.
2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

J. Conduit Support and Attachment: Also comply with Section 26 0533.13.

K. Cable Tray Support and Attachment: Also comply with Section 26 0536.

L. Box Support and Attachment: Also comply with Section 26 0533.16.

M. Interior Luminaire Support and Attachment: Also comply with Section 26 5100.

N. Exterior Luminaire Support and Attachment: Also comply with Section 26 5600.

O. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.

P. Secure fasteners according to manufacturer's recommended torque settings.

Q. Remove temporary supports.

R. Identify independent electrical component support wires above accessible ceilings (only where specifically indicated or permitted) with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect support and attachment components for damage and defects.

C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

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SECTION 26 0533.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Aluminum rigid metal conduit (RMC).

C. Intermediate metal conduit (IMC).

D. PVC-coated galvanized steel rigid metal conduit (RMC).

E. Flexible metal conduit (FMC).

F. Liquidtight flexible metal conduit (LFMC).

G. Electrical metallic tubing (EMT).

H. Rigid polyvinyl chloride (PVC) conduit.

I. Liquidtight flexible nonmetallic conduit (LFNC).

J. Reinforced thermosetting resin conduit (RTRC).

K. Conduit fittings.

L. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

1. Includes additional requirements for fittings for grounding and bonding.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0533.16 - Boxes for Electrical Systems.

E. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.

F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

H. Section 27 1000 - Structured Cabling: Additional requirements for communications systems conduits.

1.03 REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC) 2020.

B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S) 2020.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit 2018.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT) 2020.

F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC) 2017.

G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.

H. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Metal Conduit and Intermediate Metal Conduit 2018.

I. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit 2020.

J. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing 2021.

K. NEMA TC 14 (SERIES) - Reinforced Thermosetting Resin Conduit and Fittings Series 2015.

L. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

M. UL 1 - Flexible Metal Conduit Current Edition, Including All Revisions.

N. UL 6 - Electrical Rigid Metal Conduit-Steel Current Edition, Including All Revisions.

O. UL 360 - Liquid-Tight Flexible Metal Conduit Current Edition, Including All Revisions.

P. UL 514B - Conduit, Tubing, and Cable Fittings Current Edition, Including All Revisions.

Q. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings Current Edition, Including All Revisions.

R. UL 797 - Electrical Metallic Tubing-Steel Current Edition, Including All Revisions.

S. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.

T. UL 1242 - Electrical Intermediate Metal Conduit-Steel Current Edition, Including All Revisions.

U. UL 1660 - Liquid-Tight Flexible Nonmetallic Conduit Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.
3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.
4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.

C. Shop Drawings:

1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
2. Include proposed locations of roof penetrations and proposed methods for sealing.

D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2 inch (53 mm) trade size and larger.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit, intermediate metallic conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.

5. Where rigid polyvinyl (PVC) conduit larger than 2 inch (53 mm) trade size is provided, use galvanized steel rigid metal conduit elbows for bends.
6. Where steel conduit is installed in direct contact with earth where soil has a resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape to provide supplementary corrosion protection or use PVC-coated galvanized steel rigid metal conduit.
7. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.

D. Embedded Within Concrete:

1. Within Slab on Grade (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit, rigid PVC conduit, or reinforced thermosetting resin conduit (RTRC).
4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit.

I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit or electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit.

1. Locations subject to physical damage include, but are not limited to:

a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
b. Where exposed below 20 feet in warehouse areas.

K. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

L. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

M. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.

1. Maximum Length: 6 feet.

N. Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit.
2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
3. Maximum Length: 6 feet unless otherwise indicated.
4. Vibrating equipment includes, but is not limited to:
   a. Transformers.
   b. Motors.

2.02 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Electrical Service Conduits: Also comply with Section 26 2100.

C. Communications Systems Conduits: Also comply with Section 27 1000.

D. Fittings for Grounding and Bonding: Also comply with Section 26 0526.

E. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

F. Provide products listed, classified, and labeled as suitable for the purpose intended.

G. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 3/4 inch (21 mm) trade size.
2. Branch Circuit Homeruns: 3/4 inch (21 mm) trade size.
3. Control Circuits: 1/2 inch (16 mm) trade size.
4. Underground, Interior: 3/4 inch (21 mm) trade size.
5. Underground, Exterior: 1 inch (27 mm) trade size.

H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit
2. Republic Conduit
3. Wheatland Tube, a Division of Zekelman Industries

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:

1. Manufacturers:
   a. Bridgeport Fittings Inc
   b. O-Z/Gedney, a brand of Emerson Electric Co:
   c. Thomas & Betts Corporation
2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Hazardous (Classified) Locations: Use fittings listed and labeled as complying with UL 1203 for the classification of the installed location.
4. Material: Use steel or malleable iron.
   a. Do not use die cast zinc fittings.
5. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.04 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:

1. Allied Tube & Conduit
2. Republic Conduit
3. Wheatland Tube, a Division of Zekelman Industries

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:

1. Manufacturers:
   a. Bridgeport Fittings Inc
   b. O-Z/Gedney, a brand of Emerson Electric Co
   c. Thomas & Betts Corporation

2. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
    a. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.05 PVC-COATED GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Thomas & Betts Corporation
2. Robroy Industries

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit with external polyvinyl chloride (PVC) coating complying with NEMA RN 1 and listed and labeled as complying with UL 6.

C. Exterior Coating: Polyvinyl chloride (PVC), nominal thickness of 40 mil.

D. PVC-Coated Fittings:

1. Manufacturer: Same as manufacturer of PVC-coated conduit to be installed.
2. Non-Hazardous Locations: Use fittings listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
4. Exterior Coating: Polyvinyl chloride (PVC), minimum thickness of 40 mil.

E. PVC-Coated Supports: Furnish with exterior coating of polyvinyl chloride (PVC), minimum thickness of 15 mil.

2.06 FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:

1. AFC Cable Systems, Inc
2. Electri-Flex Company:
3. International Metal Hose

B. Description: NFPA 70, Type FMC standard wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems to be used.

C. Fittings:

1. Manufacturers:
    a. Bridgeport Fittings Inc
    b. O-Z/Gedney, a brand of Emerson Electric Co
    c. Thomas & Betts Corporation

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
    a. Do not use die cast zinc fittings.

2.07 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:

1. AFC Cable Systems, Inc
2. Electri-Flex Company
3. International Metal Hose

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:

1. Manufacturers:
    a. Bridgeport Fittings Inc
    b. O-Z/Gedney, a brand of Emerson Electric Co
    c. Thomas & Betts Corporation
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
    a. Do not use die cast zinc fittings.

2.08 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube & Conduit
2. Republic Conduit
3. Wheatland Tube, a Division of Zekelman Industries:

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:

1. Manufacturers:
    a. Bridgeport Fittings Inc
    b. O-Z/Gedney, a brand of Emerson Electric Co
    c. Thomas & Betts Corporation
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
3. Material: Use steel or malleable iron.
    a. Do not use die cast zinc fittings.

4. Connectors and Couplings: Use compression (gland) type.
   a. Do not use indenter type connectors and couplings.
5. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.09 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:

1. Cantex Inc
2. Carlon, a brand of Thomas & Betts Corporation
3. JM Eagle

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.10 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Manufacturers:

1. AFC Cable Systems, Inc
2. Electri-Flex Company
3. International Metal Hose

B. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

C. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.
2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

2.11 REINFORCED THERMOSETTING RESIN CONDUIT (RTRC)

A. Manufacturers:

1. Champion Fiberglass, Inc
2. FRE Composites
3. United Fiberglass of America, Inc

B. Description: NFPA 70, Type RTRC reinforced thermosetting resin conduit complying with NEMA TC 14 (SERIES).

C. Supports: Per manufacturer's recommendations.

D. Fittings: Same type and manufacturer as conduit to be connected.

1. Cement-Tight Joints: Use bonded coupling or bell and spigot.
2. Cement- and Water-Tight Joints: Use adhesive and manufacturer's standard gaskets.

2.12 ACCESSORIES

A. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil.

B. Conduit Joint Compound: Corrosion-resistant, electrically conductive; suitable for use with the conduit to be installed.

C. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

D. Epoxy Adhesive for RTRC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.

E. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

F. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

G. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

H. Sealing Systems for Roof Penetrations: 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.

1. Products:
   a. Menzies Metal Products; Electrical Roof Stack and Cap:
   b. Menzies Metal Products; Electrical Retro Box:

I. 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.

1. Manufacturers:
   a. Quickflash Weatherproofing Products, Inc:

J. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

1. Products:
   a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built:

K. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for the conduit/duct arrangement to be installed.

1. Products:
   a. Advance Products & Systems, LLC; Duct Bank Spacers:

L. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for the casing and conduit/duct arrangement to be installed.

1. Products:
   a. Advance Products & Systems, LLC; Bore Spacers:

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

G. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.

H. Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.
2. When conduit destination is indicated without specific routing, determine exact routing required.
3. Conceal all conduits unless specifically indicated to be exposed.
4. Conduits in the following areas may be exposed, unless otherwise indicated:
    a. Electrical rooms.
    b. Mechanical equipment rooms.
    c. Within joists in areas with no ceiling.
5. Unless otherwise approved, do not route conduits exposed:
    a. Across floors.
    b. Across roofs.
    c. Across top of parapet walls.
    d. Across building exterior surfaces.
6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
7. Arrange conduit to maintain adequate headroom, clearances, and access.
8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.
9. Arrange conduit to provide no more than 150 feet between pull points.
10. Route conduits above water and drain piping where possible.
11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
    a. Heaters.
    b. Hot water piping.
    c. Flues.
14. Group parallel conduits in the same area together on a common rack.

I. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
4. Use conduit strap to support single surface-mounted conduit.
   a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.
6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.
8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).
9. Use of spring steel conduit clips for support of conduits is not permitted.
10. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

J. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
3. Use suitable adapters where required to transition from one type of conduit to another.
4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.
8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

K. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
2. Make penetrations perpendicular to surfaces unless otherwise indicated.

3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
4. Conceal bends for conduit risers emerging above ground.
5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.
6. Provide suitable modular seal where conduits penetrate exterior wall below grade.
7. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
8. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.
9. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

L. Underground Installation:

1. Minimum Cover, Unless Otherwise Indicated or Required:
   a. Underground, Exterior: 24 inches.
   b. Under Slab on Grade: 12 inches to bottom of slab.
2. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.

M. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):

1. Secure conduits to prevent floating or movement during pouring of concrete.

N. Hazardous (Classified) Locations: Where conduits cross boundaries of hazardous (classified) locations, provide sealing fittings located as indicated or in accordance with NFPA 70.

O. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
3. Where calculated in accordance with NFPA 70 for reinforced thermosetting resin conduit (RTRC) conduit installed above ground to compensate for thermal expansion and contraction.
4. Where conduits are subject to earth movement by settlement or frost.

P. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible

point near the penetration to prevent condensation. This includes, but is not limited to:

1. Where conduits pass from outdoors into conditioned interior spaces.
2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
3. Where conduits penetrate coolers or freezers.

Q. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

R. Provide grounding and bonding in accordance with Section 26 0526.

S. Identify conduits in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.

C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.

D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 0533.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Boxes and enclosures for integrated power, data, and audio/video.

D. Boxes for hazardous (classified) locations.

E. Underground boxes/enclosures.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 07 8400 - Firestopping.

C. Section 08 3100 - Access Doors and Panels: Panels for maintaining access to concealed boxes.

D. Section 26 0526 - Grounding and Bonding for Electrical Systems.

E. Section 26 0529 - Hangers and Supports for Electrical Systems.

F. Section 26 0533.13 - Conduit for Electrical Systems:

1. Conduit bodies and other fittings.
2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

G. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.

H. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

I. Section 26 2726 - Wiring Devices:

1. Wall plates.
2. Floor box service fittings.

3. Poke-through assemblies.
4. Access floor boxes.
5. Additional requirements for locating boxes for wiring devices.

J. Section 27 1000 - Structured Cabling: Additional requirements for communications systems outlet boxes.

K. Section 33 7119 - Electrical Underground Ducts, Ductbanks, and Manholes: Concrete manholes for electrical systems.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable 2014.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports 2013 (Reaffirmed 2020).

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

F. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. SCTE 77 - Specifications for Underground Enclosure Integrity 2017.

H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

J. UL 508A - Industrial Control Panels Current Edition, Including All Revisions.

K. UL 514A - Metallic Outlet Boxes Current Edition, Including All Revisions.

L. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.

1. Underground Boxes/Enclosures: Include reports for load testing in accordance with SCTE 77 certified by a professional engineer or an independent testing agency upon request.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Keys for Lockable Enclosures: Two of each different key.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 - PRODUCTS

2.01 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
3. Provide products listed, classified, and labeled as suitable for the purpose intended.
4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
3. Use suitable concrete type boxes where flush-mounted in concrete.
4. Use suitable masonry type boxes where flush-mounted in masonry walls.
5. Use raised covers suitable for the type of wall construction and device configuration where required.
6. Use shallow boxes where required by the type of wall construction.
7. Do not use "through-wall" boxes designed for access from both sides of wall.
8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
12. Minimum Box Size, Unless Otherwise Indicated:

a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
b. Communications Systems Outlets: Comply with Section 27 1000.
c. Communications Systems Outlets: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
d. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.

13. Wall Plates: Comply with Section 26 2726.
14. Manufacturers:
    a. Hubbell Incorporated; Bell Products
    b. Hubbell Incorporated; RACO Products
    c. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
    d. Thomas & Betts Corporation

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
2. NEMA 250 Environment Type, Unless Otherwise Indicated:
    a. Indoor Clean, Dry Locations: Type 1, painted steel.
    b. Outdoor Locations: Type 3R, painted steel.
3. Junction and Pull Boxes Larger Than 100 cubic inches:
    a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
    b. Boxes 6 square feet and Larger: Provide sectionalized screw-cover or hinged-cover enclosures.
4. Cabinets and Hinged-Cover Enclosures, Other Than Junction and Pull Boxes:
    a. Provide lockable hinged covers, all locks keyed alike unless otherwise indicated.
    b. Back Panels: Painted steel, removable.
    c. Terminal Blocks: Provide voltage/current ratings and terminal quantity suitable for purpose indicated, with 25 percent spare terminal capacity.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation
    b. Hoffman, a brand of Pentair Technical Products
    c. Hubbell Incorporated; Wiegmann Products

D. Boxes and Enclosures for Integrated Power, Data, and Audio/Video: Size and configuration as indicated or as required with partitions to separate services; field-connected gangable boxes may be used.

1. Manufacturers:
    a. Hubbell Incorporated

E. Boxes for Hazardous (Classified) Locations: Listed and labeled as complying with UL 1203 for the classification of the installed location.

1. Manufacturers:
   a. Appleton, a brand of Emerson Electric Co
   b. Cooper Crouse-Hinds, a division of Eaton Corporation
   c. Hubbell Incorporated; Killark Products

F. Floor Boxes:

1. Description: Floor boxes compatible with floor box service fittings provided in accordance with Section 26 2726; with partitions to separate multiple services; furnished with all components, adapters, and trims required for complete installation.
2. Use cast iron floor boxes within slab on grade.
3. Use sheet-steel or cast iron floor boxes within slab above grade.
4. Metallic Floor Boxes: Fully adjustable (with integral means for leveling adjustment prior to and after concrete pour).
5. Manufacturer: Same as manufacturer of floor box service fittings.

G. Underground Boxes/Enclosures:

1. Description: In-ground, open bottom boxes furnished with flush, non-skid covers with legend indicating type of service and stainless steel tamper resistant cover bolts.
2. Size: As indicated on drawings.
3. Depth: As required to extend below frost line to prevent frost upheaval, but not less than 12 inches.
4. Provide logo on cover to indicate type of service.
5. Applications:
   a. Sidewalks and Landscaped Areas Subject Only to Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 8 load rating.
   b. Parking Lots, in Areas Subject Only To Occasional Nondeliberate Vehicular Traffic: Use polymer concrete enclosures, with minimum SCTE 77 Tier 15 load rating.
   c. Do not use polymer concrete enclosures in areas subject to deliberate vehicular traffic.
6. Polymer Concrete Underground Boxes/Enclosures: Comply with SCTE 77.
   a. Manufacturers:
      1) Hubbell Incorporated; Quazite Products:
   b. Combination fiberglass/polymer concrete boxes/enclosures are not acceptable. Use all-polymer concrete boxes/enclosures.

