Farnsworth GROUP

PROJECT MANUAL

FOR

CRAWFORD MEMORIAL HOSPITAL
RHC ADDITION AND RENO

Robinson, IL

Project No: 0200708.00.00

Bid Set

June 11, 2021

Owner:

Crawford Memorial Hospital
1000 N Allen Street
Robinson, IL 62454

200 West College Ave., Suite 301 – Normal, IL 61761 (309) 663-8436 www.f-w.com

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The portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed Architect under the laws of the State of Illinois.

SIGNATURE:

NAME: David G. Burnison

DATE: 06/11/2021

LICENSE EXPIRES: 11/30/2022

SEAL

The portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed Civil Engineer under the laws of the State of Illinois.

SIGNATURE:

NAME: Patrick J. Moone

DATE: 06/11/2021

LICENSE EXPIRES: 11/30/2021

SEAL

The portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed Structural Engineer under the laws of the State of Illinois.

SIGNATURE:

NAME: Paige M. Hefner

DATE: 06/11/2021

LICENSE EXPIRES: 11/30/2022

SEAL

The portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed Mechanical Engineer under the laws of the State of Illinois.

SIGNATURE:

NAME: Dustin R. Rhoades

DATE: 06/11/2021

LICENSE EXPIRES: 11/30/2021

SEAL

The portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed Electrical Engineer under the laws of the State of Illinois.

SIGNATURE:

NAME: Jay D. Eman

DATE: 06/11/2021

LICENSE EXPIRES: 11/30/2021

SEAL

The portion of this technical submission described below was prepared by me or under my direct supervision and responsible charge. I am a duly licensed Plumber under the laws of the State of Illinois.

SIGNATURE:

NAME: Edward J. Garrett

DATE: 06/11/2021

LICENSE EXPIRES: 04/30/2022

SEAL

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CRAWFORD MEMORIAL HOSPTIAL BOARD IS INVITING SEALED BID PROPOSALS FROM INVITED AND QUALIFIED PARTIES FOR A RURAL HEALTH CLINIC ADDITION AND RENOVATION PROJECT, LOCATED AT 1101 N. ALLEN STREET, ROBINSON, ILLINOIS 62454.

THIS PROJECT CONSISTS OF CONSTRUCTION OF A BUILDING ADDITION OF 18,900 BUILDING GROSS SQUARE FEET, SINGLE STORY, SLAB ON GRADE AS WELL AS ASSOCIATED SITE DEVELOPMENT AND 12,241 SQUARE FEET OF RENOVATIONS WITHIN THE EXISTING CLINIC BUILDING. THIS WORK SHALL INCLUDE ALL LABOR, SUPERVISION, MATERIALS, TRANSPORTATION AND SERVICES NECESSARY AND REQUIRED TO PERFORM THE PROJECT AS SET FORTH IN THE CONTRACT DOCUMENTS.

SEALED BIDS WILL BE RECEIVED BY CRAWFORD MEMORIAL HOSPITAL UNTIL THE DATE AND TIME LISTED BELOW.

Pre-Bid Date: 06/30/2021; attendance is encouraged but not mandatory.

Pre-Bid Time: 04:30 PM followed by site walk through at 5:00 PM.

Pre-Bid Location: Project site

Bid Date: 07-21-2021

Bid Time: 02:00 PM

Bid Location: electronic submission via email, attention Brooke McGuire, see Instructions to Bidders for additional information.

BID SECURITY SHALL BE SUBMITTED WITH EACH BID IN THE AMOUNT OF FIVE (5) PERCENT OF THE BID AMOUNT. NO BIDS MAY BE WITHDRAWN FOR A PERIOD OF 60 DAYS AFTER OPENING OF BIDS. OWNER RESERVES THE RIGHT TO REJECT ANY AND ALL BIDS AND TO WAIVE INFORMALITIES AND IRREGULARITIES.

ALL REQUESTS FOR INFORMATION (RFI) SHALL BE SUBMITTED TO FARNSWORTH GROUP IN WRITING. THE PROJECT TEAM WILL MAINTAIN A RECORD OF RFI'S. WRITTEN RESPONSE TO RFI'S WILL BE PROVIDED BY FARNSWORTH GROUP AND SHARED WITH ALL PLAN HOLDERS.

ONLINE PROCUREMENT AND CONTRACTING DOCUMENTS: DOCUMENTS WILL BE AVAILABLE ONLINE THROUGH AN ELECTRONIC BID SITE MANAGED BY FARNSWORTH GROUP, INC. OBTAIN ACCESS AFTER 1:00 PM, JUNE 17, 2021, BY VISITING WWW.F-W.COM AND CLICKING ON THE PROJECT BID LIST LINK AT THE BOTTOM OF THE PAGE OR BY CONTACTING FARNSWORTH GROUP, INC. ONLINE ACCESS WILL BE PROVIDED TO ALL REGISTERED BIDDERS DURING THE BIDDING PROCESS. A SEPARATE FTP SITE WILL BE MADE AVAILABLE TO THE SUCCESSFUL BIDDER FOR THE DURATION OF CONSTRUCTION.

BIDDERS MUST BE PROPERLY LICENSED UNDER THE LAWS GOVERNING THEIR RESPECTIVE TRADES AND BE ABLE TO OBTAIN INSURANCE AND BONDS REQUIRED FOR THE WORK. A PERFORMANCE BOND, SEPARATE LABOR AND MATERIAL PAYMENT BOND, AND INSURANCE IN A FORM ACCEPTABLE TO OWNER WILL BE REQUIRED OF THE SUCCESSFUL BIDDER.

THE OWNER REQUIRES ALL CONTRACTORS AND VENDORS DOING BUSINESS WITH THE OWNER NOT TO DISCRIMINATE AGAINST ANYONE ON THE BASIS OF RACE, AGE, COLOR, RELIGION, GENDER, SEXUAL ORIENTATION, ANCESTRY, NON JOB-RELATED HANDICAPS OR NATIONAL ORIGIN.

CRAWFORD MEMORIAL HOSPTIAL RESERVES THE RIGHT TO ACCEPT OR REJECT ANY AND ALL BIDS, AND TO WAIVE ANY AND ALL INFORMALITIES IN THE BIDDING. AFTER RECEIPT OF BIDS AND COMPLETION OF THE REVIEW PROCESS, CRAWFORD MEMORIAL HOSPTIAL MAY AWARD A CONTRACT TO THE BIDDER THAT, IN ITS OPINION, WILL PROVIDE A COMBINATION OF THE BEST SERVICES AND REASONABLE COST.

BIDS WILL BE HELD GOOD FOR A PERIOD OF SIXTY (60) CALENDAR SUBSEQUENT TO THE OPENING OF BIDS.

BIDDERS ARE REQUIRED TO SUBMIT CERTIFICATIONS OF COMPLIANCE WITH NON-COLLUSION, SEXUAL HARASSMENT POLICY, DRUG FREE WORKPLACE, PREVAILING WAGES AND BIDDER'S QUALIFICATIONS WITH THEIR BID.

END OF SECTION

SECTION 00 2100 - INSTRUCTIONS TO BIDDERS

1.1. GENERAL

A. Summary of Work: Type of Bid: Bids shall be on a stipulated sum basis.

1) The Crawford Memorial Hospital Board seeks bids for all material, labor and equipment necessary to complete the Work associated with construction of an Rural Health Clinic Addition and Renovation project and associated site development.

a. The Work includes General, MEP and Site trades for new building and site development as shown on the Contract Documents.

B. Time and Location for Submission of Bids:

1) Bid Date and Time: 07-21-2021, 02:00 PM central standard time.

2) Bid Location: Submit Bid Proposals in PDF form via email to the Architect, attention Brooke McGuire, bmcguire@f-w.com and copy to David Burnison, dburnison@f-w.com.

C. Examination and Procurement of Documents: Documents will be available online through an electronic bid site managed by Farnsworth Group, Inc. Obtain access after 1:00 PM, June 17, 2021, by visiting www.f-w.com and clicking on the Project Bid List Link at the bottom of the page or by contacting Farnsworth Group, Inc. Online access will be provided to all registered bidders during the bidding process. A separate FTP site will be made available to the successful bidder for the duration of construction.

D. Bidders will be required to provide Bid security in the form of a Bid Bond in the amount of five percent of the Bid.

E. Bidders will be required to provide a Performance and Payment Bond in the amount of not less than one hundred percent (100%) of the Contract as awarded.

F. Interpretations of Addenda

1) No oral interpretation will be made to any Bidder as to the meaning of the Bidding Documents or any part thereof.

2) Requests for interpretations shall be made in writing to the Architect.

3) Contact : Farnsworth Group, Inc, Brooke McGuire; 200 West College Ave, Suite 301, Normal, IL 61761; bmcguire@f-w.com.

a. Brooke McGuire, 200 West College Ave, Suite 301, Normal IL; 61761

4) Inquiries received seven (7) or more or more business days prior to the date fixed for opening of bids will be given consideration.

5) Changes to the Bidding Documents will be in the form of an Addendum to the Bidding Documents, and when issued, will be on file in the office of the Architect upon issuance.

6) Addenda will be distributed to each registered plan holder holding Bidding Documents by means of the electronic bid site maintained by Farnsworth Group, Inc. It shall be the Bidders' responsibility to make inquiry as to the Addenda issued and provide distribution of Addenda to all Subcontractors and Suppliers not registered through the electronic bid site.

7) Addenda shall become part of the Contract and all Bidders shall be bound by such Addenda, whether or not received by the Bidders.

G. Inspection of Site and Documents

1) Bidder shall visit the site of the proposed work and fully acquaint himself/herself with the existing conditions there relating to construction and labor, and should fully inform himself/herself as to the facilities involved, the difficulties and restrictions attending the performance of the Contract.

2) The Bidder shall thoroughly examine and familiarize himself/herself with the Drawings, Technical Specifications and all other Bidding Documents.

3) The Contractor by the execution of the Contract shall in no way be relieved of any obligation under it due to his/her failure to receive or examine any form or legal instrument or to visit the site and acquaint himself/herself with the existing conditions, and the Owner will be justified in rejecting any claim based on facts regarding which the contractor should have noticed as a result thereof.

4) A Prebid Meeting is scheduled for 06/30/2021.

a. The Prebid meeting will be held at the 04:30 PM at Project site. A site walk through will be conducted at 5:00 following the Prebid meeting.

H. Bids

1) Scheduled Completion Dates: Owner has provided the required Substantial Completion Date on the Bid Form. Bidder shall state a stipulated sum amount for performance of the work in accordance with these schedule dates.

a. Substantial Completion of the project shall be by 07/01/2022.

2) Each bidder shall include in his/her bid the following information:

a. Principals

1) Names

b. Firm

1) Name

2) Treasury Number

3) Address (City, State, Zip Code and Telephone Numbers)

c. Supplementary Information: In addition to Bidder's Qualifications documentation required in this Section, provide information demonstrating compliance with the following:

1) Bonding Capacity - The Contractor must be capable of providing bonding for the value of the contract from a bond company licensed in the State of Illinois and having an AM Best Rating of A VII or better..

2) 5 years minimum U.S. experience in building contracts.

3) Contractors bidding the work shall their own place of business, equipment, staff, manpower, etc., required for the type of work they are licensed to perform.

4) Contractors bidding the project shall have successfully completed similar size and scope projects during the last 5 years.

d. A list of references and past projects shall be submitted with the bid.

e. Contractors bidding the work shall be able to meet necessary insurance limits required by the Contract Documents. The insurance company shall be acceptable to the Owner. See Supplementary Conditions section for applicable insurance coverage and required monetary limits. Failure to provide proper Certificate of Insurance will result in a breach of contract and payment for completed work.

f. The successful Contractor shall submit to the Owner a list of his subcontractors not listed in Section 00 4336 for review and approval by the Owner within 3 days after being notified that his bid has been accepted.

3) Bidder shall attach a preliminary bar chart construction schedule coordinated with time frames indicated on his/her bid form. Include any additional time for construction beyond the date of substantial completion if needed.

a. The Owner reserves the right to require all or part of any remaining Work not completed by date designated for Substantial Completion to be performed after normal business hours or on other than normal working days at no “extra” or additional cost to Owner and with no extension of time.

4) Bids must be submitted on forms supplied by the Architect. All shall be properly signed and seal affixed. Bids must be regular in every respect and no interlineations, excisions or special conditions shall be made or included in the Bid Form by the Bidder except as stated above. The Contractor shall submit two copies of the completed Bid Form and retain one copy for his/her records.

a. The Owner may consider as irregular any Bid on which there is an alteration of or departure from the Bid Form provided herein, and at his/her option may reject same.

b. Corrections, erasures or other changes in the Bid Proposal Documents must be explained or noted over the signature of the Bidder.

c. Bids received prior to the advertised required receipt date and time will be securely kept. No Bid received thereafter will be considered.

d. Opening Of Bids

1) At the time and place fixed for the opening of Bids, the Owner will cause to be opened every Bid received within the time set for receiving Bids, irrespective of any irregularities therein.

2) The Owner will take the Bids into consideration and will subsequently determine recommendations to the Board for their action.

e. Withdrawal Of Bids

1) Bids may be withdrawn on written or telegraphic request dispatched by the Bidder in time for delivery in the normal course of business to the time fixed for opening; provided that written confirmation of any telegraphic withdrawal over the signature of the Bidder is placed in the mail and postmarked prior to the time set for Bid opening. The Bid guarantee of any Bidder withdrawing his Bid in accordance with the foregoing conditions will be returned promptly.

I. Substitutions

1) Each Bidder represents that his/her Bid is based upon the materials and equipment described in the Bidding Documents.

2) No Substitution will be considered unless request has been submitted to the Architect for approval at least seven (7) days prior to the date of receipt of Bids. Substitution requests shall be written and accompanied by adequate technical and cost data.

3) Requests shall include a complete description of the proposed Substitution, name of the material or equipment for which it is to be substituted, drawings, cuts, performance and test data, and any other data or information necessary for a complete evaluation by the Architect.

4) If the Architect approves any proposed Substitution, such approval will be set forth in an Addendum not less than three (3) days prior to the date for receipt of Bids.

J. Award of Contract: Rejection of Bids

1) The Contract, if awarded, will be awarded to the qualified, responsible Bidder submitting the lowest combination of "Base Bid" for the Work; plus any acceptable Alternates, complying with the conditions of the Bidding Documents, within the Owner's Budget.

2) The Contract shall be deemed to have been awarded when notice of an award shall have been given to the Bidder by some officer or agent of the Owner. The Bidder to whom the awards are made will be notified at the earliest possible date.

3) The Owner reserves the right to consider as unqualified to do the work of general construction any Bidder who does not habitually perform with his own forces the major portions of the work involved in construction of Work involved in this Contract.

4) The Owner, however, reserves the right to reject any and all Bids and to waive any informality in Bids received whenever such action(s) will serve the Owner’s best interest.

K. Bids for Base Bids will be held good for a period of sixty (60) calendar days and Alternates will be held good for a period of sixty (60) days subsequent to the opening of Bids.

L. Use and Clarification of Drawings and Specifications

1) All Drawings and Specifications for the work are the property of Owner and are intended solely for use in the work contemplated in such Drawings and Specifications.

2) If there are any discrepancies in, or omissions from, the Drawings or Specifications, or if the Bidder is in doubt as to the true meaning of any part of the Bidding Documents, he/she shall request clarification from Architect. Such request must be in writing and shall be made not less than seven (7) or more working days prior to the time scheduled for the termination of Bidding. Interpretations in response to inquiries from any Bidder, or any clarification or corrections issued, will be mailed to each Bidder. If the Bidder fails to request clarification regarding methods of performing work or the material required, his/her proposal shall be deemed to include the method requiring the greater quantity of work or material or upon the material of greatest cost indicated.

M. Execution of Agreement; Submittal of Performance and Payment Bonds and Certificate of Insurance

1) Subsequent to the award and within ten (10) days after the prescribed forms are prepared and presented for signature by the Architect, the successful Contractor shall execute and return to the Architect, an Agreement in the form referenced in the Contract Documents in such number of copies as the Owner may require. The submittal shall include required certificates of insurance forms/insurance policies, performance and payment bonds, and data requested by Owner for Owner's insurance. These submittals shall be complete prior to initiation of on-site work.

2) Contractor shall furnish Performance and Payment Bonds in penal sum equal to the contract. The bond premium is to be included in the Stipulated Sum Bid. Contractor represents that this Proposal does include all costs of such bonds.

3) Bidders should note that this Project Manual consists of all pages listed in the Table of Contents. Upon notification, the Architect will furnish any pages missing from the Project Manual, or from the Drawings as printed.

4) If the Bidder to whom the award is made shall fail to enter into a contract for the performance of the Work or furnish the Performance and Payment Bonds and the required certificates within ten (10) days, he/she shall forfeit his/her claim to the Work and the amount represented by the Bid Security accompanying his/her Proposal shall become the property of the Owner as the agreed and liquidated amount of damages caused by such failure.

N. Pre-Construction Conference

1) A "Pre-Construction" Conference will be scheduled shortly after the issuance of the "Notice to Proceed", to establish lines of communication, review schedules, and establish guidelines for execution of the work. This meeting is to be attended by the Contractor, any Subcontractors, the Owner, and the Architect.

O. Bidder's Responsibility for Condition of Work

1) The Bidder shall, before submitting his/her Proposal, be held to have examined the premises, so as to compare them with the Drawings and Specifications, and to have satisfied himself/herself as to the existing conditions of the premises and limitations under which the work will have to be executed. No allowance shall subsequently be made on behalf of the Bidder by reason of any error or neglect on his/her part for having failed to follow the instruction here given.

2) The Bidder shall be held to have carefully read the Instructions to Bidders, the General Conditions, the Specifications for his/her work and other branches of the work to the end that he/she may be fully informed not only as to the work he/she is to perform, but also know about the work that will be required to be done by all Subcontractors.

P. Contract Information:

1) Refer to Item G.1 above for completion date information.

2) Bids for Base Bids will be held good for a period of sixty (60) calendar days and Alternates will be held good for a period of sixty (60) days subsequent to the opening of Bids.