2.02 ACCESSORIES

A. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for boxes and facade materials to

be installed.

1. Manufacturers:
    a. Quickflash Weatherproofing Products, Inc:

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.
2. Unless dimensioned, box locations indicated are approximate.
3. Locate boxes as required for devices installed under other sections or by others.
    a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.
    b. Communications Systems Outlets: Comply with Section 27 1000.
4. Locate boxes so that wall plates do not span different building finishes.
5. Locate boxes so that wall plates do not cross masonry joints.

6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
    a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
    b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.
11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
    a. Concealed above accessible suspended ceilings.
    b. Within joists in areas with no ceiling.
    c. Electrical rooms.
    d. Mechanical equipment rooms.

I. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods approved by the authority having jurisdiction.
2. Provide required seismic controls in accordance with Section 26 0548.
3. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
4. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.

3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Floor-Mounted Cabinets: Mount on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.

M. Install boxes as required to preserve insulation integrity.

N. Metallic Floor Boxes: Install box level at the proper elevation to be flush with finished floor.

O. Underground Boxes/Enclosures:

1. Install enclosure on gravel base, minimum 6 inches deep.
2. Flush-mount enclosures located in concrete or paved areas.
3. Mount enclosures located in landscaped areas with top at 1 inch above finished grade.
4. Install additional bracing inside enclosures in accordance with manufacturer's instructions to minimize box sidewall deflections during backfilling. Backfill with cover bolted in place.

P. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

R. Close unused box openings.

S. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

T. Provide grounding and bonding in accordance with Section 26 0526.

U. Identify boxes in accordance with Section 26 0553.

3.03 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

SECTION 26 0536
CABLE TRAYS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Metal cable tray systems:

1. Metal ladder cable tray.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0529 - Hangers and Supports for Electrical Systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NEMA FG 1 - Fiberglass Cable Tray Systems 1993 (Revised 1994).

C. NEMA VE 1 - Metal Cable Tray Systems 2017.

D. NEMA VE 2 - Cable Tray Installation Guidelines 2018.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the arrangement of cable tray with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others. Coordinate the work with other trades to avoid installation of obstructions within cable tray required clearances.
2. Coordinate arrangement of cable tray with the dimensions and clearance requirements of the actual products to be installed.

3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
4. Notify of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Convene one week prior to commencing work of this section; require attendance of all affected installers. Review proposed routing, sequence of installation, and protection requirements for installed cable tray.

C. Sequencing:

1. Do not begin installation of cables until installation of associated cable tray run is complete.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable tray system components and accessories. Include dimensions, materials, fabrication details, finishes, and span/load ratings.

C. Shop Drawings: Include dimensioned plan views and sections indicating proposed cable tray routing, required clearances, and locations and details of supports, fittings, building element penetrations, and equipment connections.

D. Project Record Documents: Record actual routing of cable tray and locations of supports.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions and NEMA VE 2, except do not store cable tray outdoors without cover as permitted in NEMA VE 2.

B. Handle products carefully to avoid damage to finish.

PART 2 - PRODUCTS

2.01 CABLE TRAY SYSTEM - GENERAL REQUIREMENTS

A. Provide new cable tray system consisting of all required components, fittings, supports, accessories, etc. as necessary for a complete system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Do not use cable tray for applications other than as permitted by NFPA 70 and product listing/classification.

D. Provide cable tray system and associated components suitable for use at indicated span/load ratings under the service conditions at the installed location.

E. Unless otherwise indicated, specified span/load ratings are according to NEMA VE 1 (metal cable tray systems) or NEMA FG 1 (fiberglass cable tray systems) with safety factor of 1.5 and working load only (no additional concentrated static load).

F. Unless otherwise indicated, specified load/fill depths and inside widths are nominal values according to NEMA VE 1 (metal cable tray systems) or NEMA FG 1 (fiberglass cable tray systems) with applicable allowable tolerances.

2.02 METAL CABLE TRAY SYSTEMS

A. Manufacturers:

1. Metal Cable Tray System - Basis of Design: Cablofil #09-8204-0010-12.
2. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

B. Comply with NEMA VE 1.

C. Finishes:

1. As selected by Architect.
   a. Stainless Steel: Type 304 or Type 316.

D. Metal Ladder Cable Tray:

1. Material: Stainless steel.

2. Load/Fill Depth: As indicated on drawings.
3. Span/Load Rating: As indicated on drawings.
4. Rung Spacing: 9 inches on center for straight lengths.
5. Inside Width: As indicated on drawings.
6. Inside Radius of Fittings: 12 inches.

2.03 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Metal Cable Tray: Perform factory design tests in accordance with NEMA VE 1, including electrical continuity and load testing.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that work likely to damage cable tray system has been completed.

B. Verify that field measurements are as indicated.

C. Verify that the dimensions and span/load ratings of cable tray system components are consistent with the indicated requirements.

D. Verify that mounting surfaces are ready to receive cable tray and associated supports.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install cable tray in accordance with NECA 1 (general workmanship), and NEMA VE 2.

C. Unless otherwise indicated, arrange cable tray to be parallel or perpendicular to building lines.

D. Arrange cable tray to provide required clearances and maintain cable access.

1. Minimum Clearance Above and Adjacent to Cable Tray: 12 inches.

E. Install cable tray plumb and level, with sections aligned and with horizontal runs at the proper elevation.

F. Cable Tray Movement Provisions:

1. Provide suitable expansion fittings where cable tray is subject to movement, including but not limited to:

a. Where cable tray crosses structural joints intended for expansion.
b. Long straight cable tray runs in accordance with NEMA VE 2.

2. Use expansion guides in lieu of hold-down clamps where prescribed in NEMA VE 2.
3. Set gaps for expansion fittings in accordance with NEMA VE 2.

G. Cable Provisions:

1. Use suitable fixed barrier strips to maintain separation of cables as indicated and as required by NFPA 70.
2. Use suitable drop-out fittings or bushings where cables exit cable tray as required to maintain minimum cable bending radius.
3. Use suitable cable support fittings for long vertical cable tray runs with heavy cables.

H. Provide end closures at unconnected ends of cable tray runs.

I. Cable Tray Support:

1. Use manufacturer's recommended hangers and supports, located in accordance with NEMA VE 2 and manufacturer's requirements, but not exceeding specified span unless otherwise approved by Engineer. Provide required support and attachment in accordance with Section 26 0529, where not furnished by cable tray manufacturer.
2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

J. Grounding and Bonding Requirements, in Addition to Requirements of Section 26 0526:

1. Comply with grounding and bonding requirements of NEMA VE 2.
2. Metal Cable Tray Systems: Use suitable bonding jumpers or classified connectors to provide electrical continuity.
3. Painted Cable Tray Systems: Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
4. Provide suitable equipment grounding conductor in each cable tray, except where cable tray contains only multiconductor cables with integral equipment grounding conductors. Do not use metal cable tray system as sole equipment grounding conductor.
    a. Equipment Grounding Conductor for Steel Cable Tray: Use bare or insulated copper conductor.
    b. Minimum Equipment Grounding Conductor Size: 6 AWG copper.
    c. Bond equipment grounding conductor to each cable tray section using suitable listed ground clamps. Separate bonding jumpers are not required where properly bonded equipment grounding conductor provides equivalent continuity.

K. Conduit Termination:

1. Use listed cable tray conduit clamps (evaluated for bonding connection) to terminate conduits at cable tray.
2. Provide insulating bushing at conduit termination to protect cables.
3. Provide independent support for conduit.

L. Cable Installation:

1. Comply with cable installation requirements of NEMA VE 2.
2. Use appropriate cable pulling tools, applied to prevent excessive force on cable tray system and maintain minimum cable bending radius.
3. Use cable clamps or cable ties to fasten conductors/cables to vertical and horizontal runs of cable tray.
    a. Distance Between Fastening Points for Vertical Runs: 18 inches.
    b. Distance Between Fastening Points for Horizontal Runs: As required to maintain spacing and confine conductor/cable within the cable fill area.

M. Penetrations: Install firestopping to preserve fire resistance rating of building elements, using materials and methods specified in Section 07 8400.

N. Identification Requirements, in Addition to Those Specified in Section 26 0553.

O. Install cable tray covers where indicated.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect cable tray system for damage and defects.

C. Correct deficiencies and replace damaged or defective cable tray system components.

3.04 ADJUSTING

A. Adjust tightness of mechanical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Remove dirt and debris from cable tray.

B. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.06 PROTECTION

A. Protect cable tray system from subsequent construction operations.

END OF SECTION

SECTION 26 0548
VIBRATION AND SEISMIC CONTROLS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Vibration isolation requirements.

B. Seismic control requirements.

C. Vibration isolators.

D. External seismic snubber assemblies.

E. Seismic restraint systems.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 05 5000 - Metal Fabrications: Materials and requirements for fabricated metal supports.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

1.03 DEFINITIONS

A. Electrical Component: Where referenced in this section in regards to seismic controls, applies to any portion of the electrical system subject to seismic evaluation in accordance with applicable codes, including distributed systems (e.g., conduit, cable tray).

B. Seismic Restraint: Structural members or assemblies of members or manufactured elements specifically designed and applied for transmitting seismic forces between components and the seismic force-resisting system of the structure.

1.04 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications Most Recent Edition Cited by Referring Code or Reference Standard.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate selection and arrangement of vibration isolation and/or seismic control components with the actual equipment to be installed.
2. Coordinate the work with other trades to provide additional framing and materials required for installation.
3. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not install products on or provide attachment to concrete surfaces until concrete has fully cured in accordance with Section 03 3000.

1.06 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

PART 2 PRODUCTS

2.01 VIBRATION ISOLATION REQUIREMENTS

A. Design and provide vibration isolation systems to reduce vibration transmission to supporting structure from vibration-producing electrical equipment and/or electrical connections to vibration-isolated equipment.

B. Comply with applicable general recommendations of ASHRAE (HVACA), where not in conflict with other specified requirements:

C. General Requirements:

1. Select vibration isolators to provide required static deflection.
2. Select vibration isolators for uniform deflection based on distributed operating weight of actual installed equipment.

3. Select seismic type vibration isolators to comply with seismic design requirements, including conditions of equipment seismic certification where applicable.
4. Select vibration isolators for outdoor equipment to comply with wind design requirements.
5. Select vibration-isolated equipment support bases and associated vibration isolators to provide minimum 2-inch operating clearance beneath base unless otherwise indicated.

D. Equipment Isolation:

1. Transformers:
   a. Specified vibration isolators are in addition to any factory-installed internal core and coil assembly vibration isolators unless otherwise indicated.

E. Conduit Isolation:

1. Use flexible conduit or cable for electrical connections to vibration-isolated equipment, including equipment installed under other sections or by others.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install products in accordance with applicable requirements of NECA 1 (general workmanship).

C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.

D. Secure fasteners according to manufacturer's recommended torque settings.

E. Install flexible conduit and cable connections to provide sufficient slack for vibration isolation and/or seismic relative displacements as indicated or as required.

F. Vibration Isolation Systems:

1. Clean debris from beneath vibration-isolated equipment that could cause short-circuiting of isolation.

2. Use elastomeric grommets for attachments where required to prevent short-circuiting of isolation.
3. Adjust isolators to be free of isolation short circuits during normal operation.
4. Do not overtighten fasteners such that resilient material isolator pads are compressed beyond manufacturer's maximum recommended deflection.

END OF SECTION

SECTION 26 0553
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Underground warning tape.

F. Floor marking tape.

G. Warning signs and labels.

1.02 RELATED REQUIREMENTS

A. Section 09 9113 - Exterior Painting.

B. Section 09 9123 - Interior Painting.

C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

D. Section 26 0536 - Cable Trays for Electrical Systems: Additional identification requirements for cable tray systems.

E. Section 26 0573 - Power System Studies: Arc flash hazard warning labels.

F. Section 26 2300 - Low-Voltage Switchgear: Factory-installed mimic bus.

G. Section 26 2726 - Wiring Devices - Lutron: Device and wallplate finishes; factory pre-marked wallplates.

H. Section 27 1000 - Structured Cabling: Identification for communications cabling and devices.

1.03 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 70E - Standard for Electrical Safety in the Workplace 2021.

C. UL 969 - Marking and Labeling Systems Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.

B. Sequencing:

1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
2. Do not install identification products until final surface finishes and painting are complete.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittals procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Provide schedule of items to be identified indicating proposed designations, materials, legends, and formats.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.07 FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 - PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
   a. Switchgear:

1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.

b. Switchboards:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.

c. Panelboards:
1) Identify ampere rating.
2) Identify voltage and phase.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.

d. Transformers:
1) Identify kVA rating.
2) Identify voltage and phase for primary and secondary.
3) Identify power source and circuit number. Include location when not within sight of equipment.
4) Identify load(s) served. Include location when not within sight of equipment.

e. Enclosed switches, circuit breakers, and motor controllers:
1) Identify voltage and phase.
2) Identify power source and circuit number. Include location when not within sight of equipment.
3) Identify load(s) served. Include location when not within sight of equipment.

2. Service Equipment:
a. Use identification nameplate to identify each service disconnecting means.

3. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".

4. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.

a. Service equipment.
b. Industrial control panels.
c. Motor control centers.
d. Elevator control panels.
e. Industrial machinery.

5. Arc Flash Hazard Warning Labels: Use warning labels to identify arc flash hazards for electrical equipment, such as switchboards, panelboards, industrial control panels, meter socket enclosures, and motor control centers that are likely to require examination, adjustment, servicing, or maintenance while energized.
   a. Minimum Size: 3.5 by 5 inches.
   b. Legend: Include orange header that reads "WARNING", followed by the word message "Arc Flash and Shock Hazard; Appropriate PPE Required; Do not operate controls or open covers without appropriate personal protection equipment; Failure to comply may result in injury or death; Refer to NFPA 70E for minimum PPE requirements" or approved equivalent.
   c. Service Equipment: Include the following information in accordance with NFPA 70.
      1) Nominal system voltage.
      2) Available fault current.
      3) Clearing time of service overcurrent protective device(s).
      4) Date label applied.

B. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
2. Identification for Communications Conductors and Cables: Comply with Section 27 1000.
3. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
4. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
5. Use underground warning tape to identify direct buried cables.

C. Identification for Raceways:

1. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.
   a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.
      1) Color Code:
         (a) Emergency Power System: Red.
         (b) Fire Alarm System: Red.
      2) Field-Painting: Comply with Section 09 9123 and 09 9113.
      3) Vinyl Color Coding Electrical Tape: Comply with Section 26 0519.
2. Use underground warning tape to identify underground raceways.

D. Identification for Devices:

1. Identification for Communications Devices: Comply with Section 27 1000.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Manufacturers:
   a. Brimar Industries, Inc
   b. Kolbi Pipe Marker Co
   c. Seton Identification Products
2. Materials:
   a. Indoor Clean, Dry Locations: Use plastic nameplates.
   b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
3. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
4. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
5. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
6. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Manufacturers:
   a. Brady Corporation
   b. Brother International Corporation
   c. Panduit Corp
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend:
   a. System designation where applicable:
      1) Emergency Power System: Identify with text "EMERGENCY".
      2) Fire Alarm System: Identify with text "FIRE ALARM".
   b. Equipment designation or other approved description.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.

5. Color:
    a. Normal Power System: White text on black background.
        1) 480Y/277 V, 3 Phase Equipment: White text on Black background.
        2) 208Y/120 V, 3 Phase Equipment: White text on Black background.
    b. Emergency Power System: White text on red background.
    c. Fire Alarm System: White text on red background.

D. Format for General Information and Operating Instructions:

1. Minimum Size: 1 inch by 2.5 inches.
2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 1/4 inch.
5. Color: Black text on white background unless otherwise indicated.

2.03 WIRE AND CABLE MARKERS

A. Manufacturers:

1. Brady Corporation
2. HellermannTyton
3. Panduit Corp

B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.

C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.