3) If Contractor does not complete work by date designated Substantial Completion, Owner may require that all or part of any remaining Work to be performed after building leaser’s/user’s normal business hours or on other than normal working days at no “extra” or additional cost to Owner and with no extension of time.

Q. Sales Tax

1) Owner is a tax exempt organization and Contractor will be permitted to use Owner's tax exempt number for this project.

R. Building Permits

1) The Owner shall provide the Building and other required Permits for the project as may be required by government and quasi-governmental entities with jurisdiction. Contractor shall obtain the permits.

S. Payment

1) Owner will make partial payments as the work progresses, if found satisfactory by Architect. Contractor may submit to Owner, not more than once a month, a partial

payment invoice, using the form designated in Section 00 6100, setting forth the value, based on the prices in this Proposal, of labor, materials and supplies furnished and incorporated in the work to the satisfaction of Owner's Liaison and Architect and of materials suitably stored on the site at the date of such submission.

T. Execution of Agreement: Performance and Payment Bond

1) Subsequent to the award and within ten (10) days after the prescribed forms are presented for signature, the successful Bidder shall execute and deliver to the Owner an Agreement in the form included in the Contract Documents in such number of copies as the Owner may require.

2) Having satisfied all conditions of award as set forth elsewhere in these documents, the successful Bidder shall, within the period specified in paragraph “a” above, furnish a surety bond in a penal sum not less than the amount of the Contract as awarded, as security for the faithful performance of the Contract, and for the payment of all persons, firms or corporations to whom the Contractor may become legally indebted for labor, materials, tools, equipment, or services of any nature including utility and transportation services, employed or used by him in performing the work. Such bond shall be in the same form as that included in the Contract Documents and shall bear the same date as, or a date subsequent to that of the Agreement. The current power of attorney for the person who signs for any surety company shall be attached to such bond. This bond shall be signed by a guaranty or surety company listed in the latest issue of the U.S. Treasury Circular 570.

U. Non-Collusion Affidavit

1) The Contractor is required to execute the Non-Collusion Affidavit included in this package as Bid Form Attachment A. The executed Non-Collusion Affidavit is to be included with the Contractor's bid. Failure to execute and include the Non-Collusion Affidavit with the Contractor's bid may deem the Contractor's proposal non-responsive.

V. Bidder's Qualifications

1) Contractors submitting bids for this project are required to execute the Bidder's Qualifications document included in this package as Bid Form Attachment B to document their experience record in constructing the types of additions and renovations as required for this Project. The executed document is to be included with the Contractor's bid. Failure to execute and include the document with the Contractor's bid may deem the Contractor's proposal non-responsive.

2) The Owner shall have the right to reject any Bid where an investigation of the available information does not satisfy the Owner that the Bidder is qualified to carry out properly the terms of the Contract.

W. Certificate of Sexual Harassment Policy

1) The Contractor is required to execute the Certificate of Sexual Harassment Policy included in this package as Bid Form Attachment C. The executed Certificate is to be included with the Contractor's bid. Failure to execute and include the Certificate with the Contractor's bid may deem the Contractor's proposal non-responsive.

X. Drug Free Workplace Certification

1) The Contractor is required to execute the Drug Free Workplace Certification included in this package as Bid Form Attachment D. The executed Certificate is to be included with the Contractor's bid. Failure to execute and include the Certificate with the Contractor's bid may deem the Contractor's proposal non-responsive.

Y. Prevailing Wage Rate Certification

1) The Contractor is required to execute the Prevailing Wage Rate Certification included in this package as Bid Form Attachment E. The executed Certificate is to be included with the Contractor's bid. Failure to execute and include the Certificate with the Contractor's bid may deem the Contractor's proposal non-responsive.

Z. Equal Employment Opportunity

1) See Section 00 7300.

AA. Insurance Requirements

1) See Section 00 7300.

END OF SECTION

SECTION 00 3100 - AVAILABLE PROJECT INFORMATION

PART 1 GENERAL

1.1. EXISTING CONDITIONS

A. Certain information relating to existing surface and subsurface conditions and structures is available to bidders but will not be part of Contract Documents, as follows:

B. Site Topographic Survey:

1. Prepared by: Farnsworth Group, Inc; copy included in the Drawings.

C. Geotechnical Report: Entitled Subsurface Exploration and Foundation Recommendations Proposed Crawford Memorial Hospital Additions, dated January 8, 2021.

1. Prepared by Midwest Engineering and Testing, Inc.
2. This report identifies properties of below grade conditions and offers recommendations for the design of foundations, prepared primarily for the use of Architect.
3. This report, by its nature, cannot reveal all conditions that exist on the site. Should subsurface conditions be found to vary substantially from this report, changes in the design and construction of foundations will be made, with resulting credits or expenditures to the Contract Sum accruing to Owner.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION (NOT USED)

END OF SECTION

SECTION 00 4000 - PROCUREMENT FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.1. Contractor is responsible for obtaining a valid license to use all copyrighted documents specified but not included in the Project Manual.

1.2. FORMS

A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in the procurement requirements.

B. Instructions to Bidders: Section 002100 - Instructions to Bidders

C. Substitution Request Form (During Procurement): CSI Form 1.5C - Substitution Request (During Bidding/Negotiating Stage).

D. Bid Form: Section 00 4100 - Bid Form and associated Attachments.

E. Procurement Form Supplements:

1) Bid Security Form: AIA A310.

2) Substitution Request Form (for substitutions requested with bid): CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage).

3) Proposed Schedule of Values Form: AIA G703.

1.3. REFERENCE STANDARDS

A. AIA A305 - Contractor's Qualification Statement; 1986.

B. AIA A310 - Bid Bond; 2010.

C. AIA G703 - Continuation Sheet; 1992.

D. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage); Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 00 4100 - BID FORM

THE PROJECT AND THE PARTIES

1.1. TO:

A. Crawford Memorial Hosptial (Owner)

1. 1000 N Allen Street, Robinson, IL, 62454

1.2. FOR:

A. Project: CMH RHC Addition and Renovations

1101 N. Allen Street

Robinson, Illinois 62454

1.3. DATE: _____ (Bidder to enter date)

1.4. SUBMITTED BY: (Bidder to enter name and address)

A. Bidder's Full Name _____

1. Address _____

2. City, State, Zip_____

1.5. OFFER

A. The Undersigned, having received and examined the Bidding Documents titled, "0200708.00 - Rural Health Clinic Addition and Renovations" dated 1:00 PM, June 17, 2021, and having visited the site and examined the conditions affecting the Work, we hereby proposes and agrees to furnish all labor, materials, equipment, appliances and services, and to perform operations necessary to complete the Work as required by said Bidding Documents, for the Work identified below.

B. Base Bid: _____
_____ dollars
($_____), in lawful money of the United States of America.

1.6. ACKNOWLEDGEMENTS

A. The Undersigned acknowledges the following:

1. Receipt of complete set of bidding documents and understands the meaning of their content and shall willingly comply with the guidelines set forth in those documents.
2. Receipt of Addenda numbers _____.
3. Bid Guarantee/Bond executed by the Bidder, equal to five percent of bid amount, is attached to completed bid form.
4. Non-Collusion Affidavit (attachment A) is completed and attached to completed bid form.
5. Bidder's Qualifications (attachment B) is completed and attached to completed bid form.
6. Certification of compliance with Sexual Harassment Policy (attachment C) is completed and attached to completed bid form.
7. Drug Free Workplace Certification (attachment D) is completed and attached to completed bid form.
8. Certification of compliance with Prevailing Wage Rates (attachment E) is completed and attached to completed bid form.
9. Costs and premiums for all associated bonds Performance Bond and Payment Bond, insurance, all permits and fees are included in the bid amount.
10. Bids for Base Bid will be held good for a period of sixty (60) calendar and Alternates will be held good for a period of sixty (60) days subsequent to the opening of Bids.

11. The undersigned agrees to comply with Owner's and building leaser's policies:
    a. Comply with the Illinois Drug Free Workplace Act,
    b. Comply with the Illinois Prevailing Wage Act, 820 IL CS 130/1 et seq. and use Wage Determination as determined by the Illinois Department of Labor, Conciliation, and Mediation Division,
    c. Comply with Public Works Employment Discrimination Act (775 ILCS 10/001 and 775 ILCS 5/2-105(A), (1), (2), (3), (4)).

1.7. CONTRACT TIME

A. If the Undersigned receives written notification of acceptance of this Proposal within fifteen (15) days after the Bid Opening Date he agrees to execute a Contract for the Work described in the Bidding Documents for the compensation identified in the Bidding Documents for the compensation identified in this proposal and to guarantee substantial completion of the Work no later than July 1, 2022.