D. Legend: Power source and circuit number or other designation indicated.

E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

A. Manufacturers:

1. Brady Corporation
2. Brimar Industries, Inc
3. Seton Identification Products

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

C. Minimum Size:

1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.

D. Legend:

1. Markers for System Identification:

E. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

A. Manufacturers:

1. Brady Corporation
2. Brimar Industries, Inc
3. Seton Identification Products

B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

1. Exception: Use foil-backed detectable type tape where required by serving utility or where directed by Owner.

C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.

E. Legend: Type of service, continuously repeated over full length of tape.

F. Color:

2.06 WARNING SIGNS AND LABELS

A. Manufacturers:

1. Brimar Industries, Inc
2. Clarion Safety Systems, LLC
3. Seton Identification Products

B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

C. Warning Signs:

1. Materials:
2. Minimum Size: 7 by 10 inches unless otherwise indicated.

D. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 - EXECUTION

3.01 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.
2. Flush-Mounted Equipment: Inside of equipment door.
3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
4. Elevated Equipment: Legible from the floor or working platform.
5. Branch Devices: Adjacent to device.
6. Interior Components: Legible from the point of access.
7. Conduits: Legible from the floor.
8. Conductors and Cables: Legible from the point of access.
9. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.

END OF SECTION

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SECTION 26 0923
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Occupancy sensors.

B. Time switches.

C. In-wall time switches.

D. In-wall interval timers.

E. Outdoor photo controls.

F. Lighting contactors.

G. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 25 3626 - Integrated Automation Lighting Relays.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems

D. Section 26 0533.16 - Boxes for Electrical Systems.

E. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

F. Section 26 5100 - Interior Lighting.

G. Section 26 5600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.

C. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Disharge Ballasts 2020.

D. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices 2017.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 916 - Energy Management Equipment Current Edition, Including All Revisions.

G. UL 917 - Clock-Operated Switches Current Edition, Including All Revisions.

H. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of lighting control devices with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate the placement of wall switch occupancy sensors with actual installed door swings.
3. Coordinate the placement of occupancy sensors with millwork, furniture, equipment or other potential obstructions to motion detection coverage installed under other sections or by others.
4. Coordinate the placement of photo sensors for daylighting controls with windows, skylights, and luminaires to achieve optimum operation. Coordinate placement with ductwork, piping, equipment, or other potential obstructions to light level measurement installed under other sections or by others.
5. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include ratings, configurations, standard wiring diagrams, dimensions, colors, service condition requirements, and installed features.

1. Occupancy Sensors: Include detailed motion detection coverage range diagrams.

C. Shop Drawings:

1. Occupancy Sensors: Provide lighting plan indicating location, model number, and orientation of each occupancy sensor and associated system component.

D. Field Quality Control Reports.

E. Manufacturer's Installation Instructions: Include application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection,

examination, preparation, and installation of product.

F. Operation and Maintenance Data: Include detailed information on device programming and setup.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

H. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store products in a clean, dry space in original manufacturer's packaging in accordance with manufacturer's written instructions until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for all occupancy sensors.

C. Provide five year manufacturer warranty for utility grade locking receptacle-mounted outdoor photo controls.

PART 2 - PRODUCTS

2.01 LIGHTING CONTROL DEVICES - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide all required conduit, wiring, connectors, hardware, components, accessories, etc. as required for a complete operating system.

C. Products for Switching of Electronic Ballasts/Drivers: Tested and rated to be suitable for peak inrush currents specified in NEMA 410.

2.02 OCCUPANCY SENSORS

A. Manufacturers:

1. Leviton
2. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. All Occupancy Sensors:

1. Description: Factory-assembled commercial specification grade devices for indoor use capable of sensing both major motion, such as walking, and minor motion, such as small desktop level movements, according to published coverage areas, for automatic control of load indicated.
2. Sensor Technology:
   a. Passive Infrared/Ultrasonic Dual Technology Occupancy Sensors: Designed to detect occupancy using a combination of both passive infrared and ultrasonic technologies.
3. Provide LED to visually indicate motion detection with separate color LEDs for each sensor type in dual technology units.
4. Operation: Unless otherwise indicated, occupancy sensor to turn load on when occupant presence is detected and to turn load off when no occupant presence is detected during an adjustable turn-off delay time interval.
5. Dual Technology Occupancy Sensors: Field configurable turn-on and hold-on activation with settings for activation by either or both sensing technologies.
6. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.
7. Sensitivity: Field adjustable.
8. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.
9. Compatibility (Non-Dimming Sensors): Suitable for controlling incandescent lighting, low-voltage lighting with electronic and magnetic transformers, fluorescent lighting with electronic and magnetic ballasts, and fractional motor loads, with no minimum load requirements.
10. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

C. Wall Switch Occupancy Sensors:

1. All Wall Switch Occupancy Sensors:
   a. Description: Occupancy sensors designed for installation in standard wall box at standard wall switch mounting height with a field of view of 180 degrees, integrated

manual control capability, and no leakage current to load in off mode.

b. Unless otherwise indicated or required to control the load indicated on drawings, provide line voltage units with self-contained relay.

c. Where indicated, provide two-circuit units for control of two separate lighting loads, with separate manual controls and separately programmable operation for each load.

d. Manual-Off Override Control: When used to turn off load while in automatic-on mode, unit to revert back to automatic mode after no occupant presence is detected during the delayed-off time interval.

e. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.

f. Finish: Color to be selected by Architect..

2. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

a. Products:

1) Wattstopper.

D. Directional Occupancy Sensors:

1. All Directional Occupancy Sensors: Designed for wall or ceiling mounting, with integral swivel for field adjustment of motion detection coverage.

a. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.

b. Provide field selectable setting for disabling LED motion detector visual indicator.

c. Finish: White unless otherwise indicated.

2. Passive Infrared (PIR) Directional Occupancy Sensors:

a. Standard Range Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.

E. Power Packs for Low Voltage Occupancy Sensors:

1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage occupancy sensors for switching of line voltage loads.

2. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.

3. Input Supply Voltage: Dual rated for 120/277 V ac.

4. Load Rating: As required to control the load indicated on drawings.

F. Power Packs for Wireless Occupancy Sensors:

1. Description: Plenum rated, self-contained relay compatible with specified wireless occupancy sensors for switching of line voltage loads.

2. Input Supply Voltage: Dual rated for 120/277 V ac.

3. Load Rating: As required to control the load indicated on drawings.

2.03 ACCESSORIES

A. Auxiliary Contacts:

1. Comply with NEMA ICS 5.

2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each lighting contactor, minimum.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that openings for outlet boxes are neatly cut and will be completely covered by devices or wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that branch circuit wiring installation is completed, tested, and ready for connection to lighting control devices.

F. Verify that the service voltage and ratings of lighting control devices are appropriate for the service voltage and load requirements at the location to be installed.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Install lighting control devices in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Install lighting control relays furnished under Section 25 3626

C. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of lighting control devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:

a. Wall Switch Occupancy Sensors: 48 inches above finished floor.
b. In-Wall Time Switches: 48 inches above finished floor.
c. In-Wall Interval Timers: 48 inches above finished floor.

2. Orient outlet boxes for vertical installation of lighting control devices unless otherwise indicated.
3. Locate wall switch occupancy sensors on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.

D. Install lighting control devices in accordance with manufacturer's instructions.

E. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

F. Install lighting control devices plumb and level, and held securely in place.

G. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.

H. Provide required supports in accordance with Section 26 0529.

I. Where applicable, install lighting control devices and associated wall plates to fit completely flush to mounting surface with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

J. Occupancy Sensor Locations:

1. Location Adjustments: Do not make adjustments to locations without obtaining approval from the Architect.
2. Location Adjustments: Within the design intent, reasonably minor adjustments to locations may be made in order to optimize coverage and avoid conflicts or problems affecting coverage.
3. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for complete coverage of respective room or area based on manufacturer's recommendations for installed devices.
4. Locate ultrasonic and dual technology passive infrared/ultrasonic occupancy sensors a minimum of 4 feet from air supply ducts or other sources of heavy air flow and as per manufacturer's recommendations, in order to minimize false triggers.

K. Outdoor Photo Control Locations:

1. Where possible, locate outdoor photo controls with photo sensor facing north. If north facing photo sensor is not possible, install with photo sensor facing east, west, or down.

2. Locate outdoor photo controls so that photo sensors do not face artificial light sources, including light sources controlled by the photo control itself.

L. Install outdoor photo controls so that connections are weatherproof. Do not install photo controls with conduit stem facing up in order to prevent infiltration of water into the photo control.

M. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

N. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

O. Where indicated or required, provide cabinet or enclosure in accordance with Section 26 0533.16 for mounting of lighting control device system components.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each lighting control device for damage and defects.

C. Test occupancy sensors to verify proper operation, including time delays and ambient light thresholds where applicable. Verify optimal coverage for entire room or area. Record test results in written report to be included with submittals.

D. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust occupancy sensor settings to minimize undesired activations while optimizing energy savings, and to achieve desired function as indicated or as directed by Architect.

C. Adjust position of directional occupancy sensors and outdoor motion sensors to achieve optimal coverage as required.

D. Where indicated or as directed by Architect, install factory masking material or adjust integral blinders on passive infrared (PIR) and dual technology occupancy sensor lenses to block

undesired motion detection.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstration: Demonstrate proper operation of lighting control devices to Architect, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, programming, and maintenance of lighting control devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.
3. Instructor: Qualified contractor familiar with the project and with sufficient knowledge of the installed lighting control devices.
4. Location: At project site.

END OF SECTION

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SECTION 26 2100
LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Electrical service requirements.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for cast-in-place concrete equipment pads.

B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0529 - Hangers and Supports for Electrical Systems.

E. Section 26 0533.13 - Conduit for Electrical Systems.

F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 2300 - Low-Voltage Switchgear: Service entrance equipment.

H. Section 26 2413 - Switchboards: Service entrance equipment.

I. Section 26 2416 - Panelboards: Service entrance equipment.

J. Section 26 2816.16 - Enclosed Switches: Service entrance equipment.

K. Section 26 3600 - Transfer Switches: Service entrance equipment.

L. Section 26 4300 - Surge Protective Devices: Service entrance surge protective devices.

M. Section 31 2316 - Excavation.

N. Section 31 2316.13 - Trenching: Excavating, bedding, and backfilling.

O. Section 31 2323 - Fill: Bedding and backfilling.

P. Section 33 7119 - Electrical Underground Ducts, Ductbanks, and Manholes.

1.03 DEFINITIONS

A. Service Point: The point of connection between the facilities of the serving utility and the premises wiring as defined in NFPA 70, and as designated by the Utility Company.

1.04 REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code(R) (NESC(R)) 2023.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.05 ADMINISTRATIVE REQUIREMENTS

A. No later than two weeks following date of the Agreement, notify Utility Company of anticipated date of service.

B. Coordination:

1. Verify the following with Utility Company representative:
   a. Utility Company requirements, including division of responsibility.
   b. Exact location and details of utility point of connection.
   c. Utility easement requirements.
   d. Utility Company charges associated with providing service.
2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for electrical service and associated equipment.
3. Coordinate arrangement of service entrance equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

C. Arrange for Utility Company to provide permanent electrical service. Prepare and submit documentation required by Utility Company.

D. Utility Company charges associated with providing permanent service to be paid by Owner.

E. Preinstallation Meeting: Convene one week prior to commencing work of this section to review service requirements and details with Utility Company representative.

F. Scheduling:

1. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.06 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Record actual locations of equipment and installed service routing.

1.07 QUALITY ASSURANCE

A. Comply with the following:

1. IEEE C2 (National Electrical Safety Code).
2. NFPA 70 (National Electrical Code).
3. The requirements of the Utility Company.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products indoors in a clean, dry space having a uniform temperature to prevent condensation (including outdoor rated products which are not weatherproof until completely and properly installed). Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle products carefully to avoid damage to internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 ELECTRICAL SERVICE REQUIREMENTS

A. Provide new electrical service consisting of all required conduits, conductors, equipment, metering provisions, supports, accessories, etc. as necessary for connection between Utility Company point of supply and service entrance equipment.

B. Electrical Service Characteristics: As indicated on drawings.

C. Utility Company: As indicated on drawings.

D. Division of Responsibility:

1. Pad-Mounted Utility Transformers:
   a. Transformer Vaults and Pads: Furnished and installed by Contractor per Utility Company requirements.
   b. Transformers: Furnished and installed by Utility Company.

c. Transformer Grounding Provisions: Furnished and installed by Contractor per Utility Company requirements.
d. Primary:
1) Trenching and Backfilling: Provided by Contractor.
2) Conduits: Furnished and installed by Contractor.
3) Conductors: Furnished and installed by Utility Company.
e. Secondary:
1) Trenching and Backfilling: Provided by Contractor.
2) Conduits: Furnished and installed by Contractor.
3) Conductors: Furnished and installed by Contractor (Service Point at transformer).

2. Terminations at Service Point: Provided by Utility Company.
3. Metering Provisions:
a. Meter Bases: Furnished and installed by Contractor per Utility Company requirements.
b. Metering Transformer Cabinets: Furnished and installed by Contractor per Utility Company requirements.
c. Metering Compartments in Service Entrance Equipment: Furnished and installed by Contractor per Utility Company requirements.
d. Metering Transformers: Furnished and installed by Utility Company.
e. Conduits Between Metering Transformers and Meters: Furnished and installed by Contractor per Utility Company requirements.
f. Wiring Between Metering Transformers and Meters: Furnished and installed by Utility Company.
g. Communications Conduits for Meters: Furnished and installed by Contractor per Utility Company requirements.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings and configurations of service entrance equipment are consistent with the indicated requirements.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Verify and mark locations of existing underground utilities.

3.03 INSTALLATION

A. Install products in accordance with manufacturer's instructions and Utility Company requirements.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required trenching and backfilling in accordance with Section 31 2316 and Section 31 2323.

E. Construct cast-in-place concrete pads for utility equipment in accordance with Utility Company requirements and Section 03 3000.

F. Provide required protective bollards in accordance with Utility Company requirements.

G. Provide required support and attachment components in accordance with Section 26 0529.

H. Provide grounding and bonding for service entrance equipment in accordance with Section 26 0526.

I. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 0553.

3.04 PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION

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SECTION 26 2200
LOW-VOLTAGE TRANSFORMERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. General purpose transformers.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0533.13 - Conduit for Electrical Systems: Flexible conduit connections.

E. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.

F. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

G. Section 26 0916 - Electric Controls and Relays: Industrial control transformers.

H. Section 26 2416 - Panelboards.

1.03 REFERENCE STANDARDS

A. 10 CFR 431, Subpart K - Energy Efficiency Program for Certain Commercial and Industrial Equipment - Distribution Transformers Current Edition.

B. IEEE C57.94 - IEEE Recommended Practice for Installation, Application, Operation, and Maintenance of Dry-Type Distribution and Power Transformers 2015.

C. IEEE C57.96 - IEEE Standard Guide for Loading Dry-Type Distribution and Power Transformers 2013.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

E. NECA 409 - Standard for Installing and Maintaining Dry-Type Transformers 2015.

F. NEMA ST 20 - Dry Type Transformers for General Applications 2014.

G. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 506 - Standard for Specialty Transformers Current Edition, Including All Revisions.

K. UL 1561 - Standard for Dry-Type General Purpose and Power Transformers Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with placement of supports, anchors, etc. required for mounting.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include voltage, kVA, impedance, tap configurations, insulation system class and rated temperature rise, efficiency, sound level, enclosure ratings, outline and support point dimensions, weight, required clearances, service condition requirements, and installed features.

1. Vibration Isolators: Include attachment method and rated load and deflection.
2. Shielded Transformers: Include shielding method and noise attenuation performance.

C. Shop Drawings: Provide dimensioned plan and elevation views of transformers and adjacent equipment with all required clearances indicated.

D. Manufacturer's equipment seismic qualification certification.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA ST 20 as design and routine tests.

F. Field Quality Control Test Reports.

G. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Maintenance Data: Include recommended maintenance procedures and intervals.

I. Project Record Documents: Record actual locations of transformers.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to transformer internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Ambient Temperature: Do not exceed the following maximum temperatures during and after installation of transformers.