1.8. BID FORM SIGNATURE(S)

A. The Corporate Seal of
B. _____
C. was hereunto affixed in the presence of:
D. _____
E. (Authorized signing officer, Title)
F. (Seal)
G. _____
H. (Authorized signing officer, Title)

END OF BID FORM

SECTION 00 4105 - BID FORM ATTACHMENT A - NON-COLLUSION AFFIDAVIT

(COMPLETE AND SUBMIT WITH BID)

STATE OF _____)

COUNTY OF _____)

_____ being duly sworn, says that he/she is

_____ OF _____,

(Sole owner, member of firm, corporate official) *(Individual, firm or corporate name)*

which has by the enactment of this document affirmed that he/she, in the preparation of the bid estimates, has not entered into any verbal and/or written agreement with any of the other bidders or their agents for the specific purpose of fixing bid estimates to benefit him/her-self or the firm he/she represents.

Certification: The Undersigned Bidder certifies that it has not been convicted of bribery or attempting to bribe an officer or employee of the State of Illinois, or any unit of government in the State of Illinois, nor has the Bidder made an admission of guilt of such conduct which is a matter of record, nor has an official, agent, or employee of the Bidder committed bribery or attempted bribery on behalf of the Bidder and pursuant to the direction or authorization of a responsible official of the Bidder. The Undersigned Bidder further certifies that it is not barred from bidding on this contract as a result of a conviction for the violation of state laws prohibiting bid-rigging or bid-rotating.

Signature _____

Subscribed and sword to me this ____ DAY OF _____ A.D. _____.

_____ (seal)

END OF SECTION

SECTION 00 4105.06 - BID FORM ATTACHMENT B - BIDDERS QUALIFICATION

(COMPLETE AND SUBMIT WITH BID)

1.1. How many years has your organization been in business under its present business name?

_____

1.2. What type of organization is your Company (i.e. corporation, partnership, individually owned)?

_____

1.3. On separate sheet, describe Bidder's experience record in constructing the type of additions and renovations embraced in this contract.

1.4. On separate sheet, describe Bidder's organization and equipment available for the work involved in this contract.

1.5. Supplementary Information: Provide information on 5 most recent projects of similar budget and scope including the following:

A. Project 1:

_____

1. Project Name _____
2. Project Completion Date_____
3. Contract amount at award _____
4. Total Change Order amount _____
5. Owner Contact Information _____

B. Project 2:

_____

1. Project Name _____
2. Project Completion Date_____
3. Contract amount at award _____
4. Total Change Order amount _____
5. Owner Contact Information _____

C. Project 3:

_____

1. Project Name _____
2. Project Completion Date_____
3. Contract amount at award _____
4. Total Change Order amount _____
5. Owner Contact Information _____

D. Project 4:

_____

1. Project Name _____
2. Project Completion Date_____
3. Contract amount at award _____
4. Total Change Order amount _____
5. Owner Contact Information _____

E. Project 5:

_____

1. Project Name _____
2. Project Completion Date_____
3. Contract amount at award _____
4. Total Change Order amount _____
5. Owner Contact Information _____

1.6. Signature _____

END OF SECTION

SECTION 00 4105.22 - BID FORM ATTACHMENT C

CERTIFICATE OF COMPLIANCE WITH SEXUAL HARASSMENT PREVENTION POLICY

(COMPLETE AND SUBMIT WITH BID)

STATE OF _____)

COUNTY OF _____)

_____ being duly sworn, says that he/she is

_____ OF

_____,

(Sole owner, member of firm, corporate official) (Individual, firm or corporate name)

Certification: The Undersigned Bidder certifies that this company is in compliance with the Owner's Sexual Harassment Prevention Policy.

Signature _____

Subscribed and sword to me this ____ DAY OF _____ A.D. _____.

_____ (seal)

END OF SECTION

SECTION 00 4105.33 - BID FORM ATTACHMENT D

DRUG FREE WORKPLACE CERTIFICATION

(COMPLETE AND SUBMIT WITH BID)

STATE OF _____)

COUNTY OF _____)

_____ being duly sworn, says that he/she is

_____ OF

_____,

Certification: The Undersigned Bidder certifies that his company is in compliance with Drug Free Workplace requirements in the State of Illinois.

Signature _____

Subscribed and sword to me this ____ DAY OF _____ A.D. _____.

_____ (seal)

END OF SECTION

SECTION 00 4105.44 - BID FORM ATTACHMENT E

CERTIFICATION OF PREVAILING WAGE RATES

(COMPLETE AND SUBMIT WITH BID)

STATE OF _____)

COUNTY OF _____)

_____ being duly sworn, says that he/she is

_____ OF

_____,

(Sole owner, member of firm, corporate official) (Individual, firm or corporate name)

Certification: The Undersigned Bidder certifies that his bid complies with Prevailing Wage Rate requirements for Crawford County, Illinois.

Signature _____

Subscribed and sword to me this ____ DAY OF _____ A.D. _____.

_____ (seal)

END OF SECTION

SECTION 00 4336 - PROPOSED SUBCONTRACTORS FORM

PARTICULARS

1.1. Herewith is the list of Subcontractors referenced in the bid submitted by:

1.2. (Bidder) _____

1.3. TO (Owner): Crawford Memorial Hosptial

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

1.5. The following work will be performed (or provided) by Subcontractors and coordinated by us:

LIST OF SUBCONTRACTORS

WORK SUBJECT SUBCONTRACTOR NAME

A. Concrete _____

B. Masonry _____

C. Roofing _____

D. Fire Protection _____

E. Plumbing _____

F. HVAC _____

G. Electrical _____

H. _____

I. _____

J. _____

END OF SECTION

SECTION 00 5000 - CONTRACTING FORMS AND SUPPLEMENTS

PART 1 GENERAL

1.1. AGREEMENT AND CONDITIONS OF THE CONTRACT

A. The Agreement is based on AIA A101-2017.

B. The General Conditions are based on AIA A201-2017 as modified under Section 00 7300 - Supplementary Conditions.

1.2. FORMS

A. Use the following forms for the specified purposes unless otherwise indicated elsewhere in Contract Documents.

B. Bond Forms:

1. Bid Bond Form: AIA A310.
2. Performance and Payment Bond Form: AIA A312.

C. Post-Award Certificates and Other Forms:

1. Certificate of Insurance Form: ACORD Certificate of Insurance 25.
2. Application for Payment Forms: AIA G702 with AIA G703 (for Contractors).
3. Consent of Surety to Reduction of Retainage Form: G707A.

D. Clarification and Modification Forms:

1. Architect's Supplemental Instructions Form: AIA G710.
2. Construction Change Directive Form: AIA G714.
3. Change Order Form: AIA G701.

E. Closeout Forms:

1. Certificate of Substantial Completion Form: AIA G704.

1.3. REFERENCE STANDARDS

A. AIA A101-2017 - Standard Form of Agreement Between Owner and Contractor where the basis of Payment is a Stipulated Sum; 2017.

B. AIA A201 - General Conditions of the Contract for Construction; 2017.

C. AIA A310 - Bid Bond; 2010.

D. AIA A312 - Performance Bond and Payment Bond; 2010.

E. AIA G701 - Change Order; 2001.

F. AIA G702 - Application and Certificate for Payment; 1992.

G. AIA G703 - Continuation Sheet; 1992.

H. AIA G704 - Certificate of Substantial Completion; 2000.

I. AIA G710 - Architect's Supplemental Instructions; 1992.

J. AIA G714 - Construction Change Directive; 2007.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 00 7200 - GENERAL CONDITIONS

FORM OF GENERAL CONDITIONS

1.1. The General Conditions applicable to this contract are AIA A201-2017, copy not included with this manual but available upon request.

RELATED REQUIREMENTS

2.1. SECTION 00 5000 - Contracting Forms and Supplements.

2.2. SECTION 00 7300 - Supplementary Conditions.

SUPPLEMENTARY CONDITIONS

3.1. REFER TO DOCUMENT 00 7300 - Supplementary Conditions for ammendments to these General Conditions.

END OF SECTION

SECTION 00 7300 - SUPPLEMENTARY CONDITIONS

PART 1 GENERAL

1.1. SUMMARY

A. These Supplementary Conditions amend and supplement the General Conditions defined in Document 00 7200 - General Conditions and other provisions of Contract Documents as indicated below. Provisions that are not so amended or supplemented remain in full force and effect.

B. The terms used in these Supplementary Conditions that are defined in the General Conditions have the meanings assigned to them in the General Conditions.

1.2. MODIFICATIONS TO GENERAL CONDITIONS

A. ARTICLE 2: OWNER

1. Add new Paragraph 2.6 Waivers

The Owner's waiver of any breach or failure to enforce any of the terms, conditions and specifications of the invitation to bidder, shall not in any way affect, limit or waive the Owner's right thereafter to enforce and compel strict compliance with every term, condition and specification thereof.

B. ARTICLE 3: CONTRACTOR

1. 3.4 Labor and Materials

a. ADD the following to Paragraph 3.4.1:

3.4.1 "…Should the Contract Documents require work to be performed after regular working hours or should the Contractor elect to perform work after regular working hours, the additional cost of such work shall be borne by the Contractor"

b. Add the following Subparagraph 3.4.2.1 to Paragraph 3.4.2:

"3.4.2.1 After Contract has been executed, Owner and Architect will consider formal requests for the substitution of products in place of those specified only under the conditions set forth in the General Requirements (Division 01 of the Specifications).