1. Greater than 10 kVA: 104 degrees F maximum.
2. Less than 10 kVA: 77 degrees F maximum.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation

B. Schneider Electric; Square D Products

C. Siemens Industry, Inc

D. Source Limitations: Furnish transformers produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 TRANSFORMERS - GENERAL REQUIREMENTS

A. Description: Factory-assembled, dry type transformers for 60 Hz operation designed and manufactured in accordance with NEMA ST 20 and listed, classified, and labeled as suitable for the purpose intended.

B. Unless noted otherwise, transformer ratings indicated are for continuous loading according to IEEE C57.96 under the following service conditions:

1. Altitude: Less than 3,300 feet.
2. Ambient Temperature:
    a. Greater than 10 kVA: Not exceeding 104 degrees F.
    b. Less than 10 kVA: Not exceeding 77 degrees F.

C. Core: High grade, non-aging silicon steel with high magnetic permeability and low hysteresis and eddy current losses. Keep magnetic flux densities substantially below saturation point, even at 10 percent primary overvoltage. Tightly clamp core laminations to prevent plate movement and maintain consistent pressure throughout core length.

D. Impregnate core and coil assembly with non-hydroscopic thermo-setting varnish to effectively seal out moisture and other contaminants.

E. Basic Impulse Level: 10 kV.

F. Ground core and coil assembly to enclosure by means of a visible flexible copper grounding strap.

G. Isolate core and coil from enclosure using vibration-absorbing mounts.

H. Nameplate: Include transformer connection data, ratings, wiring diagrams, and overload capacity based on rated winding temperature rise.

2.03 GENERAL PURPOSE TRANSFORMERS

A. Description: Self-cooled, two winding transformers listed and labeled as complying with UL 506 or UL 1561; ratings as indicated on the drawings.

B. Primary Voltage: 480 volts delta, 3 phase.

C. Secondary Voltage: 208Y/120 volts, 3 phase.

D. Insulation System and Allowable Average Winding Temperature Rise:

1. Less than 15 kVA: Class 180 degrees C insulation system with 115 degrees C average winding temperature rise.
2. 15 kVA and Larger: Class 220 degrees C insulation system with 150 degrees C average winding temperature rise.

E. Coil Conductors: Continuous copper windings with terminations brazed or welded.

F. Winding Taps:

1. Less than 3 kVA: None.
2. 3 kVA through 15 kVA: Two 5 percent full capacity primary taps below rated voltage.
3. 15 kVA through 300 kVA: Two 2.5 percent full capacity primary taps above and four 2.5 percent full capacity primary taps below rated voltage.
4. 500 kVA and Larger: Two 2.5 percent full capacity primary taps above and two 2.5 percent full capacity primary taps below rated voltage.

G. Energy Efficiency: Comply with 10 CFR 431, Subpart K.

H. Sound Levels: Standard sound levels complying with NEMA ST 20

I. Mounting Provisions:

1. Less than 15 kVA: Suitable for wall mounting.
2. 15 kVA through 75 kVA: Suitable for wall, floor, or trapeze mounting.
3. Larger than 75 kVA: Suitable for floor mounting.

J. Transformer Enclosure: Comply with NEMA ST 20.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor clean, dry locations: Type 2.
   b. Outdoor locations: Type 3R.
2. Construction: Steel.
   a. Less than 15 kVA: Totally enclosed, non-ventilated.
   b. 15 kVA and Larger: Ventilated.

3. Finish: Manufacturer's standard grey, suitable for outdoor installations.
4. Provide lifting eyes or brackets.

K. Accessories:

1. Lug Kits: Sized as required for termination of conductors as indicated on the drawings.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that suitable support frames and anchors are installed where required and that mounting surfaces are ready to receive transformers.

C. Perform pre-installation tests and inspections on transformers per manufacturer's instructions and as specified in NECA 409. Correct deficiencies prior to installation.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install transformers in accordance with NECA 409 and IEEE C57.94.

D. Use flexible conduit, under the provisions of Section 26 0533.13, 2 feet minimum length, for connections to transformer case. Make conduit connections to side panel of enclosure.

E. Arrange equipment to provide minimum clearances as specified on transformer nameplate and in accordance with manufacturer's instructions and NFPA 70.

F. Install transformers plumb and level.

G. Transformer Support:

1. Provide required support and attachment in accordance with Section 26 0529, where not furnished by transformer manufacturer.
2. Use integral transformer flanges, accessory brackets furnished by manufacturer, or field-fabricated supports to support wall-mounted transformers.
3. Unless otherwise indicated, mount floor-mounted transformers on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.
4. Use trapeze hangers assembled from threaded rods and metal channel (strut) to support suspended transformers. Provide independent support from building structure. Do not

provide support from piping, ductwork, or other systems.

H. Provide grounding and bonding in accordance with Section 26 0526.

I. Remove shipping braces and adjust bolts that attach the core and coil mounting bracket to the enclosure according to manufacturer's recommendations in order to reduce audible noise transmission.

J. Where not factory-installed, install lugs sized as required for termination of conductors as indicated.

K. Identify transformers in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS Sections 7.2.1.1 and 7.2.1.2. Tests and inspections listed as optional are not required.

1. 167 kVA single phase, 500 kVA three phase and smaller:
   a. Perform turns ratio tests at all tap positions.

3.04 ADJUSTING

A. Measure primary and secondary voltages and make appropriate tap adjustments.

B. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from transformer components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 26 2413
SWITCHBOARDS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.

B. Overcurrent protective devices for switchboards.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 25 3613 - Integrated Automation Power Meters: Smart (AMI and AMR) Meters.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems.

D. Section 26 0529 - Hangers and Supports for Electrical Systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

G. Section 26 2100 - Low-Voltage Electrical Service Entrance.

H. Section 26 2300 - Low-Voltage Switchgear.

I. Section 26 2813 - Fuses: Fuses for fusible switches.

J. Section 26 4300 - Surge Protective Devices.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NECA 400 - Standard for Installing and Maintaining Switchboards 2007.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

E. NEMA PB 2 - Deadfront Distribution Switchboards 2011.

F. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less 2013.

G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.

J. UL 891 - Switchboards Current Edition, Including All Revisions.

K. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.

1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Identify mounting conditions required for equipment seismic qualification.

D. Manufacturer's equipment seismic qualification certification.

E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

F. Field Quality Control Test Reports.

G. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Enclosure Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.

B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed).

Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.

C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Switchboards - Basis of Design: Square D.

B. Switchboards - Other Acceptable Manufacturers:

1. Eaton Corporation; [_____]: www.eaton.com/#sle.
2. Siemens Industry, Inc: www.usa.siemens.com/#sle.

C. Products other than basis of design are subject to compliance with specified requirements and prior approval of Engineer. By using products other than basis of design, Contractor accepts responsibility for costs associated with any necessary modifications to related work, including any design fees.

D. Source Limitations: Furnish switchboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 SWITCHBOARDS

A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.

D. Service Conditions:

1. Provide switchboards and associated components suitable for operation under the following service conditions without derating:
   a. Altitude: Less than 6,600 feet.
   b. Ambient Temperature:
      1) Switchboards Containing Molded Case or Insulated Case Circuit Breakers: Between 23 degrees F and 104 degrees F.
2. Provide switchboards and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Short Circuit Current Rating:

1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 0573.
2. Minimum Rating: 65,000 rms symmetrical amperes.

F. Main Devices: Configure for top or bottom incoming feed as indicated or as required for the installation. Provide separate pull section and/or top-mounted pullbox as indicated or as required to facilitate installation of incoming feed.

G. Bussing: Sized in accordance with UL 891 temperature rise requirements.

1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
2. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
3. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
4. Phase and Neutral Bus Material: Aluminum.
5. Ground Bus Material: Aluminum.

H. Conductor Terminations: Suitable for use with the conductors to be installed.

1. Line Conductor Terminations:
   a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   b. Main and Neutral Lug Type: Mechanical.
2. Load Conductor Terminations:
   a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
   b. Lug Type:

1) Provide mechanical lugs unless otherwise indicated.

I. Enclosures:

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 2 (drip-proof).
   b. Outdoor Locations: Type 3R.
2. Finish: Manufacturer's standard unless otherwise indicated.

J. Future Provisions:

1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

K. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list switchboards as a complete assembly including surge protective device.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

1. Where overcurrent protective devices equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.
2. Where accessory ground fault sensing and relaying equipment is used, equip companion overcurrent protective devices with ground-fault shunt trips.
   a. Use zero sequence or residual ground fault detection method unless otherwise indicated.
   b. Provide test panel and field-adjustable ground fault pick-up and delay settings.

M. Arc Flash Energy-Reducing Maintenance Switching: For circuit breakers rated 1200 A or higher, provide a local accessory switch with status indicator light that permits selection of a maintenance mode with alternate electronic trip unit settings for reduced fault clearing time.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Circuit Breakers:

1. Interrupting Capacity:
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
2. Molded Case Circuit Breakers:
   a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with

FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

d. Provide the following circuit breaker types where indicated:

1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive switchboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.

C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.

D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install switchboards plumb and level.

G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03 3000.

H. Provide grounding and bonding in accordance with Section 26 0526.

I. Install all field-installed devices, components, and accessories.

J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

K. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

L. Provide filler plates to cover unused spaces in switchboards.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

C. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

D. Inspect and test in accordance with NETA ATS, except Section 4.

E. Perform inspections and tests listed in NETA ATS, Section 7.1.

F. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than [_____] amperes. Tests listed as optional are not required.

G. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

1. Perform inspections and tests listed in NETA ATS, Section 7.14. The insulation-resistance test on control wiring listed as optional is not required.

H. Correct deficiencies and replace damaged or defective switchboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

3.05 CLEANING

A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

3.07 PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION

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SECTION 26 2416
PANELBOARDS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.02 RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NECA 407 - Standard for Installing and Maintaining Panelboards 2015.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

E. NEMA PB 1 - Panelboards 2011.

F. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less 2013.

G. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

H. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

J. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

K. UL 67 - Panelboards Current Edition, Including All Revisions.

L. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.

M. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.

N. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

O. UL 1699 - Arc-Fault Circuit-Interrupters Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.
4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.

D. Manufacturer's equipment seismic qualification certification.

E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

F. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Panelboard Keys: Two of each different key.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store panelboards in accordance with manufacturer's instructions and NECA 407.

B. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

C. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature within the following limits during and after installation of panelboards:

1. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation

B. Schneider Electric; Square D Products

C. Siemens Industry, Inc

2.02 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.
2. Ambient Temperature:
    a. Panelboards Containing Circuit Breakers: Between 23 degrees F and 104 degrees F.

C. Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

D. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

E. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

F. Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.
2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
    a. Indoor Clean, Dry Locations: Type 1.
    b. Outdoor Locations: Type 3R.
2. Boxes: Galvanized steel unless otherwise indicated.
    a. Provide wiring gutters sized to accommodate the conductors to be installed.
    b. Increase gutter space as required where sub-feed lugs, feed-through lugs, gutter taps, or oversized lugs are provided.
    c. Provide removable end walls for NEMA Type 1 enclosures.
    d. Provide painted steel boxes for surface-mounted panelboards where indicated, finish to match fronts.
3. Fronts:
    a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.
    b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.
    c. Finish for Painted Steel Fronts: Manufacturer's standard grey unless otherwise indicated.
4. Lockable Doors: All locks keyed alike unless otherwise indicated.

I. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

J. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

K. Multi-Section Panelboards: Provide enclosures of the same height, with feed-through lugs or sub-feed lugs and feeders as indicated or as required to interconnect sections.

L. Load centers are not acceptable.

M. Provide the following features and accessories where indicated or where required to complete installation:

1. Feed-through lugs.
2. Sub-feed lugs.

2.03 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase and Neutral Bus Material: Copper.
2. Ground Bus Material: Copper.

D. Circuit Breakers:

1. Provide bolt-on type or plug-in type secured with locking mechanical restraints.

E. Enclosures:

1. Provide surface-mounted enclosures unless otherwise indicated.

2.04 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.
2. Phase and Neutral Bus Material: Copper.
3. Ground Bus Material: Copper.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.
2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.
3. Provide clear plastic circuit directory holder mounted on inside of door.

2.05 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
2. Interrupting Capacity:

a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

3. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Lug Material: Copper, suitable for terminating copper conductors only.
4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.
7. Provide the following circuit breaker types where indicated:
   a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.
   b. Ground Fault Equipment Protection Circuit Breakers: Designed to trip at 30 mA for protection of equipment.
   c. Arc-Fault Circuit Interrupter (AFCI) Circuit Breakers: Combination type listed as complying with UL 1699.
   d. 100 Percent Rated Circuit Breakers: Listed for application within the panelboard where installed at 100 percent of the continuous current rating.
   e. Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
8. Do not use tandem circuit breakers.
9. Do not use handle ties in lieu of multi-pole circuit breakers.
10. Provide the following features and accessories where indicated or where required to complete installation:
    a. Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.
    b. Handle Pad-Lock Provision: For locking circuit breaker handle in OFF position.

2.06 SOURCE QUALITY CONTROL

A. Factory test panelboards according to NEMA PB 1.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install panelboards in accordance with NECA 407 and NEMA PB 1.1.

D. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install panelboards plumb.

G. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

H. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

I. Mount floor-mounted power distribution panelboards on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.

J. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

K. Provide grounding and bonding in accordance with Section 26 0526.

L. Install all field-installed branch devices, components, and accessories.

M. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 0573.

N. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

O. Provide filler plates to cover unused spaces in panelboards.

P. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:

1. Fire detection and alarm circuits.

Q. Identify panelboards in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers and circuit breakers larger than 100 amperes. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Test GFCI circuit breakers to verify proper operation.

F. Test AFCI circuit breakers to verify proper operation.

G. Test shunt trips to verify proper operation.

H. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

3.05 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 26 2726
WIRING DEVICES

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

1.02 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Manufactured wiring systems for use with access floor boxes with compatible pre-wired connectors.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 0533.23 - Surface Raceways for Electrical Systems: Surface raceway systems, including multioutlet assemblies.

E. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

F. Section 26 0583 - Wiring Connections: Cords and plugs for equipment.

G. Section 26 0923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

H. Section 26 2913 - Enclosed Controllers: Manual motor starters and horsepower rated motor-starting switches without overload protection.

1.03 REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for 2014h, with Amendments (2017).

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification) 2014g, with Amendment (2017).

C. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices 2016.

E. NEMA WD 1 - General Color Requirements for Wiring Devices 1999 (Reaffirmed 2020).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications 2016.

G. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. UL 20 - General-Use Snap Switches Current Edition, Including All Revisions.

I. UL 498 - Attachment Plugs and Receptacles Current Edition, Including All Revisions.

J. UL 514D - Cover Plates for Flush-Mounted Wiring Devices Current Edition, Including All Revisions.

K. UL 943 - Ground-Fault Circuit-Interrupters Current Edition, Including All Revisions.

L. UL 1472 - Solid-State Dimming Controls Current Edition, Including All Revisions.

M. UL 1917 - Solid-State Fan Speed Controls Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.
2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.
3. Coordinate the placement of outlet boxes for wall switches with actual installed door swings.
4. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.
5. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.
6. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

1. Wall Dimmers: Include derating information for ganged multiple devices.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

D. Operation and Maintenance Data:

1. Wall Dimmers: Include information on operation and setting of presets.
2. GFCI Receptacles: Include information on status indicators.

E. Project Record Documents: Record actual installed locations of wiring devices.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Extra Wall Plates: Two of each style, size, and finish.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 - PRODUCTS

2.01 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFCI receptacles with specified weatherproof covers for receptacles installed outdoors or in damp or wet locations.

D. Provide tamper resistant receptacles for receptacles installed in dwelling units.

E. Provide GFCI protection for receptacles installed within 6 feet of sinks.

F. Provide GFCI protection for receptacles installed in kitchens.

G. Provide GFCI protection for receptacles serving electric drinking fountains.

H. For flush floor service fittings, use tile rings for installations in tile floors.

I. For flush floor service fittings, use carpet flanges for installations in carpeted floors.

2.02 WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices, Unless Otherwise Indicated: Color to be selected by Architect from Manufacturer's list of standard colors.

C. Wiring Devices Installed in Wet or Damp Locations: Color to be selected by Architect from Manufacturer's list of standard colors with weatherproof cover.

D. Flush Floor Box Service Fittings: Gray wiring devices with aluminum cover and ring/flange.

E. Flush Poke-Through Service Fittings: Gray wiring devices with aluminum cover and aluminum flange.

F. Access Floor Boxes: Gray wiring devices with gray steel cover with insert to match floor covering.

2.03 WALL SWITCHES

A. Manufacturers:

1. Hubbell Incorporated
2. Leviton Manufacturing Company, Inc
3. Pass & Seymour, a brand of Legrand North America, Inc

B. Wall Switches - General Requirements: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20 and where applicable, FS W-S-896; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

C. Standard Wall Switches: Commercial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Pilot Light Wall Switches: Commercial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

2.04 WALL DIMMERS

A. Manufacturers:

1. Leviton Manufacturing Company, Inc
2. Lutron Electronics Company, Inc; Maestro Series:
3. Pass & Seymour, a brand of Legrand North America, Inc:

B. Wall Dimmers - General Requirements: Solid-state with continuous full-range even control following square law dimming curve, integral radio frequency interference filtering, power failure preset memory, air gap switch accessible without removing wall plate, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 1472; types and ratings suitable for load controlled as indicated on the drawings.

C. Control: Slide control type with separate on/off switch.

D. Power Rating, Unless Otherwise Indicated or Required to Control the Load Indicated on the Drawings:

2.05 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated
2. Leviton Manufacturing Company, Inc
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. Receptacles - General Requirements: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498, and where applicable, FS W-C-596; types

as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.
2. NEMA configurations specified are according to NEMA WD 6.
3. Hospital Grade Receptacles: Listed as complying with UL 498 Supplement SD, with green dot hospital grade mark on device face.

C. Convenience Receptacles:

1. Weather Resistant Convenience Receptacles: Hospital grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.
2. Tamper Resistant Convenience Receptacles: Hospital grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.
   a. Products:
3. Tamper Resistant and Weather Resistant Convenience Receptacles: Hospital grade, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFCI Receptacles:

1. GFCI Receptacles - General Requirements: Self-testing, with feed-through protection and light to indicate ground fault tripped condition and loss of protection; listed as complying with UL 943, class A.
   a. Provide test and reset buttons of same color as device.
2. Weather Resistant GFCI Receptacles: Hospital grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.
3. Tamper Resistant GFCI Receptacles: Hospital grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.
4. Tamper Resistant and Weather Resistant GFCI Receptacles: Hospital grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

2.06 WALL PLATES

A. Manufacturers:

1. Hubbell Incorporated
2. Leviton Manufacturing Company, Inc
3. Lutron Electronics Company, Inc
4. Pass & Seymour, a brand of Legrand North America, Inc

B. Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.
2. Size: Standard.
3. Screws: Metal with slotted heads finished to match wall plate finish.

C. Nylon Wall Plates: Smooth finish, high-impact thermoplastic.

D. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

E. Weatherproof Covers for Damp Locations: Gasketed, cast aluminum, with self-closing hinged cover and corrosion-resistant screws; listed as suitable for use in wet locations with cover closed.

F. Weatherproof Covers for Wet or Damp Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that core drilled holes for poke-through assemblies are in proper locations.

H. Verify that openings in access floor are in proper locations.

I. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards unless otherwise indicated.

B. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.

1. Mounting Heights: Unless otherwise indicated, as follows:
   a. Wall Switches: 48 inches above finished floor.
   b. Wall Dimmers: 48 inches above finished floor.
   c. Fan Speed Controllers: 48 inches above finished floor.
   d. Receptacles: 18 inches above finished floor or 6 inches above counter.
2. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
3. Where multiple receptacles, wall switches, or wall dimmers are installed at the same location and at the same mounting height, gang devices together under a common wall plate.
4. Locate wall switches on strike side of door with edge of wall plate 3 inches from edge of door frame. Where locations are indicated otherwise, notify Architect to obtain direction prior to proceeding with work.
5. Locate receptacles for electric drinking fountains concealed behind drinking fountain according to manufacturer's instructions.

C. Install wiring devices in accordance with manufacturer's instructions.

D. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

E. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

F. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

G. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

H. Provide GFCI receptacles with integral GFCI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

I. Install wiring devices plumb and level with mounting yoke held rigidly in place.

J. Install wall switches with OFF position down.

K. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

L. Do not share neutral conductor on branch circuits utilizing wall dimmers.

M. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

N. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

O. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each wiring device for damage and defects.

C. Operate each wall switch, wall dimmer, and fan speed controller with circuit energized to verify proper operation.

D. Test each receptacle to verify operation and proper polarity.

E. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

F. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.05 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

B. Adjust presets for wall dimmers according to manufacturer's instructions as directed by Architect.

3.06 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 2816.13
ENCLOSED CIRCUIT BREAKERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Enclosed circuit breakers.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0548 - Vibration and Seismic Controls for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.03 REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service 2013e (Amended 2017).

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

H. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

J. UL 1053 - Ground-Fault Sensing and Relaying Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for circuit breakers, enclosures, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, installation, and starting of product.

E. Project Record Documents: Record actual installed locations of enclosed circuit breakers.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed circuit breaker internal components, enclosure, and finish.

1.08 FIELD CONDITIONS

A. Maintain ambient temperature between 23 degrees F and 104 degrees F during and after installation of enclosed circuit breakers.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation

B. Schneider Electric; Square D Products

C. Siemens Industry, Inc

D. Source Limitations: Furnish enclosed circuit breakers and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED CIRCUIT BREAKERS

A. Description: Units consisting of molded case circuit breakers individually mounted in enclosures.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.

2. Ambient Temperature: Between 23 degrees F and 104 degrees F.

D. Short Circuit Current Rating:

1. Provide enclosed circuit breakers with listed short circuit current rating not less than the available fault current at the installed location indicated on the drawings.

E. Enclosed Circuit Breakers Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Provide thermal magnetic circuit breakers unless otherwise indicated.

H. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

I. Provide solidly bonded equipment ground bus in each enclosed circuit breaker, with a suitable lug for terminating each equipment grounding conductor.

J. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R.
2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.
3. Provide surface-mounted enclosures unless otherwise indicated.

K. Provide externally operable handle with means for locking in the OFF position.

L. Ground Fault Protection: Where ground-fault protection is indicated, provide system listed and labeled as complying with UL 1053.

1. Where electronic circuit breakers equipped with integral ground fault protection are used, provide separate neutral current sensor where applicable.

2.03 MOLDED CASE CIRCUIT BREAKERS

A. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

B. Interrupting Capacity:

1. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:
   a. 10,000 rms symmetrical amperes at 240 VAC or 208 VAC.
   b. 14,000 rms symmetrical amperes at 480 VAC.
2. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

C. Conductor Terminations:

1. Provide mechanical lugs unless otherwise indicated.
2. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

D. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

E. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

1. Provide the following field-adjustable trip response settings:
   a. Ground fault pickup and delay where ground fault protection is indicated.

F. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed circuit breakers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed circuit breakers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed circuit breakers plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed circuit breakers such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Set field-adjustable ground fault protection pickup and time delay settings as indicated.

I. Identify enclosed circuit breakers in accordance with Section 26 0553.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with manufacturer's instructions and NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers used for service entrance and for circuit breakers larger than [_____] amperes. Tests listed as optional are not required.

D. Ground Fault Protection Systems: Test in accordance with manufacturer's instructions as required by NFPA 70.

E. Correct deficiencies and replace damaged or defective enclosed circuit breakers.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from circuit breaker enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 26 2816.16
ENCLOSED SWITCHES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Enclosed safety switches.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 2813 - Fuses.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.

D. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations Current Edition, Including All Revisions.

G. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations Current Edition, Including All Revisions.

H. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

I. UL 869A - Reference Standard for Service Equipment Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades. Avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and within working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage and current ratings, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to enclosed switch internal components, enclosure, and finish.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation

B. Schneider Electric; Square D Products

C. Siemens Industry, Inc

D. Source Limitations: Furnish enclosed switches and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.02 ENCLOSED SAFETY SWITCHES

A. Description: Quick-make, quick-break enclosed safety switches listed and labeled as complying with UL 98; heavy duty; ratings, configurations, and features as indicated on the drawings.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless otherwise indicated, provide products suitable for continuous operation under the following service conditions:

1. Altitude: Less than 6,600 feet.
2. Ambient Temperature: Between -22 degrees F and 104 degrees F.

D. Horsepower Rating: Suitable for connected load.

E. Voltage Rating: Suitable for circuit voltage.

F. Short Circuit Current Rating:

1. Provide enclosed safety switches, when protected by the fuses or supply side overcurrent protective devices to be installed, with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.
2. Minimum Ratings:
   a. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.
   b. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.

G. Provide with switch blade contact position that is visible when the cover is open.

H. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

I. Conductor Terminations: Suitable for use with the conductors to be installed.

J. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

K. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

L. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
   b. Outdoor Locations: Type 3R.
2. Finish for Painted Steel Enclosures: Manufacturer's standard, factory applied grey unless otherwise indicated.

M. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

N. Heavy Duty Switches:

1. Comply with NEMA KS 1.
2. Conductor Terminations:
   a. Provide mechanical lugs unless otherwise indicated.
   b. Lug Material: Copper, suitable for terminating copper conductors only.
3. Provide externally operable handle with means for locking in the OFF position, capable of accepting three padlocks.
   a. Provide means for locking handle in the ON position where indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings of the enclosed switches are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed safety switches.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Provide fuses complying with Section 26 2813 for fusible switches as indicated or as required by equipment manufacturer's recommendations.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Correct deficiencies and replace damaged or defective enclosed safety switches or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from switch enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

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SECTION 26 2913
ENCLOSED CONTROLLERS

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Enclosed NEMA controllers for low-voltage (600 V and less) applications:

1. Magnetic motor starters.
2. General purpose contactors.
3. Manual motor starters.
4. Motor-starting switches without overload protection.

B. Overcurrent protective devices for motor controllers, including overload relays.

C. Control accessories:

1. Auxiliary contacts.
2. Pilot devices.
3. Control and timing relays.
4. Control power transformers.

1.02 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 2813 - Fuses: Fuses for fusible switches.

1.03 REFERENCE STANDARDS

A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers 2016.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum) 2020.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts 2008 (Reaffirmed 2020).

E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices 2017.

F. NEMA ICS 6 - Industrial Control and Systems: Enclosures 1993 (Reaffirmed 2016).

G. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum) 2013.

H. NETA ATS - Standard For Acceptance Testing Specifications For Electrical Power Equipment And Systems 2021.

I. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. UL 98 - Enclosed and Dead-Front Switches Current Edition, Including All Revisions.

K. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules Current Edition, Including All Revisions.

L. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contactors and Motor-starters - Electromechanical Contactors and Motor-starters Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
2. Coordinate the work to provide motor controllers and associated overload relays suitable for use with the actual motors to be installed.
3. Coordinate the work to provide controllers and associated wiring suitable for interface with control devices to be installed.
4. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
5. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
6. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for motor controllers, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

D. Project Record Documents: Record actual installed locations of controllers and final equipment settings.

1. Include nameplate data of actual installed motors and associated overload relay selections and settings.

E. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

PART 2 - PRODUCTS

2.01 MANUFACTURERS

A. Eaton Corporation

B. Rockwell Automation, Inc; Allen-Bradley Products:

C. Schneider Electric; Square D Products

2.02 ENCLOSED CONTROLLERS

A. Provide enclosed controller assemblies consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete

operating system.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Description: Enclosed controllers complying with NEMA ICS 2, and listed and labeled as complying with UL 60947-1 and UL 60947-4-1; ratings, configurations and features as indicated on the drawings.

D. Service Conditions:

1. Provide controllers and associated components suitable for operation under the following service conditions without derating:
   a. Altitude:
      1) Class 1 Km Equipment (devices utilizing power semiconductors, e.g. variable frequency controllers): Less than 3,300 feet.
      2) Class 2 Km Equipment (electromagnetic and manual devices): Less than 6,600 feet.
   b. Ambient Temperature: Between 32 degrees F and 104 degrees F.
2. Provide controllers and associated components suitable for operation at indicated ratings under the service conditions at the installed location.

E. Short Circuit Current Rating:

1. Provide controllers with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Enclosures:

1. Comply with NEMA ICS 6.
2. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1 or Type 12.
   b. Outdoor Locations: Type 3R or Type 4.
   c. Hazardous (Classified) Locations: Type 7/9, as required for the classification of the installed location.
3. Finish: Manufacturer's standard unless otherwise indicated.

H. Instrument Transformers:

1. Comply with IEEE C57.13.
2. Select suitable ratio, burden, and accuracy as required for connected devices.
3. Current Transformers: Connect secondaries to shorting terminal blocks.
4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

I. Magnetic Motor Starters: Combination type unless otherwise indicated.

1. Combination Magnetic Motor Starters: NEMA ICS 2, Class A combination motor controllers with magnetic contactor(s), externally operable disconnect and overload relay(s).
2. Configuration: Full-voltage non-reversing unless otherwise indicated.
3. Disconnects: Disconnect switch type.
    a. Disconnect Switches: Fusible or nonfusible type as indicated.
    b. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
    c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
4. Overload Relays: Bimetallic thermal type unless otherwise indicated.

J. General Purpose Contactors: Combination type unless otherwise indicated.

1. Combination Contactors: NEMA ICS 2, Class A combination controllers with magnetic contactor(s) and externally operable disconnect, but without integral overload relay(s).
2. Configuration: Full-voltage non-reversing unless otherwise indicated.
3. Disconnects: Circuit breaker or disconnect switch type as indicated.
    a. Circuit Breakers: Thermal magnetic unless otherwise indicated or required.
    b. Disconnect Switches: Fusible or nonfusible type as indicated.
    c. Provide externally operable handle with means for locking in the OFF position. Provide safety interlock to prevent opening the cover with the disconnect in the ON position with capability of overriding interlock for testing purposes.
    d. Provide auxiliary interlock for disconnection of external control power sources where applicable.

K. Manual Motor Starters:

1. Description: NEMA ICS 2, Class A manually-operated motor controllers with overload relay(s).
2. Configuration: Non-reversing unless otherwise indicated.
3. Fractional-Horsepower Manual Motor Starters:
    a. Furnish with toggle operator.
    b. Overload Relays: Bimetallic or melting alloy thermal type.
4. Integral-Horsepower Manual Motor Starters:
    a. Furnish with toggle or pushbutton operator.
    b. Overload Relays: Bimetallic or melting alloy thermal type.

L. Motor-Starting Switches: Horsepower-rated switches without overload protection; toggle operator.

2.03 OVERCURRENT PROTECTIVE DEVICES

A. Overload Relays:

1. Provide overload relays and, where applicable, associated current elements/heaters, selected according to actual installed motor nameplate data, in accordance with

manufacturer's recommendations and NFPA 70; include consideration for motor service factor and ambient temperature correction, where applicable.

2. Inverse-Time Trip Class Rating: Class 20 unless otherwise indicated or required.
3. Trip-free operation.
4. Visible trip indication.
5. Resettable.
   a. Employ manual reset unless otherwise indicated.
   b. Do not employ automatic reset with two-wire control.
6. Bimetallic Thermal Overload Relays:
   a. Interchangeable current elements/heaters.
   b. Adjustable trip; plus/minus 10 percent of nominal, minimum.
   c. Trip test function.
7. Melting Alloy Thermal Overload Relays:
   a. Interchangeable current elements/heaters.

B. Fusible Disconnect Switches:

1. Description: Quick-make, quick-break, dead-front fusible switch units complying with NEMA KS 1, and listed and labeled as complying with UL 98; ratings, configurations, and features as indicated on the drawings.
2. Fuse Clips: As required to accept indicated fuses.
3. Provide externally operable handle with means for locking in the OFF position. Provide means for locking switch cover in the closed position. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

C. Circuit Breakers:

1. Interrupting Capacity (not applicable to motor circuit protectors):
   a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
   b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

2.04 CONTROL ACCESSORIES

A. Auxiliary Contacts:

1. Comply with NEMA ICS 5.
2. Provide number and type of contacts indicated or required to perform necessary functions, including holding (seal-in) circuit and interlocking, plus one normally open (NO) and one normally closed (NC) spare contact for each magnetic motor starter, minimum.