By making requests for substitutions based on Subparagraph 3.4.3 above, Contractor:

.1 represents that Contractor has personally investigated the proposed substitute product and determined that it is equal or superior in all respects to that specified;

.2 represents that Contractor will provide the same warranty for the substitution that Contractor would for that specified;

.3 certifies that the cost data presented is complete and includes all related costs under this Contract except Architect's redesign costs, and waives all claims for additional costs related to the substitution which subsequently become apparent; and

.4 will coordinate the installation of the accepted substitute, making such changes as may be required for the Work to be complete in all respects."

2. 3.5 Warranty

a. Add the following Paragraph 3.5.3:

"3.5.3 Contractor makes the following warranties to the Owner that he will, at the date of delivery, have good title to any and all goods supplied in the project and said goods will be free and clear of any and all liens and encumbrances.

.1 Contractor shall, at his sole cost and expense, promptly repair or replace to the Owner's satisfaction all damaged or defective goods/services received for a period of

one (1) year from date of delivery or date of installation, unless the Project Bid Specifications require a greater warranty period."

3. 3.6 Taxes

a. Add the following Paragraph 3.6.1:

"3.6.1 Owner is a tax exempt organization and Contractor will be permitted to use Owner's tax exempt number for this project for all materials physically incorporated into the project, that become property of Owner.

Items which do not become property of Owner and are not incorporated into real estate are taxable. (Example: fuel oil for machinery, construction stakes, temporary fencing, etc.)

Refer any questions about taxability of specific items to the Illinois Department of Revenue."

4. 3.10 Contractor's Construction Schedules

a. Change Subparagraph 3.10.1 to read as follows:

"3.10.1 The Contractor, promptly after being awarded the contract, shall prepare and submit for the Owner's and Architect's information a contractor's construction schedule for the Work. The schedule shall not exceed time limits current under the Contract Documents, shall be revised only with the Owner's approval as required by conditions of the Work and Project, shall be related to the entire Project to the extent required by the Contract Documents, and shall provide for expeditious and practicable execution of the Work."

5. 3.12 Shop Drawings, Product Data and Samples

a. Add Paragraph 3.12.11 to Section 3.12:

3.12.11 Architect's review of Contractor's submittals will be limited to examination of an initial submittal and two (2) resubmittals. Owner is entitled to obtain reimbursement from Contractor for amounts paid to Architect for evaluation of additional resubmittals."

6. 3.13 Use of Site

a. Add the following Paragraph 3.13.1:

3.13.1 The Contractor acknowledges that portions of the property on which the Project and Work are located will be occupied and in use by the Owner during the execution of the Work. The Contractor shall perform and coordinate his work in such a manner that the portions of the property occupied and in use will not be encumbered or the use interfered with or interrupted.

7. Add the following paragraph 3.19:

3.19 Non-Collusion Affidavit State of Illinois

3.19.1 The Contractor is required to execute the Non-Collusion Affidavit included in this package as Bid Form Attachment A. The executed Non-Collusion Affidavit is to be included with the Contractor's bid. Failure to execute and include the Non-Collusion Affidavit with the Contractor's bid may deem the Contractor's proposal non-responsive.

8. Add the following paragraph 3.20:

3.21: Sexual Harassment Policy

3.21.1: The Contractor is required to execute the Certificate of Sexual Harassment Policy included in this package as Bid Form Attachment C. The executed Certificate is to be included with the Contractor's bid. Failure to execute and include

the Certificate with the Contractor's bid may deem the Contractor's proposal non-responsive.

9. Add the following paragraph 3.21:

3.22: Drug Free Workplace Certification

3.22.1: The Contractor is required to execute the Drug Free Workplace Certification included in this package as Bid Form Attachment D. The executed Certificate is to be included with the Contractor's bid. Failure to execute and include the Certificate with the Contractor's bid may deem the Contractor's proposal non-responsive.

10. Add the following paragraph 3.22:

3.23: Certification of Prevailing Wage Rates

3.23.1 The Contractor is required to execute the Prevailing Wage Rate Certification included in this package as Bid Form Attachment E. The executed Certificate is to be included with the Contractor's bid. Failure to execute and include the Certificate with the Contractor's bid may deem the Contractor's proposal non-responsive.

C. ARTICLE 7: CHANGES IN THE WORK

1. 7.1 General

a. Add the following Paragraph 7.1.4 to Section 7.1:

"7.1.4 The Contractor is entitled to add a fixed percentage fee to the actual cost involved for changes in the Work. The combined overhead and profit included in the total cost to Owner for a change in the Work shall be based on the following schedule:

.1 For Contractor, for Work performed by Contractor's own forces, 10 percent

.2 For Contractor, for Work performed by Contractor's Subcontractors,

8 percent of the amount due the Subcontractors.

.3 For each Subcontractor involved, for Work performed by that Subcontractor's own forces, 8 percent of the cost.

.4 For each Subcontractor involved, for Work performed by the Subcontractor's Sub-subcontractors, 8 percent of the amount due the Sub-subcontractor.

.5 Cost to which overhead and profit is to be applied shall be determined in accordance with Section 7.3.4.

.6 In order to facilitate checking of quotations for extras or credits, all proposals, except those so minor that their propriety can be seen by inspection, shall be accompanied by a complete itemization of costs including labor, materials and Subcontracts. Labor and materials shall be itemized in the manner prescribed above. Where major cost items are Subcontracts, they shall be itemized also. In no case will a change involving over $200.00 be approved without such itemization.

D. ARTICLE 8: TIME

1. 8.1 Definitions

a. Delete Paragraph 8.1.4 and substitute the following:

"8.1.4 The term "day" as used in the Contract Documents shall mean working day, excluding weekends and legal holidays."

2. 8.2 Progress and Completion

a. Add the following Subparagraph 8.2.4:

"8.2.4 Owner reserves the right to require all or part of any remaining work not completed by date designated for Substantial Completion to be performed after normal business hours or on other than normal working days at no "extra" or additional cost to Owner and with no extension of time."

E. ARTICLE 9: PAYMENTS AND COMPLETION

1. 9.3 Applications for Payment

a. Add the following sentence to Paragraph 9.3.1:

"9.3.1 The form of Application for Payment, duly notarized, shall be a current authorized edition of AIA G702-1992, Application and Certificate for Payment, supported by a current authorized edition of AIA G703-1992, Continuation Sheet."

b. Add the following Subparagraph 9.3.1.3 and 9.3.1.4 to Paragraph 9.3.1:

9.3.1.3 Until Substantial Completion, Owner shall pay 90 percent of the amount due the Contractor on account of progress payments.

9.3.1.4 The first payment application shall be accompanied by Contractor's partial waiver for the full amount of the payment. Each subsequent monthly payment application shall be accompanied by the Contractor's partial waiver and the partial waivers of the Subcontractors and Suppliers who were included in the immediately preceding payment application to the extent of that payment. Application for final payment shall be accompanied by final waivers of lien from the Contractor, Subcontractor and Suppliers who have not previously furnished such final waivers.

2. 9.8 Substantial Completion

a. Add the following Subparagraph 9.8.3.1 to Paragraph 9.8.3:

9.8.3.1 Architect will perform no more than one (1) inspection per phase to determine whether the Work or a designated portion thereof has attained Substantial Completion in accordance with the Contract Documents. Owner is entitled to reimbursement from the Contractor for amounts paid to Architect for any additional inspections."

3. 9.10 Final Completion and Final Payment

a. Add the following Subparagraph 9.10.1.1 to Paragraph 9.10.1:

9.10.1.1 Architect will perform no more than one (1) inspection to determine whether the Work or a designated portion thereof has attained Final Completion in accordance with the Contract Documents. Owner is entitled to reimbursement from the Contractor for amounts paid to Architect for any additional inspections."

F. ARTICLE 10: PROTECTION OF PERSONS AND PROPERTY

1. 10.1 Safety Precautions and Programs

a. Add the following Paragraphs 10.1.1, 10.1.2 and 10.1.3 to Section 10.1:

10.1.1 The Contractor shall not use asbestos, PCB or any material which contains asbestos or PCB in his work. If requested by Architect, Contractor shall submit a signed statement insuring that no asbestos or PCB has been used on this project."

10.1.2 If reasonable precautions will be inadequate to prevent foreseeable bodily injury of death to persons resulting from a material or substance encountered on the site by the Contractor, the Contractor shall, upon recognizing the condition, immediately stop Work in the affected area and report the condition to the Owner and Architect in writing. The Owner, Contractor and Architect shall then proceed in the same manner described in Subparagraph 10.1.3.

10.1.3 The Owner shall be responsible for obtaining the services of a licensed laboratory to verify a presence of the material or substance reported by the Contractor and, in the event such material or substance reported by and, in the event such material or substance is found to be present, to verify that it has been rendered harmless. Unless otherwise required by the Contract Documents, the Owner shall furnish in writing to the Contractor and the Architect the names and qualifications of persons or entities who are to perform the task of removal or safe containment of such 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 the 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.