B. Pilot Devices:

1. Comply with NEMA ICS 5; heavy-duty type.
2. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
3. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.

4. Indicating Lights: Push-to-test type unless otherwise indicated.
5. Provide LED lamp source for indicating lights and illuminated devices.

C. Control and Timing Relays:

1. Comply with NEMA ICS 5.
2. Provide number and type of relays indicated or required to perform necessary functions.

D. Control Power Transformers:

1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices..
2. Include primary and secondary fuses.

PART 3 - EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings of enclosed controllers are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive enclosed controllers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install controllers in accordance with NECA 1 (general workmanship).

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install enclosed controllers plumb and level.

F. Provide grounding and bonding in accordance with Section 26 0526.

G. Install all field-installed devices, components, and accessories.

H. Provide fuses complying with Section 26 2813 for fusible switches as indicated.

I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

J. Set field-adjustable controllers and associated components according to installed motor requirements, in accordance with manufacturer's recommendations and NFPA 70.

K. Set field-adjustable circuit breaker tripping function settings as indicated.

3.03 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test in accordance with NETA ATS, except Section 4.

C. Motor Starters: Perform inspections and tests listed in NETA ATS, Section 7.16.1.1. Tests listed as optional are not required.

D. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

E. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for circuit breakers larger than 100 amperes. Tests listed as optional are not required.

F. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

3.04 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.05 CLEANING

A. Clean dirt and debris from controller enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

3.06 PROTECTION

A. Protect installed enclosed controllers from subsequent construction operations.

END OF SECTION

SECTION 26 5100
INTERIOR LIGHTING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Ballasts and drivers.

E. Lamps.

F. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

B. Section 26 0533.16 - Boxes for Electrical Systems.

C. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.

D. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.

E. Section 26 5600 - Exterior Lighting.

1.03 REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction 2015.

B. NECA/IESNA 500 - Standard for Installing Indoor Lighting Systems 2006.

C. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems 1999 (Reaffirmed 2006).

D. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility 2012 (Reaffirmed 2018).

E. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 844 - Luminaires for Use in Hazardous (Classified) Locations Current Edition, Including All Revisions.

H. UL 924 - Emergency Lighting and Power Equipment Current Edition, Including All Revisions.

I. UL 1598 - Luminaires Current Edition, Including All Revisions.

J. UL 1598C - Light-Emitting Diode (LED) Retrofit Luminaire Conversion Kits Current Edition, Including All Revisions.

K. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.
2. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.
3. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.
4. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.
2. Provide photometric calculations where luminaires are proposed for substitution upon request.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets including detailed information on luminaire construction, dimensions, ratings, finishes, mounting requirements, listings, service conditions, photometric performance, installed accessories, and ceiling compatibility; include model number nomenclature clearly marked with all proposed features.

1. Lamps: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

D. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.06 QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.07 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting), NECA/IESNA 502 (industrial lighting), and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.08 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.09 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturer warranty for LED luminaires, including drivers.

C. Provide five year pro-rata warranty for batteries for emergency lighting units.

D. Provide ten year pro-rata warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.01 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.02 LUMINAIRES

A. Provide products that comply with requirements of NFPA 70.

B. Provide products that are listed and labeled as complying with UL 1598, where applicable.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

E. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

F. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

G. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.
2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.
3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

H. Hazardous (Classified) Location Luminaires: Listed and labeled as complying with UL 844 for the classification of the installed location.

I. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

2.03 EMERGENCY LIGHTING UNITS

A. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

B. Operation: Upon interruption of normal power source or brownout condition exceeding 20 percent voltage drop from nominal, solid-state control automatically switches connected lamps to integral battery power for minimum of 90 minutes of rated emergency illumination, and automatically recharges battery upon restoration of normal power source.

C. Battery:

1. Sealed maintenance-free lead calcium unless otherwise indicated.
2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

D. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

E. Provide low-voltage disconnect to prevent battery damage from deep discharge.

F. Self-Diagnostics: Provide units that self-monitor functionality and automatically perform testing required by NFPA 101 where indicated; provide indicator light(s) to report test and diagnostic status.

G. Accessories:

1. Provide compatible accessory mounting brackets where indicated or required to complete installation.

2.04 EXIT SIGNS

A. Description: Exit signs complying with NFPA 101 and applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single- or double-face as indicated or as required for installed location.
2. Directional Arrows: As indicated or as required for installed location.

B. Powered Exit Signs: Internally illuminated with LEDs unless otherwise indicated.

2.05 BALLASTS AND DRIVERS

A. Ballasts/Drivers - General Requirements:

1. Provide ballasts containing no polychlorinated biphenyls (PCBs).
2. Minimum Efficiency/Efficacy: Provide ballasts complying with all current applicable federal and state ballast efficiency/efficacy standards.

B. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to one percent relative light output unless dimming capability to lower level is indicated, without flicker.
2. Control Compatibility: Fully compatible with the dimming controls to be installed.
   a. Wall Dimmers: See Section 26 2726.

2.06 LAMPS

A. Lamps - General Requirements:

1. Unless explicitly excluded, provide new, compatible, operable lamps in each luminaire.
2. Verify compatibility of specified lamps with luminaires to be installed. Where lamps are not specified, provide lamps per luminaire manufacturer's recommendations.
3. Minimum Efficiency: Provide lamps complying with all current applicable federal and state lamp efficiency standards.
4. Color Temperature Consistency: Unless otherwise indicated, for each type of lamp furnish products which are consistent in perceived color temperature. Replace lamps that are determined by the Architect to be inconsistent in perceived color temperature.
5. Unless otherwise noted, color temperature shall be 3500k for indoor fixtures and 4000k for exterior fixtures.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.03 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Perform work in accordance with NECA 1 (general workmanship).

C. Install products in accordance with manufacturer's instructions.

D. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

E. Provide required support and attachment in accordance with Section 26 0529.

F. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

G. Suspended Ceiling Mounted Luminaires:

1. Do not use ceiling tiles to bear weight of luminaires.
2. Do not use ceiling support system to bear weight of luminaires unless ceiling support system is certified as suitable to do so.
3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
4. In addition to ceiling support wires, provide two galvanized steel safety wire(s), minimum 12 gage, connected from opposing corners of each recessed luminaire to building structure.
5. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

H. Recessed Luminaires:

1. Install trims tight to mounting surface with no visible light leakage.
2. Non-IC Rated Luminaires: Maintain required separation from insulation and combustible materials according to listing.
3. Luminaires Recessed in Fire-Rated Ceilings: Install using accessories and firestopping materials to meet regulatory requirements for fire rating.

I. Suspended Luminaires:

1. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
2. Install canopies tight to mounting surface.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Emergency Lighting Units:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

M. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

N. Install lamps in each luminaire.

O. Lamp Burn-In: Operate lamps at full output for prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect each product for damage and defects.

C. Operate each luminaire after installation and connection to verify proper operation.

D. Test self-powered exit signs, emergency lighting units, and fluorescent emergency power supply units to verify proper operation upon loss of normal power supply.

E. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

3.05 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Aim and position adjustable emergency lighting unit lamps to achieve optimum illumination of egress path as required or as directed by Architect or authority having jurisdiction.

C. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by Architect or authority having jurisdiction.

3.06 CLEANING

A. Clean surfaces according to NECA 500 (commercial lighting), NECA 502 (industrial lighting), and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

3.07 CLOSEOUT ACTIVITIES

3.08 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

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SECTION 27 1000
STRUCTURED CABLING

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Communications system design requirements.

B. Communications pathways.

C. Copper cable and terminations.

D. Communications outlets.

E. Communications identification.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0533.13 - Conduit for Electrical Systems.

D. Section 26 0536 - Cable Trays for Electrical Systems.

E. Section 26 0533.16 - Boxes for Electrical Systems.

F. Section 26 0553 - Identification for Electrical Systems: Identification products.

G. Section 26 2726 - Wiring Devices.

1.03 REFERENCE STANDARDS

A. EIA/ECA-310 - Cabinets, Racks, Panels, and Associated Equipment 2005e.

B. NECA/BICSI 568 - Standard for Installing Commercial Building Telecommunications Cabling 2006.

C. NFPA 70 - National Electrical Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. TIA-568 (SET) - Commercial Building Telecommunications Cabling Standard Set 2020.

E. TIA-568.2 - Balanced Twisted-Pair Telecommunications Cabling and Components Standards 2009c, with Addendum (2016).

F. TIA-569 - Telecommunications Pathways and Spaces 2019e.

G. TIA-606 - Administration Standard for Telecommunications Infrastructure 2021d.

H. TIA-607 - Generic Telecommunications Bonding and Grounding (Earthing) for Customer Premises 2019d.

I. UL 444 - Communications Cables Current Edition, Including All Revisions.

J. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers Current Edition, Including All Revisions.

K. UL 1863 - Communications-Circuit Accessories Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate requirements for service entrance and entrance facilities with Communications Service Provider.
2. Coordinate the work with other trades to avoid placement of other utilities or obstructions within the spaces dedicated for communications equipment.
3. Coordinate arrangement of communications equipment with the dimensions and clearance requirements of the actual equipment to be installed.
4. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.05 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product.

C. Shop Drawings: Show compliance with requirements on isometric schematic diagram of network layout, showing cable routings, telecommunication closets, rack and enclosure layouts and locations, service entrance, and grounding, prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

D. Evidence of qualifications for installer.

E. Test Plan: Complete and detailed plan, with list of test equipment, procedures for inspection and testing, and intended test date; submit at least 60 days prior to intended test date.

F. Field Test Reports.

G. Project Record Documents: Prepared and approved by BICSI Registered Communications Distribution Designer (RCDD).

1. Record actual locations of outlet boxes and distribution frames.
2. Show as-installed color coding, pair assignment, polarization, and cross-connect layout.
3. Identify distribution frames and equipment rooms by room number on drawings.

H. Operation and Maintenance Data: List of all components with part numbers, sources of supply, and operation and maintenance instructions; include copy of project record documents.

I. All initial installation and modifications to cable paths, backbone cabling, exterior cabling, fiber, fire stops, horizontal wiring, termination and testing is to be documented in accordance with ANSI/TIA/EIA 606A standards

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: At least 5 years experience manufacturing products of the type specified.

B. Installer Qualifications: A company having at least 3 years experience in the installation and testing of the type of system specified, and:

1. Employing a BICSI Registered Communications Distribution Designer (RCDD).
2. Supervisors and installers factory certified by manufacturers of products to be installed.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Keep stored products clean and dry.

1.08 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a 2 year period after Date of Substantial Completion.

PART 2 - PRODUCTS

2.01 SYSTEM DESIGN

A. Provide a complete permanent system of cabling and pathways for voice and data communications, including cables, conduits and wireways, pull wires, support structures, enclosures and cabinets, and outlets.

1. Comply with TIA-568 (SET) (cabling) and TIA-569 (pathways) (commercial standards).
2. Provide fixed cables and pathways that comply with NFPA 70 and TIA-607 and are UL listed or third party independent testing laboratory certified.
3. Provide connection devices that are rated for operation under conditions of 32 to 140 degrees F at relative humidity of 0 to 95 percent, noncondensing.
4. In this project, the term plenum is defined as return air spaces above ceilings, inside ducts, under raised floors, and other air-handling spaces.

B. System Description:

1. Offices and Work Areas: Provide one voice outlet and two data outlets. in each work area.

C. Cabling to Outlets: Specified horizontal cabling, wired in star topology to distribution frame located at center hub of star; also referred to as "links".

2.02 PATHWAYS

A. Conduit: As specified in Section 26 0533.13; provide pull cords in all conduit.

1. Conduits to communication outlets are to be a minimum of one inch. A dedicated conduit will serve each outlet box. Pull boxes, if needed, must be accessible. Pull boxes, should not be placed above fixed ceilings, HVAC ducts or piping.
2. No conduit run, without a pull box, is to be longer than 100 feet, such run is to have no more than two 90-degree bends.

B. Cable Trays: As specified in Section 26 0536.

C. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.

1. Products:
   a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built:

2.03 COPPER CABLE AND TERMINATIONS

A. Manufacturers:

1. CommScope

2. General Cable Technologies Corporation
3. Siemon Company

B. Copper Horizontal Cable:

1. Description: 100 ohm, balanced twisted pair cable complying with TIA-568.2 and listed and labeled as complying with UL 444.
2. Cable Type - Voice and Data: TIA-568.2 Category 6 UTP (unshielded twisted pair); 23 AWG.
3. Cable Capacity: 4-pair.
4. Cable Applications: Use listed NFPA 70 Type CMP plenum cable unless otherwise indicated.
5. Cable Jacket Color -Data Cable: Blue.
6. Product(s):
   a. CommScope; SYSTIMAX Twisted Pair Cables; GigaSPEED XL Category 6 U/UTP Cable
   b. CommScope; Uniprise Twisted Pair Cables; CS34 Series Category 6 U/UTP Cable
   c. General Cable Technologies Corporation; GenSPEED Cables:

C. Jacks and Connectors: Modular RJ-45, non-keyed, terminated with 110-style insulation displacement connectors (IDC); high impact thermoplastic housing; suitable for and complying with same standard as specified horizontal cable; UL 1863 listed.

1. Performance: 500 mating cycles.
2. Voice and Data Jacks: 8-position modular jack, color-coded for both T568A and T568B wiring configurations.
3. Product(s):
   a. CommScope; SYSTIMAX RJ45 Jacks; MGS400 Series Category 6 U/UTP Modular Jacks
   b. CommScope; Uniprise RJ45 Jacks; UNJ600 Series Category 6 U/UTP Modular Jacks

D. Copper Patch Cords:

1. Description: Factory-fabricated 4-pair cable assemblies with 8-position modular connectors terminated at each end.
2. Patch Cords for Patch Panels:
   a. Quantity: One for each pair of patch panel ports.
   b. Length: 6 feet.
3. Product(s):
   a. CommScope; SYSTIMAX Category 6 U/UTP Patch Cords:
   b. CommScope; Uniprise Category 6 U/UTP Patch Cords:

2.04 COMMUNICATIONS EQUIPMENT ROOM FITTINGS

A. Copper Cross-Connection Equipment:

1. Manufacturers:
   a. CommScope

b. Siemon Company

2. Connector Blocks for Category 5e and Up Cabling: Type 110 insulation displacement connectors; capacity sufficient for cables to be terminated plus 25 percent spare.
3. Patch Panels for Copper Cabling: Sized to fit EIA/ECA-310 standard 19 inch wide equipment racks; 0.09 inch thick aluminum; cabling terminated on Type 110 insulation displacement connectors; printed circuit board interface.
   a. Jacks: Non-keyed RJ-45, suitable for and complying with same standard as cable to be terminated; maximum 48 ports per standard width panel.
   b. Capacity: Provide ports sufficient for cables to be terminated plus 25 percent spare.
   c. Labels: Factory installed laminated plastic nameplates above each port, numbered consecutively; comply with TIA-606.
   d. Provide incoming cable strain relief and routing guides on back of panel.
4. Product(s):
   a. CommScope; SYSTIMAX Copper Panels; 360-IPR-1100-XX Series Patch Panels:
   b. CommScope; Uniprise Copper Panels; UNP-XX-DM Series Patch Panels

B. Cable Management:

1. Manufacturers:
   a. CommScope
   b. Siemon Company
2. Product(s):
   a. CommScope Cable Runway
   b. CommScope Horizontal/Vertical Cable Managers; HCM-SS-XX-XX/VCM-DS-XX-XX Series
   c. CommScope FiberGuide Raceway

2.05 COMMUNICATIONS OUTLETS

A. Manufacturers:

1. CommScope
2. Siemon Company

B. Outlet Boxes: Comply with Section 26 0533.16.

1. Provide depth as required to accommodate cable manufacturer's recommended minimum conductor bend radius.

C. Wall Plates:

1. Comply with system design standards and UL 514C.
2. Accepts modular jacks/inserts.
3. Capacity:
   a. Data or Combination Voice/Data Outlets: as specified on the drawings. ports
4. Wall Plate Material/Finish - Flush-Mounted Outlets: Match wiring device and wall plate finishes specified in Section 26 2726.