G. ARTICLE 11: INSURANCE AND BONDS

1. 11.1 Contractor's Liability Insurance

a. Add the following Subparagraphs 11.1.2.1 through 11.1.2.6.2 to Paragraph 11.1.2:

"11.1.2.1 The limits for Worker's Compensation and Employers' Liability insurance shall meet statutory limits mandated by State and Federal Laws. If (1) limits in excess of those required by statute are to be provided, (2) the employer is not statutorily bound to obtain such insurance coverage, or (3) additional coverages are required, additional coverages and limits for such insurance shall be as follows:

11.1.2.2 The limits for Commercial General Liability insurance including coverage for Premises-Operations, Independent Contractors' Protective, Products-Completed Operations, Contractual Liability, Personal Injury and Broad Form Property Damage (including coverage for Explosion, Collapse and Underground hazards) shall be as follows:

$1,000,000 Each Occurrence

$2,000,000 General Aggregate

$1,000,000 Personal and Advertising Injury

$2,000,000 Products-Completed Operations Aggregate

.1 The policy shall be endorsed to have the General Aggregate apply to this Project only.

.2 The Contractual Liability insurance shall include coverage sufficient to meet the obligations in O/C A201™-2017 under Section 3.18.

.3 Products and Completed Operations insurance shall be maintained for a minimum period of at least four (4) year(s) after the expiration of the period for correction of Work.

11.1.2.3 Automobile Liability insurance (owned, non-owned and hired vehicles) for bodily injury and property damage:

$1,000,000 Each Accident

11.1.2.4 Umbrella or Excess Liability coverage: $4,000,000.

b. 11.1.2.5 Contractor shall at Contractor's own expense provide insurance coverage for materials stored off the site after written approval of Owner at the value established in the approval, and also for portions of the Work in transit until such materials are permanently attached to the Work. "

11.1.2.6 Contractor shall furnish bonds covering faithful performance of the Contract and payment of obligations arising thereunder. Bonds may be obtained through Contractor's usual source and the cost thereof shall be included in the Contract Sum. The amount of each bond shall be equal to 100 percent of the Contract Sum.

.1 Contractor shall deliver the required bonds to Owner not later than three days following the date the Agreement is entered into, or if the Work is to be commenced prior thereto in response to a letter of intent, Contractor shall, prior to the commencement of the Work, submit evidence satisfactory to Owner that such bonds will be furnished.

.2 Contractor shall require the attorney-in-fact who executes the required bonds on behalf of the surety to affix thereto a certified and current copy of the power of attorney."

c. Add the following sentence to Paragraph 11.1.3:

"11.1.3 …If this insurance is written on a Commercial General Liability policy form, the certificates shall be ACORD form 25-S, completed and supplemented in accordance with AIA G715™-1991, Instruction Sheet and Supplemental Attachment for ACORD Certificate of Insurance 25-S."

2. 11.2 Owner's Insurance

a. Add the following Subparagraph 11.2.1.1 to Paragraph 11.2.1:

11.2.1.1 The insurance required by Section 11.2 is not intended to cover machinery, tools or equipment owned or rented by Contractor that are utilized in the performance of the Work but not incorporated into the permanent improvements. Contractor shall, at Contractor's own expense, provide insurance coverage for owned or rented machinery, tools or equipment, which shall be subject to the provisions of Section 11.3."

H. ARTICLE 13: MISCELLANEOUS PROVISIONS

1. 13.5 Interest

a. Delete Paragraph 13.5.

b. Add the following Paragraphs 13.5 through 13.7 to Article 13:

13.5 Wage Rates

13.5.1 The Contractor shall comply in all respects with "An Act Regulating Wages of Laborers and Mechanics and other Workmen Employed under Contracts for Public Works" enacted by the 62nd General Assembly, approved on June 26, 1941, as amended and codified as the Illinois Prevailing Wage Act, 820 ILCS 1130/1 et seq, and use the Wage Determination as determined by the Illinois Department of Labor, Conciliation, and Mediation Division current at this project's bid opening date. These wages will remain in effect until superseded by a new determination.

13.5.1.1 The prevailing rates of wages are indicated in the schedule following this section and at the State of Illinois' website = http://www.state.il.us/agency/idol/rates/rates.HTM<http://www.state.il.us/agency/> idol/rates/rates.HTM.

13.5.1.2 In case it shall become necessary for the Contractor or any Subcontractor to employ in the Work under this Contract any person in a trade or occupation (except executive, administrative or supervisory workers) for which no wage rates are specified, except in classes of work for which the prevailing rate of wages has been found by the Owner not to be ascertainable, the Contractor shall immediately notify the Owner which will attempt to ascertain and to furnish the Contractor with the general prevailing rate for such trade or occupation. The rate thus furnished shall be applicable for such trade or occupation from the time of initial employment of persons affected and during the continuance of such employment.

13.5.1.3 Prospective Bidders should make an investigation of existing labor conditions and any negotiated labor agreements which may exist or are contemplated at this time.

13.6 Equal Opportunity

13.6.1 The Contractor shall maintain policies of employment as follows:

13.6.1.1 The contractor and the Contractor's Subcontractors shall not discriminate against any employee or applicant for employment because of race, religion, color, sex or national origin. Such action shall include, but not be limited to, the following: employment, upgrading, demotion or transfer; recruitment or recruitment advertising; layoff or termination; rates of pay or other forms of compensation; and selection for training, including apprenticeship. The Contractor agrees to post in conspicuous places, available to employees and applicants for employment notices setting forth the policies of non-discrimination.

13.6.1.2 The Contractor and the Contractor's Subcontractors shall, in all solicitations or advertisements for employees placed by them or on their behalf, state that all qualified applicants will receive consideration for employment without regard to race, religion, color, sex or national origin.

13.7 Smoking, Musical Devices, Language, Dress Code, Noise and Vibration, Employee Background Checks

13.7.1 Owner has certain policies regarding the following:

.1 Smoking - The Owner prohibits smoking in building and on County property.

.2 Musical Devices - The Owner has restricted the use of radios, tape players, compact disc players, etc. to the extent that sound generated is not audible in adjacent occupied areas while grounds are in use.

.3 Dress Code - The Contractor and all employees and subcontractors shall keep shirts on at all times while grounds are in use.

.4 Noise and Vibration Control - The Contractor shall notify Owner 48 hours in advance of construction activities which might result in excessive noise and/or vibration into the existing grounds while they are in use. Coordinate scheduling of such activities with the Owner to minimize impact on Owner's activities.

I. ARTICLE 15: CLAIMS AND DISPUTES

1. 15.1.6 Claims for Additional Time

a. Add the following Subparagraphs 15.1.6.3 and 15.1.6.4 to Paragraph 15.1.6:

15.1.6.3 Claims for increase in the Contract Time shall set forth in detail the circumstances that form the basis for the Claim, the date upon which each cause of delay began to affect the progress of the Work, the date upon which each cause of delay ceased to affect the progress of the Work and the number of days' increase in the Contract Time claimed as a consequence of each such cause of delay. Contractor shall provide such supporting documentation as Owner may require including, where appropriate, a revised construction schedule indicating all the activities affected by the circumstances forming the basis of the Claim.

15.1.6.4 Contractor shall not be entitled to a separate increase in the Contract Time for each one of the number of causes of delay which may have concurrent or interrelated effects on the progress of the Work, or for concurrent delays due to the fault of Contractor."

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 1000 - SUMMARY

PART 1 GENERAL

1.1. SUMMARY

A. Section Includes:

1. Project information.
2. Contract description.
3. Work by Owner.
4. Owner occupancy.
5. Contractor use of site and premises.
6. Work restrictions.
7. Existing conditons and measurements.
8. Interim Life Safety Measures.
9. Specification and Drawing conventions.

1.2. PROJECT INFORMATION

A. Project Name: CMH RHC Addition and Renovations

B. Owner's Name: Crawford Memorial Hosptial.

C. Architect's Name: Farnsworth Group, Inc..

D. The Project consists of the construction of a Rural Health Clinic addition and renovations to the existing Rural Health Clinic and associated site development.

1. New construction addition is single story, slab on grade of 18,900 building gross square feet. Space program includes:
   a. New main entry, clinic pods, staff support and MEP support space.
   b. Pharmacy suite.
2. Renovation includes 12,240 square feet to gut and remodel existing clinic space to new clinic space.
3. Site work includes but is not limited to new parking lot and driveway paving, utility work and stormwater management.
4. This work shall include all labor, supervision, materials, transportation and services necessary and required to perform the Rural Health Clinic Addition and Renovations project as set forth in the Contract Documents.

1.3. CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 00 5000 - Contracting Forms and Supplements.

1.4. DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings and specified in Section 02 4100.

1.5. WORK BY OWNER

A. Items noted NIC (Not in Contract) will be supplied and installed by Owner before Substantial Completion. Some items include:

1. Movable cabinets.
2. Furnishings.
3. Small equipment.

B. Owner will supply and install the following:

C. Owner will supply the following for installation by Contractor:

1. Toilet accessories.

1.6. OWNER OCCUPANCY

A. Owner will utilize the existing Hospital, Rehab Building and Helipad adjacent to this project's site throughout construction.

B. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

C. Schedule the Work to accommodate Owner occupancy.

1.7. CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.

B. Arrange use of site and premises to allow:

1. Owner occupancy.

a. Owner will occupy the premises during the entire construction period, with the exception of areas under construction. Coordinate with the Owner during construction operations to minimize conflicts and facilitate Owner usage. Perform the Work so as not to interfere with the Owner's operations. Maintain existing exits unless otherwise indicated.

2. Use of site by the public.

a. Schedule deliveries to minimize use of driveways and entrances by construction operations.

b. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

C. Provide access to and from site as required by law and by Owner:

1. Emergency Building Exits During Construction: The existing building consists of several individual provider suites. A varying number of those will remain occupied during constuction and egress must be maintained for those..

2. Do not obstruct roadways, sidewalks, or other public ways without permit.

a. Do not block public streets at any time.

D. Utility Outages and Shutdown:

1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.

2. Prevent accidental disruption of utility services to other facilities.

E. Protect existing site improvements and public access ways to remain. If pavements, curbs, , and other site improvements to remain are damaged or defaced during construction operations, repair and restore all to condition at start of construction or better.

F. Keep paved driveways on Owner’s property, full project site and public streets, alleys and walkways clear of earth and debris spillage from trucking and traffic involved in construction operations.

1.8. WORK RESTRICTIONS

A. Work Restrictions, COVID19 Related: Comply with State and Owner's restrictions on access to existing building and safety provisions associated with mitigation of COVID19 risks including but not limited to wearing of face coverings/masks.

B. Work Restrictions, General: Comply with restrictions on construction operations.

1. Comply with limitations on use of public streets and other requirements of authorities having jurisdiction.

2. On-Site Work Hours: Limit work in the existing building to normal business working hours of 7 a.m. to 5 p.m., Monday through Friday, except as otherwise indicated.
    a. Weekend Hours: same as workday hours.
    b. Early Morning Hours: Comply with regulations from authorities having jurisdiction for restrictions on noisy work.
3. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Crawford Memorial Hospital unless permitted under the following conditions and then only after providing temporary utility services according to requirements indicated:
    a. Notify Architect and Owner not less than two business days in advance of proposed utility interruptions.
    b. Obtain Owner's written permission before proceeding with utility interruptions.
4. Noise, Vibration, Dust and Odors: Coordinate operations that may result in high levels of noise and vibration, odors, or other disruption to Crawford Memorial Hospital.
    a. Notify Architect and Owner not less than two days in advance of proposed disruptive operations.
    b. Obtain Owner's Liaison’s written permission before proceeding with disruptive operations.
    c. Comply with applicable noise control laws, ordinances, and regulations. Where field sound measurements exceed allowable limits cease operating such equipment and repair or replace it with equipment that complies with requirements.
    d. Dust: Take precautions necessary to keep Work under this contract and adjoining properties free from dust. Perform dust control in compliance with authorities having jurisdiction. Follow procedures and protocol to prevent pollution of land, air, and water.
5. Nonsmoking Site and Building: Smoking or use of any tobacco is not permitted within the building or on the site.
6. Controlled Substances: Use controlled substances on the Project site are not permitted. Contractor is responsible for maintaining a drug-free work place.
7. Employee Identification: Provide identification tags for Contractor personnel working on the Project site. Require personnel to utilize identification tags at all times.
8. Patient confidentiality: The Contractor shall instruct all employees and subcontractors that the patient's right to privacy is to be maintained on the job site and off the job.

1.9. EXISTING CONDITIONS AND MEASUREMENTS

A. Information pertaining to the project site has been obtained through photographs and investigations and is indicated on the Drawings. This information has been gathered with reasonable care, but is of a schematic nature and is not warranted. Verify all dimensions in the field prior to ordering materials or proceeding with construction.

B. Be alert to any indication or evidence of existing building conditions not indicate on the Contract Documents. Measurements shall be verified form actual observation at the project site. If unexpected existing conditions are encountered, notify the Architect immediately.

C. Existing Building Considerations:
    1. The existing building is single story, slab on grade and has an approximately 11'-2" floor to bottom of roof truss height.
    2. The existing building is non combustible, non protected construction and is not currently sprinklered.

1.10. INTERIM LIFE SAFETY MEASURES

A. It is the intent of the Owner to implement, document and enforce interim life safety measures (ILSM) to temporarily compensate for any hazards caused by construction activities during this project. Contractors and their subcontractors, employees and suppliers shall take every measure required to fully support the Owner in its efforts.

B. Comply with ILSM measures as follows:

1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered All alternative exits are to be clearly marked and personnel are to be instructed about their use. Contractor to maintain safe escape routes for construction workers at all times. These are to be inspected daily.

2. Maintain free and unobstructed access to emergency services and for ambulance, fire, police and other emergency forces.

3. Ensure that fire alarm, detection, and fire suppression systems are maintained in good working order. A temporary but equivalent system shall be provided when any of these systems are impaired. These temporary systems shall be inspected and tested monthly. Any temporary disconnections are to be reported daily to the local fire department and a log of these reports is to be maintained for inspection.

4. Temporary construction partitions or other barriers shall be erected and maintained to separate construction areas from the existing building operations and to protect existing ratings. These shall be smoke tight and built of noncombustible or limited combustible materials that will not contribute to the development or spread of fire.

5. The Owner and the Contractor shall each provide additional fire-fighting equipment, as appropriate to their areas. They will each provide appropriate training in its use. The Contractor shall provide, as a minimum, type 2A:10BC fire extinguishers such that travel distance to one shall not exceed 75 feet in construction areas.

6. The construction site is to be kept clean and free of debris.

7. There shall be a minimum of two fire drills per shift per quarter during the period of construction. The Contractor and his forces shall cooperate and participate in these drills as appropriate.

8. The Owner and its representatives will increase surveillance for hazards in and around buildings, grounds and equipment, during periods of construction. The Contractor and his forces shall watch for possible hazards and shall immediately report same to Safety and Security or fire or police, as appropriate

9. The Owner and the Contractor shall each train their own personnel to compensate for impaired structural or compartmentalization features of fire safety.

10. The Contractor shall cooperate with the Owner in conducting safety education programs to promote awareness of life safety deficiencies, construction hazards, and interim life safety measures.

1.11. 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 the Drawings are described in detail in the Specifications. One or more of the following are used on the 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 scheduled on Drawings.
3. Keynoting: Materials and products are identified by reference keynotes referencing Specification Section numbers found in this Project Manual.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2000 - PRICE AND PAYMENT PROCEDURES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Procedures for preparation and submittal of applications for progress payments.

B. Documentation of changes in Contract Sum and Contract Time.

C. Change procedures.

D. Correlation of Contractor submittals based on changes.

E. Procedures for preparation and submittal of application for final payment.

1.2. RELATED REQUIREMENTS

A. Section 00 5000 - Contracting Forms and Supplements: Forms to be used.

B. Section 00 5200 - Agreement Form: Contract Sum, retainages, payment period, monetary values of unit prices.

C. Section 00 7200 - General Conditions: Additional requirements for progress payments, final payment, changes in the Work.

D. Section 00 7300 - Supplementary Conditions: Percentage allowances for Contractor's overhead and profit.

E. Section 01 7800 - Closeout Submittals: Project record documents.

1.3. SCHEDULE OF VALUES

A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.

B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.

C. Forms filled out by hand will not be accepted.

D. Submit Schedule of Values in electronic format within 15 days after date of Owner-Contractor Agreement.

E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section.

F. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.

G. Revise schedule to list approved Change Orders, with each Application For Payment.

1.4. APPLICATIONS FOR PROGRESS PAYMENTS

A. Payment Period: Submit at intervals stipulated in the Agreement.

B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.

C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.

D. Forms filled out by hand will not be accepted.

E. Execute certification by signature of authorized officer.

F. Submit one electronic copy of each Application for Payment until Final application. Submit hard-copy of Final Application for Payment.

G. Include the following with the application:

1. Transmittal letter as specified for submittals in Section 01 3000.

2. Partial release of liens from major subcontractors and vendors.

3. Affidavits attesting to off-site stored products.

H. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

1.5. MODIFICATION PROCEDURES

A. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.

B. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.

1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.

2. Promptly execute the change.

C. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 14 days.

D. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation. Document any requested substitutions in accordance with Section 01 6000.

E. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.

1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.

2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.

3. For pre-determined unit prices and quantities, the amount will based on the fixed unit prices.

4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.

F. Substantiation of Costs: Provide full information required for evaluation.

1. Provide the following data:

a. Quantities of products, labor, and equipment.

b. Taxes, insurance, and bonds.

c. Overhead and profit.

d. Justification for any change in Contract Time.

e. Credit for deletions from Contract, similarly documented.

2. Support each claim for additional costs with additional information:

a. Origin and date of claim.

b. Dates and times work was performed, and by whom.

c. Time records and wage rates paid.

d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.

3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

G. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.

H. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.

I. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.

J. Promptly enter changes in Project Record Documents.

1.6. APPLICATION FOR FINAL PAYMENT

A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.

B. Application for Final Payment will not be considered until the following have been accomplished:

1. All closeout procedures specified in Section 01 7000.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 2500 - SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.2. RELATED REQUIREMENTS

A. Section 00 2100 - Instructions to Bidders: Restrictions on timing of substitution requests.

B. Section 01 3000 - Administrative Requirements: Submittal procedures, coordination.

C. Section 01 6000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.3. DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.