2.06 GROUNDING AND BONDING COMPONENTS

A. Comply with TIA-607.

2.07 IDENTIFICATION PRODUCTS

A. Comply with TIA-606.

2.08 SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Factory test cables according to TIA-568 (SET).

PART 3 - EXECUTION

3.01 INSTALLATION - GENERAL

A. Comply with latest editions and addenda of TIA-568 (SET) (cabling), TIA-569 (pathways), TIA-607 (grounding and bonding), NECA/BICSI 568, NFPA 70, and SYSTEM DESIGN as specified in PART 2.

B. Comply with Communication Service Provider requirements.

C. Grounding and Bonding: Perform in accordance with TIA-607 and NFPA 70.

D. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

3.02 INSTALLATION OF PATHWAYS

A. Install pathways with the following minimum clearances:

1. 48 inches from motors, generators, frequency converters, transformers, x-ray equipment, and uninterruptible power systems.
2. 12 inches from power conduits and cables and panelboards.
3. 5 inches from fluorescent and high frequency lighting fixtures.
4. 6 inches from flues, hot water pipes, and steam pipes.

B. Conduit, in Addition to Requirements of Section 26 0533.13:

1. Arrange conduit to provide no more than the equivalent of two 90 degree bend(s) between pull points.
2. Conduit Bends: Inside radius not less than 10 times conduit internal diameter.
3. Arrange conduit to provide no more than 100 feet between pull points.

C. Outlet Boxes:

1. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of telecommunications outlets provided under this section.

a. Mounting Heights: Unless otherwise indicated, as follows:
   1) Telephone and Data Outlets: 18 inches above finished floor.
   2) Telephone Outlets for Side-Reach Wall-Mounted Telephones: 54 inches above finished floor to top of telephone.
   3) Telephone Outlets for Forward-Reach Wall-Mounted Telephones: 48 inches above finished floor to top of telephone.
b. Orient outlet boxes for vertical installation of wiring devices unless otherwise indicated.
c. Provide minimum of 24 inches horizontal separation between flush mounted outlet boxes installed on opposite sides of fire rated walls.
d. Unless otherwise indicated, provide separate outlet boxes for line voltage and low voltage devices.
e. Locate outlet boxes so that wall plate does not span different building finishes.
f. Locate outlet boxes so that wall plate does not cross masonry joints.

3.03 INSTALLATION OF EQUIPMENT AND CABLING

A. Cabling:

1. Do not bend cable at radius less than manufacturer's recommended bend radius; for unshielded twisted pair use bend radius of not less than 4 times cable diameter.
2. Do not over-cinch or crush cables.
3. Do not exceed manufacturer's recommended cable pull tension.
4. When installing in conduit, use only lubricants approved by cable manufacturer and do not chafe or damage outer jacket.

B. Service Loops (Slack or Excess Length): Provide the following minimum extra length of cable, looped neatly:

1. At Distribution Frames: 120 inches.
2. At Outlets - Copper: 12 inches.

C. Copper Cabling:

1. Category 5e and Above: Maintain cable geometry; do not untwist more than 1/2 inch from point of termination.
2. For 4-pair cables in conduit, do not exceed 25 pounds pull tension.
3. Use T568B wiring configuration.

D. Identification:

1. Use wire and cable markers to identify cables at each end.
2. Use manufacturer-furnished label inserts, identification labels, or engraved wallplate to identify each jack at communications outlets with unique identifier.
   a. Each wall plate should be labeled with the appropriate closet/room number where the cables terminate. The label should be located in the top center area of the wall plate.
3. Use identification nameplate to identify cross-connection equipment, equipment racks, and cabinets.

a. Equipment racks that will contain patch panels should be labeled with a single alphabetic character beginning with the letter 'A'. The second rack should be 'B', etc.
b. Patch panel ports in each rack will be labeled starting with the rack label and a port number. For example A1 would be port 1 on the first patch panel in rack A. Port A49 would be the first port on the 2nd patch panel, assuming the rack contained 48 port patch panels. Port A97 would be the 1st port on the 3rd patch panel in rack A and so on. As you can see from the previous examples, the ports should be labeled consecutively from 1…n where n is the last port on the last patch panel in a particular rack.
c. Due to the small space above each port on a patch panel the alphabetic character can be omitted from the label as it will be referenced from the rack label.
d. On the wall plate end the entire port label will need to be indicated.

3.04 FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Comply with inspection and testing requirements of specified installation standards.

C. Visual Inspection:

1. Inspect cable jackets for certification markings.
2. Inspect cable terminations for color coded labels of proper type.
3. Inspect outlet plates and patch panels for complete labels.
4. Inspect patch cords for complete labels.

D. Testing - Copper Cabling and Associated Equipment:

1. Testing Documentation
   a. All infrastructure testing results will be documented. Paper and electronic copies of all testing documentation is to be provided to the Facilities Planning at the conclusion of testing
2. Testing Standards
   a. Testing shall be performed in accordance with the following standards:
      1) ASTM D 4566-98 - Standard Test Methods for Electrical Performance Properties of Insulation and Jackets for communications Wire and Cable, 1998.
      2) ANSI/TIA/EIA-568-B.2 and current addenda -"Commercial Building Communications Cabling Standard - Part 2: Balanced Twisted-Pair Cabling Components -- Addendum 1 – Transmission Performance Specifications for 4-Pair 100 ohm Category 6 Cabling - (June 2002)
3. Cable Testing Requirements
   a. This document provides required test values at specific discrete frequencies. The tabulated values are intended for reference only. ACH requires 100% compliance throughout the specified range of frequencies tested. By convention, all values of electrical characteristics, while predominantly negative numbers (representing losses), are expressed as absolute values (positive numbers).
4. Warranty and certification:

a. All wiring is to be warranted for 15 years and certified to EIA/TIA 568 and NFPA standards for Category 6 UTP data and Category 5e UPT plenum-rated cabling.
b. Test operation of shorting bars in connection blocks.
c. Category 5e and Above Backbone: Perform near end cross talk (NEXT) and attenuation tests.
d. Category 5e and Above Links: Perform tests for wire map, length, attenuation, NEXT, and propagation delay.

E. Final Testing: After all work is complete, including installation of telecommunications outlets, and telephone dial tone service is active, test each voice jack for dial tone.

END OF SECTION

SECTION 28 4600
FIRE DETECTION AND ALARM

PART 1 - GENERAL

1.01 SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Replacement and removal of existing fire alarm system components, wiring, and conduit indicated.

D. Maintenance of fire alarm system under contract for specified warranty period.

1.02 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping: Materials and methods for work to be performed by this installer.

B. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

C. Section 21 2200 - Clean-Agent Fire-Extinguishing System: Supervisory, alarm, and releasing devices installed in extinguishing system.

D. Section 23 3300 - Air Duct Accessories: Smoke dampers monitored and controlled by fire alarm system.

1.03 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.

F. NFPA 101 - Life Safety Code Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 268 - Standard for Smoke Detectors for Fire Alarm Systems Current Edition, Including All Revisions.

1.04 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Proposal Documents: Submit the following with cost/time proposal:

1. NFPA 72 "Record of Completion", filled out to the extent known at the time.
2. Manufacturer's detailed data sheet for each control unit, initiating device, and notification appliance.
3. Certification by Contractor that the system design will comply with Contract Documents.
4. Proposed maintenance contract.

C. Drawings must be prepared using AutoCAD Release 2010 or greater.

D. Evidence of designer qualifications.

E. 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.
13. Do not show existing components to be removed.

F. Evidence of installer qualifications.

G. Evidence of instructor qualifications; training lesson plan outline.

H. Evidence of maintenance contractor qualifications, if different from installer.

I. 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.

J. Operating and Maintenance Data: See Section 01 7800 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.

K. Project Record Documents: See Section 01 7800 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.

L. 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.
3. Certificate of Occupancy.
4. Maintenance contract.

M. 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 and place in spare parts cabinet.
2. In addition to the items in quantities indicated in PART 2, furnish the following:
   a. All tools, software, and documentation necessary to modify the fire alarm system using Owner's personnel; minimum modification capability to include addition and deletion of devices, circuits, and zones, and changes to system description, operation, and evacuation and instructional messages.
   b. One copy, on CD-ROM, of all software not resident in read-only-memory.
   c. Extra Fuses: Two for each installed fuse; store inside applicable control cabinet.
   d. Printer Paper.

1.05 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.
4. Contract maintenance office located within 50 miles of project site.
5. Certified in the State in which the Project is located as fire alarm installer.

C. Maintenance Contractor Qualifications: Same entity as installer.

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.

1.06 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 1 year 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

2.01 MANUFACTURERS

A. Initiating Devices and Notification Appliances:

1. Same manufacturer as control units.

2.02 FIRE ALARM SYSTEM

A. Fire Alarm System: Provide modifications and extensions to the existing 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 State Fire Marshal.
   c. The requirements of the local authority having jurisdiction. .
   d. Applicable local codes.
   e. Contract Documents (drawings and specifications).
   f. 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. Voice Notification: Provide emergency voice/alarm communications with multichannel capability; digital.
6. 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.
7. Program notification zones and voice messages as directed by Owner.
8. Fire Command Center: Location indicated on drawings.
9. Master Fire Alarm Control Unit: Existing, located at supervising station.
10. Two-Way Telephone: Provide two-way telephone service for the use of the fire service and others; provide jacks and two portable handsets.

B. Supervising Stations and Fire Department Connections:

1. Public Fire Department Notification: By remote supervising station.
2. 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 4.
3. Notification Appliance Circuits (NAC): Class B, Style Y.

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).

2.03 EXISTING COMPONENTS

A. Existing Fire Alarm System: Remove existing components indicated and incorporate remaining components into new system, under warranty as if they were new; do not take existing portions of system out of service until new portions are fully operational, tested, and connected to existing system.

B. Clearly label components that are "Not In Service."

C. Remove unused existing components and materials from site and dispose of properly.

2.04 FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:

1. Sprinkler water control valves.
2. Dry-pipe sprinkler system pressure.
3. Dry-pipe sprinkler valve room low temperature.
4. Sprinkler water storage tank low level.
5. Sprinkler water storage tank low temperature.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:

1. Sprinkler water flow.
2. Total flooding suppression system activation.

C. HVAC:

1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

2.05 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: Addressable, digital; listed, classified, and labeled as suitable for the purpose intended.

C. Master Control Unit: .

1. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, and listed and labeled by an NRTL.
2. System software and programs shall be held in flash memory, retaining the information through failure of primary and secondary power supplies.
3. Include a real-time clock for time annotation of events on the event recorder.

D. Addressable initiation devices that communicate device identity and status.

1. Smoke sensors shall additionally communicate sensitivity setting and allow for adjustment of sensitivity at fire-alarm control unit.
2. Temperature sensors shall additionally test for and communicate the sensitivity range of the device.

E. Remote Annunciators: Verify location with Fire Marshall prior to install.

F. 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.

2. Manual Pull Stations:
   a. Boxes shall be finished in red with molded, raised-letter operating instructions in contrasting color; shall show visible indication of operation; and shall be mounted on recessed outlet box. If indicated as surface mounted, provide manufacturer's surface back box.
   b. Double-action mechanism requiring two actions to initiate an alarm, pull-lever type; with integral addressable module arranged to communicate manual-station status (normal, alarm, or trouble) to fire-alarm control unit.
   c. Station Reset: Key- or wrench-operated switch.
   d. Outdoor Weatherproof Protective Shield: Factory-fabricated clear plastic enclosure hinged at the top to permit lifting for access to initiate an alarm.
   e. Provide 1 extra.
3. Smoke Detectors: .
   a. Operates at 24-V dc, nominal.
   b. Detectors shall be two-wire, SLC type.
   c. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
   d. Base Mounting: Detector and associated electronic components shall be mounted in a twist-lock module that connects to a fixed base. Provide terminals in the fixed base for connection to building wiring.
   e. Self-Restoring: Detectors do not require resetting or readjustment after actuation to restore them to normal operation.
   f. Integral Visual-Indicating Light: LED type indicating detector has operated and power-on status.
   g. Remote Control: Unless otherwise indicated, detectors shall be analog-addressable type, individually monitored at fire-alarm control unit for calibration, sensitivity, and alarm condition and individually adjustable for sensitivity by fire-alarm control unit.
   h. Provide multiple levels of detection sensitivity for each sensor.
   i. Provide 1 extra.
4. Heat Detectors:
   a. Heat Detector, Combination Type: Actuated by either a fixed temperature of 135 deg F or a rate of rise that exceeds 15 deg F per minute unless otherwise indicated. Install combination type unless indicated otherwise on drawings.
   b. Mounting: Twist-lock base interchangeable with smoke-detector bases.
   c. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
   d. Heat Detector, Fixed-Temperature Type: Actuated by temperature that exceeds a fixed temperature of 190 deg F. Install fixed-temp type only where indicated on drawings.
   e. Mounting: Twist-lock base interchangeable with smoke-detector bases.

5. Integral Addressable Module: Arranged to communicate detector status (normal, alarm, or trouble) to fire-alarm control unit.
    a. Provide 1 extra.
6. Ionization Smoke Detectors: Are not allowed.

G. Notification Appliances:

1. Horns:
    a. Electric-vibrating-polarized type, 24-V dc; with provision for housing the operating mechanism behind a grille. Horns shall produce a sound-pressure level of 90 dBA, measured 10 feet from the horn.
2. Strobes:
    a. Visible Notification Appliances: Xenon strobe lights, with clear or nominal white polycarbonate lens mounted on an aluminum faceplate. The word "FIRE" is engraved in minimum 1-inch- high letters on the lens.
    b. Rated Light Output shall be as specified on the drawings. Where not indicated as specified by the fire alarm shop drawings.
    c. 15/30/75/110 cd field selectable.
    d. Wall mounted, unless otherwise shown.
    e. Flashing shall be in a temporal pattern, synchronized with other units.
    f. Strobe Leads: Factory connected to screw terminals.
    g. Provide 1 extra.

H. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.

I. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.

J. Locks and Keys: Deliver keys to Owner.

K. 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.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, and Contract Documents.

B. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

C. Obtain Owner's approval of locations of devices, before installation.

D. Install instruction cards and labels.

3.02 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.

3.03 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.

3.04 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.

B. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:

1. Approved operating and maintenance data has been delivered.
2. Spare parts, extra materials, and tools have been delivered.
3. All aspects of operation have been demonstrated to Owner.
4. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
5. Occupancy permit has been granted.
6. Specified pre-closeout instruction is complete.

3.05 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner, at no extra cost, a written maintenance contract for entire manufacturer's warranty period, to include the work described below.

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.

END OF SECTION

PART 1 - GENERAL

1.01 DESCRIPTION

A. Perform foundation and under floor termite control treatment in accordance with the Arkansas Pest Control Law and to qualify construction under this Contract for continuous guaranteed protection specified.

B. Applicable Regulations:
   1. International Building Code
   2. Arkansas Pest Control Law.

1.02 RELATED DOCUMENTS

A. Applicable portions of the Agreement, Conditions of the Contract (General, Supplementary, and other Conditions), Drawings, Specifications, Addenda issued prior to the execution of the Contract, other documents listed in the Agreement and Modifications issued after the execution of the Contract shall apply to this Section. The general requirements for this work are located in Division 1 of the Specifications.

1.03 SUBMITTALS AND SUBSTITUTIONS

A. In accordance with Section 01 3000.

B. Substitutions will not be considered prior to the award of the General Contract.

1.04 GUARANTEE

A. Furnish damage guarantee with service and re-service for any subterranean termite infestation without cost to Owner. Write Damage Guaranty Contract additionally to cover any and all subterranean termite damage to the structures and contents in amount of $10,000.00. Such damage to be repaired, replaced or corrected at Contractor's expense.

B. Furnish damage guarantee effective for 5 year period after completion of initial treatment without payment of additional fees or premiums by Owner. Upon expiration of 5-year period, Owner has option of extending damage guarantee contract at an annual fee mutually agreed upon by Owner and applicator. Owner reserves the right to cancel as of any anniversary date. Service, re-service, and Damage Guaranty provisions of the extended damage contract are noncancellable by applicator. Annual fee subject to revision by giving advance written notice to Owner.

PART 2 - PRODUCTS

2.01 TERMITE CONTROL CHEMICALS

A. Use chemicals approved by the Arkansas State Plant Board and of type required to give guaranteed protection specified.

B. Acceptable treatment products are:
   1. Bayer "PREMISE 75"; 0.10 percent in water emulsion.
   2. Bayer "PREMISE PRO"; 0.10 percent in water emulsion.
   3. FMC Corporation "PREVAIL"; 0.25 percent in water emulsion.
   4. FMC Corporation "DRAGNET"; 0.50 percent in water emulsion.
   5. Syngenta Inc. "DEMON TC"; 0.25 percent in water emulsion.

PART 3 - EXECUTION

3.01 PREPARATION

A. From investigation at the site determine soil texture or otherwise obtain this information from the County Agent, Soil Conservation Service or other approved authorities, if not already known.

B. Remove wood and cellulose containing materials from earth sub-grade to be treated before chemical is applied.

3.02 TREATMENT

A. Perform foundation and under floor termite control treatment at buildings to be constructed under this Contract. Use type chemical approved by the Arkansas State Plant Board and currently known to give guaranteed protection for the soil and fill used at this Project. Apply chemical using applicator licensed by the Arkansas State Plant Board. Apply in sufficient quantity under and around the structures, to qualify building and contents for continuous guaranteed protection against damage by subterranean termites.

B. Reapply soil treatment solution to areas disturbed by subsequent excavation or construction activities following application.

C. Under Slabs: Apply under slabs at the rate recommended by manufacturer. Apply after placement of gravel drainage fill and immediately prior to placement of vapor barrier . When necessary to insure proper penetration, the ground surface will be left loose or lightly scarified until treatment has been completed.

D. Critical Areas: Treat a one foot strip along critical areas under walls, around interior piers and pipes rising from the ground at the rate recommended by manufacturer. Treatment shall be applied as specified for overall treatment under slabs.

E. Outside of Foundations: Apply a one foot strip along the outside of the foundations of the building at the rate recommended by manufacturer. Apply in a trench dug to a depth of approximately 2" below finish grade. Loosen earth in trench to a depth of 12" before treating. This treatment is to be performed prior to finish grading.

3.03 PROTECTION

A. Unless treated surfaces are to be immediately covered, take means necessary to prevent disturbance of treated areas by human or animal contact.

END OF SECTION

Part 1 - GENERAL

1.1 GENERAL REQUIREMENTS

A. Work of this Section, as shown or specified, shall be in accordance with the requirements of the Contract Documents.

B. Drawings and General Provisions of the Contract, including General and Supplemental Conditions, and Division 1 Specifications, apply to the work in this specification.

C. Coordination of work between General/Site Contractor and Ductile Iron Pile Contractor affected by work of this Section. Cooperate with trades to assure the steady progress of all work under the contract.

1.2 DESCRIPTION OF WORK

A. Work Included: Work to be done under this Section includes providing all labor, materials, supervision, equipment, transportation and services as necessary and incidental to the proper execution of the work as shown on the Drawings and specified herein.

1. The Specialty Contractor shall select, design, furnish and install Ductile Iron Piles to provide support for CARTI LAV addition foundation and bottom mat/slab locations as shown on the Drawings.

2. The design and selected capacity of the Ductile Iron Piles shall be the responsibility of the Specialty Contractor provided the following minimum design guidelines are followed:
   a. Design is in general accordance with IBC 2015 (IBC 2012).
   b. Design relies on subsurface information presented in the project geotechnical report. (GHBW Report No. 22-068, dated August 25, 2022.)
   c. Minimum allowable design compression capacity of 100 kips per pile.
   d. Minimum allowable design tension capacity of 15 kips per pile.
   e. Piles achieve acceptable compression capacity as outlined in Article 3.5 - Load Testing.
   f. Piles are installed to penetrate the [upper soft to firm to stiff fine sandy clay and clay] and terminate in the very stiff to hard silty clay or fine sandy clay below 35-ft depth as needed to develop the specified design capacity.
   g. Design must consider corrosion potential unless grout is used to isolate surface of pile.
   h. Maximum allowable concrete/grout stress of 33 percent of specified 28-day unconfined compressive strength, up to 1,600 psi.

3. Install a minimum of one (1) non-production pile for purposes of load testing to demonstrate acceptable performance. In accordance with the requirements of Section 3.5 of the specifications, perform a compression pile load test on one of the non-production piles, to a maximum test load of two (2.0) times the design capacity or to geotechnical failure. Pile load testing and production pile installation shall be coordinated with the Owner's Geotechnical Engineer representative.

4. Prepare and provide submittals as required herein for review by the Owner's Representative.

5. Furnishing and installing all elements of the load reaction frame, including hold down anchors, reaction frame, and hydraulic jack.

6. Cut-off of or coordinate with General Contractor for pile stick-ups at design cut-off elevation and legally dispose or recycle pile cut-offs at approved off-site locations.

7. Coordinate with the General/Site Contractor to provide survey control, site working elevations and layout of design pile locations to complete the work.

B. Coordinate all handling and disposal of any cuttings or spoils as required to complete the Work described in this Section.

C. General Contractor is responsible for locating and protecting existing and new utilities, structures, and other facilities and site improvements during all Work. The General Contractor shall coordinate installation of new utilities with Specialty Contractor to avoid interferences with foundation construction.

D. General Contractor is responsible for excavations required during construction to remove obstructions and allow production piles to be installed. Pile installation shall continue at other nearby locations so as to reasonably continue installation and maintain schedule as the pile location(s) in question is evaluated.

E. Conduct all Work in accordance with OSHA requirements and other applicable laws and regulations, and with the requirements of all federal, state, county and local agencies and authorities having jurisdiction over the Work.

F. Obtain, pay for and comply with all required permits, licenses and approvals prior to commencing and during the Work.

1.3 QUALITY CONTROL / QUALITY ASSURANCE

A. The Specialty Contractor shall have a full-time, on-site quality control representative to verify and report all installation procedures and test results. The Specialty Contractor shall immediately report any unusual conditions encountered during installation to the Ductile Iron Pile Designer, the General Contractor and the Quality Assurance representative.

B. The Owner shall retain an independent engineering testing firm to provide Quality Assurance services in the form of on-site monitoring of Ductile Iron Pile installations. The Quality Assurance representative shall observe installation and load testing of non-production load test pile(s) and as well as installation of production piles. The Quality Assurance representative shall advise the Specialty Designer/Contractor and General Contractor in writing, if at any time, in his opinion, the work is not in substantial conformity with the plans and specifications. The Quality Assurance representative shall at no time direct the Specialty Contractor's work.

1.4 SUBMITTALS

A. The Specialty Contractor shall submit the information specified herein to the Owner's Representative for review and approval. Unless otherwise specified, submittals shall be made not less than two (2) weeks before the start of work.

B. All submittals specific to the design shall be prepared and stamped by a Professional Engineer licensed in the State in which the project is constructed.

C. Submittals shall include the following:

1. Detailed information on proposed type, design capacity, configuration, dimensions, materials and methods for installing the Ductile Iron Piles.

2. Experience and qualifications of Specialty Contractor and proposed personnel.

3. Written statement verifying the Specialty Contractor has successfully completed at least three (3) projects of similar size and complexity in this type of installation. Identify the name of the project, location, design consultant and owner for each project.

4. Description of the proposed pile installation equipment, materials, and procedures. Include catalog cut sheets of equipment including (but not limited to) hammers, excavators, drills, pumps, and mixing plants.

5. Detailed design calculations and drawings (the Design Submittal), for review and approval. The information shall include but not be limited to design capacities; spacing; depths; embedment in bearing stratum; locations; soil properties; element installation termination criteria and all other relevant information.

6. Description of load test location(s), equipment, procedures and load schedule. Provide shop drawings with details of load test setup including test pile, reaction system layout, hydraulic jack, telltales or strain gages, and anticipated subsurface conditions at the test pile location. Provide calibration records for the hydraulic jack to be used, prior to conducting the load test. After test completion, the Specialty Contractor shall furnish a detailed description of the test pile installation and all test records and data, an analysis of the load test data and recommended design capacity based on the test results.

7. Cement grout or mortar mix design (if applicable) proposed for this work and strength test data for that mix by an independent testing laboratory certified by the State in which the project is constructed.

8. Daily installation records including:
    a. Project name and number.
    b. Name of Specialty Contractor.
    c. Date and time of installation (driving, grouting, etc).
    d. Pile numbers, sizes, lengths and locations of piles.
    e. Type and size of installation equipment (i.e. excavator, hammer, etc)
    f. Sequences of installation.
    g. Ground Elevation.
    h. Cut-off elevation of each pile to the nearest 0.1 foot.
    i. Volume of grout used and typical pumping pressure.
    j. Reinforcing steel details (bar size, length, etc).
    k. Rate of penetration.
    l. Total pile embedment.

1.5 LINES, GRADES AND TOLERANCES

A. The Specialty Contractor shall coordinate with the General Contractor and Site Contractor to stake the pile locations and establish all elevations required.

B. Maximum variation of any pile from its indicated location at the cut-off elevation shall not exceed six inches (6") unless approved by the Engineer.

C. Cut-off elevation shall be within ½-inch of elevation shown on the plans.

D. See Article 3.4A of this Section for remedial actions for non-conforming piles.

Part 2 - MATERIALS

2.1 MATERIALS

A. Piling materials shall consist of pre-fabricated Ductile Iron Piles utilizing high strength ductile iron pipes manufactured with a centrifugal-casting process to deliver high impact resistance, ultimate strength and high elastic limit along with high corrosion resistance manufactured by Tiroler Rohre GmbH (TRM) in Austria or another approved manufacturer that provides verification of Ductile Iron Pile material properties and is certified BS EN ISO 9001 compliant. Alternative manufacturers must be accredited by the European Technical Assessment ETA-07/0169 and German Institute for Structural Engineering Approval Z-34.25-230 / DIBt. The material must exhibit a yield stress for design of 45 ksi or greater and a modulus of elasticity of 24,000 ksi. Materials used in production piles shall be the same as used in the non-production test piles and those described in the Specialty Contractor submittals.

B. Grout (if applicable) shall be a mixture of Portland Cement (Type I/II), sand (if applicable) and clean, potable water proportioned and mixed to maintain solids in suspension without appreciable water gain and flowable to provide good bonding in the bearing stratum. Minimum compressive strength as required per the design of the piles but at a minimum of 3000 psi compressive strength at 28 days. Admixtures shall be used in accordance with manufacturer's recommendations.

C. Reinforcing Bars (if applicable) shall be a minimum Grade 75 steel, free of rust, grease, oil, dirt or other objectionable material at the time of placement.

Part 3 - EXECUTION

3.1 SEQUENCE OF OPERATIONS AND EQUIPMENT REQUIREMENTS

A. The Specialty Contractor shall provide the necessary equipment for full-time operation at the site to complete the Work.

B. The Specialty Contractor shall coordinate his activities with other Work on the site, including activities performed by the Site Contractor.

3.2 EQUIPMENT

A. Piles shall be installed with approved modern equipment. The proposed pile installation equipment and methods shall be similar as described in the approved Ductile Iron Pile Submittal, subject to approval by the Owner's Representative.

3.3 INSTALLATION

A. The Specialty Contractor shall furnish and install all Ductile Iron Piles per the project plans and approved Ductile Iron Pile Submittal. In the event of a conflict between the project plans and the approved Ductile Iron Pile submittal, the Specialty Contractor shall not begin construction on any affected items until such conflict has been resolved.

B. Specialty Contractor shall conduct his work in a manner to insure the safety of persons and property in the vicinity of the work. The Specialty Contractor's personnel shall comply with safety procedures in accordance with OSHA standards and any established project safety plan.

C. Piles shall be installed using high-frequency impact energy to penetrate the upper soft to firm to stiff fine sandy clay and clay and terminate in the very stiff to hard silty clay or fine sandy clay below 35-ft depth or deeper as needed to develop the proposed design capacity as described in the Ductile Iron Pile Submittal.

D. For Friction Ductile Iron Piles, piles shall be installed by driving the ductile iron pile using high-frequency impact energy while continuously pumping grout to fill the annulus between the pile and the surrounding soil created by the oversized conical grout driving shoe. The pile shall be installed to develop the minimum bond length required in the resisting soil layer based on the approved Ductile Iron Pile submittal and as determined by the non-production test pile that meets the load test acceptance criteria.

E. Daily installation summary reports shall be provided at the end of each day to the Owner's Representative.

3.4 NON-CONFORMING PILES

A. Non-conforming piles include piles that are installed out of tolerance, as specified in Article 3.4A of this Section, are damaged, the grout tests do not achieve the minimum strength required for the design (if grouted), or the pile is not installed into the required stratum. To mitigate and/or remedy non-conforming piles, the Specialty Contractor may be required to provide additional piles or supplement piles to meet the specified requirements at no additional cost to the Owner.

3.5 COMPRESSION LOAD TESTING

A. GENERAL

1. As described in Article 1.4.A.4, the Specialty Contractor shall install a minimum of one (1) non-production piles for purposes of load testing to demonstrate acceptable performance. The pile shall be the same size and type of pile as proposed for the production piles used for the project and installed in the same manner.

2. One (1) of the non-production piles shall be successfully load tested to a maximum compression (or tensile) test load of twice the maximum design capacity. The test shall be performed in general accordance with ASTM D1143-07, as specified herein. The maximum test load shall be a minimum of twice the maximum design load or the load required to produce geotechnical failure of the pile.

3. The Specialty Contractor shall provide all labor, materials and equipment required to set up the load tests, and shall provide personnel at the test(s) during the entire test, to operate the hydraulic jack and all equipment necessary to vary the load increments on the test pile. The Owner's Representative shall be notified of the test schedule to be on-site to observe the test.

B. TEST PROCEDURE

1. The Specialty Contractor is solely responsible for designing and conducting the test(s) in accordance with these specifications.

2. Allow a minimum of five (5) days for the grout to cure.

3. Load shall be applied to the test pile by means of a hydraulic jack which reacts against a system of hold down piles, or against a loaded box or test platform, which is supported by cribbing or temporary piles. The load box or platform shall be centered on the test pile and loaded with approved material. The total dead weight or reaction above the jack and the load test support frame shall be capable of safety applying a minimum load of 110 tons.

4. The hydraulic jack shall be of an approved make with a capacity of at least 200 tons and shall be capable of providing enough stroke to load the pile to the maximum testing load without resetting the jack.

5. The top of the test pile shall be level and capped in such a manner as to produce a plane horizontal bearing surface.

6. A minimum of three gages (micrometer dial indicators), each having a range of two inches and graduated to 0.001 inch divisions shall be used to monitor the top-of-pile movement.

7. Micrometer dials shall be mounted to one or more steel reference beams provided by the Specialty Contractor. Beams shall be supported outside the zone of loading influence of the test pile.

8. The load test shall be performed in general accordance with ASTM D-1143-07, except as specified herein.

C. TEST ACCEPTANCE CRITERIA

1. Ductile Iron Piles will be approved for the design load provided that the piles meet one of the following criteria:
   a. Net settlement of the top of pile, after removal of all load at the completion of the test, does not exceed 0.5 inches, or
   b. Gross settlement of the pile top at the load corresponding to the design capacity does not exceed the elastic compression of the pile plus 0.15 inches plus one hundredth of the pile tip in width in inches.

2. If the allowable compression load as determined by the load test is less than the required design load, the Contractor shall perform another load test at no additional cost to the Owner.

D. TEST REPORTING

1. The Specialty Contractor shall submit a load test report to Owner's Representative for review within five (5) days following completion of each test. Load test reports shall include the following:
   a. All test pile record information specified in Article 1.5C.8 of this Section.
   b. Tabular and graphical summary of the specified load-deformation data.
   c. Brief memorandum summarizing testing procedure, test results and recommended allowable design load.

END OF SECTION