1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.

a. Unavailability.

b. Regulatory changes.

2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.

a. Substitution requests offering advantages solely to the Contractor will not be considered.

1.4. REFERENCE STANDARDS

A. CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage); Current Edition.

B. CSI/CSC Form 13.1A - Substitution Request (After the Bidding/Negotiating Phase); Current Edition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1. GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:

1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.

2. Agrees to provide the same warranty for the substitution as for the specified product.

3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.

4. Waives claims for additional costs or time extension that may subsequently become apparent.

5. Agrees to reimburse Owner and Architect for review or redesign services associated with re-approval by authorities.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

1. Note explicitly any non-compliant characteristics.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.

1. Forms indicated in the Project Manual are adequate for this purpose, and must be used.

D. Limit each request to a single proposed substitution item.

1. Submit an electronic document, combining the request form with supporting data into single document.

3.2. SUBSTITUTION PROCEDURES DURING PROCUREMENT

A. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period, and the documents required.

B. Submittal Form (before award of contract):

1. Submit substitution requests by completing CSI/CSC Form 1.5C - Substitution Request (During the Bidding/Negotiating Stage). See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

C. Owner will consider requests for substitutions only if submitted at least 5 days prior to the date for receipt of bids.

3.3. SUBSTITUTION PROCEDURES DURING CONSTRUCTION

A. Submittal Form (after award of contract):

1. Submit substitution requests by completing CSI/CSC Form 13.1A - Substitution Request. See this form for additional information and instructions. Use only this form; other forms of submission are unacceptable.

B. Submit request for Substitution for Cause within 14 days of discovery of need for substitution, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

C. Submit request for Substitution for Convenience immediately upon discovery of its potential advantage to the project, but not later than 14 days prior to time required for review and approval by Architect, in order to stay on approved project schedule.

1. In addition to meeting general documentation requirements, document how the requested substitution benefits the Owner through cost savings, time savings, greater energy conservation, or in other specific ways.

2. Document means of coordinating of substitution item with other portions of the work, including work by affected subcontractors.

3. Bear the costs engendered by proposed substitution of:

a. Owner's compensation to the Architect for any required redesign, time spent processing and evaluating the request.

b. Other construction by Owner.

c. Other unanticipated project considerations.

D. Substitutions will not be considered under one or more of the following circumstances:

1. When they are indicated or implied on shop drawing or product data submittals, without having received prior approval.

2. Without a separate written request.

3. When acceptance will require revisions to Contract Documents.

3.4. RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.

1. Architect's decision following review of proposed substitution will be noted on the submitted form.

3.5. ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.6. CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Include completed Substitution Request Forms as part of the Project record. Include both approved and rejected Requests.

END OF SECTION

SECTION 01 3000 - ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. General administrative requirements.

B. Electronic document submittal service.

C. Preconstruction meeting.

D. Site mobilization meeting.

E. Progress meetings.

F. Construction progress schedule.

G. Contractor's daily reports.

H. Progress photographs.

I. Submittals for review, information, and project closeout.

J. Number of copies of submittals.

K. Requests for Information (RFI) procedures.

L. Submittal procedures.

1.2. RELATED REQUIREMENTS

A. Section 00 7200 - General Conditions: Dates for applications for payment.

B. Section 01 6000 - Product Requirements: General product requirements.

C. Section 01 7000 - Execution and Closeout Requirements: Additional coordination requirements.

D. Section 01 7800 - Closeout Submittals: Project record documents; operation and maintenance data; warranties and bonds.

E. Sections 01 7900 - Demonstration and Training: Additional requirements for demonstration and training to be provided to the Owner.

1.3. REFERENCE STANDARDS

A. AIA G716 - Request for Information; 2004.

B. AIA G810 - Transmittal Letter; 2001.

1.4. GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 01 7000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:

1. Requests for Information (RFI).
2. Requests for substitution.
3. Shop drawings, product data, and samples.
4. Test and inspection reports.
5. Design data.
6. Manufacturer's instructions and field reports.
7. Applications for payment and change order requests.
8. Progress schedules.
9. Coordination drawings.

10. Correction Punch List and Final Correction Punch List for Substantial Completion.
11. Closeout submittals.

1.5. PROJECT COORDINATOR

A. Project Coordinator: Owner.

B. During construction, coordinate use of site and facilities through the Project Coordinator.

C. Comply with instructions of the Project Coordinator for use of temporary utilities and construction facilities. Responsibility for providing temporary utilities and construction facilities is identified in Section 01 1000 - Summary.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1. ELECTRONIC DOCUMENT SUBMITTAL SERVICE

A. All documents transmitted for purposes of administration of the contract are to be in electronic (PDF, MS Word, or MS Excel) format, as appropriate to the document, and transmitted via an Internet-based submittal service that receives, logs and stores documents, provides electronic stamping and signatures, and notifies addressees via email.

1. Besides submittals for review, information, and closeout, this procedure applies to Requests for Information (RFIs), progress documentation, contract modification documents (e.g. supplementary instructions, change proposals, change orders), applications for payment, field reports and meeting minutes, Contractor's correction punchlist, and any other document any participant wishes to make part of the project record.
2. Contractor and Architect are required to use this service.
3. It is Contractor's responsibility to submit documents in allowable format.
4. Subcontractors, suppliers, and Architect's consultants will be permitted to use the service at no extra charge.
5. Users of the service need an email address, internet access, and PDF review software that includes ability to mark up and apply electronic stamps (such as Adobe Acrobat, www.adobe.com, or Bluebeam PDF Revu, www.bluebeam.com), unless such software capability is provided by the service provider.
6. Paper document transmittals will not be reviewed; emailed electronic documents will not be reviewed.
7. All other specified submittal and document transmission procedures apply, except that electronic document requirements do not apply to samples or color selection charts.

B. Submittal Service: The selected service is:

1. Newforma ConstructEx: www.newforma.com/products/constructex/#sle.

C. Project Closeout: Architect will determine when to terminate the service for the project and is responsible for obtaining archive copies of files for Owner.

3.2. PRECONSTRUCTION MEETING

A. Schedule meeting after Notice of Award.

B. Attendance Required:

1. Owner.
2. Architect.
3. Contractor.

C. Agenda:

1. Execution of Owner-Contractor Agreement.
2. Submission of executed bonds and insurance certificates.
3. Distribution of Contract Documents.
4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
5. Submission of initial Submittal schedule.
6. Designation of personnel representing the parties to Contract, and Architect.
7. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
8. Scheduling.
9. Materials staging.
10. Background checks.

D. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.3. SITE MOBILIZATION MEETING

A. Schedule meeting at the Project site prior to Contractor occupancy.

B. Attendance Required:

1. Contractor.
2. Owner.
3. Architect.
4. Contractor's superintendent.
5. Major subcontractors.

C. Agenda:

1. Use of premises by Owner and Contractor.
2. Owner's requirements.
3. Construction facilities and controls provided by Owner.
4. Temporary utilities provided by Owner.
5. Survey and building layout.
6. Security and housekeeping procedures.
7. Schedules.
8. Application for payment procedures.
9. Procedures for maintaining record documents.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.4. PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum bi-monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:

1. Contractor.
2. Owner.
3. Architect.

4. Contractor's superintendent.
5. Major subcontractors.

D. Agenda:

1. Review minutes of previous meetings.
2. Review of work progress.
3. Field observations, problems, and decisions.
4. Identification of problems that impede, or will impede, planned progress.
5. Review of submittals schedule and status of submittals.
6. Review of RFIs log and status of responses.
7. Maintenance of progress schedule.
8. Corrective measures to regain projected schedules.
9. Planned progress during succeeding work period.
10. Coordination of projected progress.
11. Maintenance of quality and work standards.
12. Effect of proposed changes on progress schedule and coordination.
13. Other business relating to work.

E. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.5. CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 5 days after review of preliminary schedule, submit draft of proposed complete schedule for review.

1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Submit updated schedule with each Application for Payment.

3.6. DAILY CONSTRUCTION REPORTS

A. Include only factual information. Do not include personal remarks or opinions regarding operations and/or personnel.

B. Prepare a daily construction report recording the following information concerning events at Project site and project progress:

1. Date.
2. High and low temperatures, and general weather conditions.
3. List of subcontractors at Project site.
4. Safety, environmental, or industrial relations incidents.
5. Meetings and significant decisions.
6. Stoppages, delays, shortages, and losses. Include comparison between scheduled work activities (in Contractor's most recently updated and published schedule) and actual activities. Explain differences, if any. Note days or periods when no work was in progress and explain the reasons why.

7. Testing and/or inspections performed.
8. List of verbal instruction given by Owner and/or Architect.
9. Signature of Contractor's authorized representative.

3.7. PROGRESS PHOTOGRAPHS

A. Submit photographs with each application for payment, taken not more than 3 days prior to submission of application for payment.

B. Photography Type: Digital; electronic files.

C. Provide photographs of site and construction throughout progress of work produced by an experienced photographer, acceptable to Architect.

3.8. REQUESTS FOR INFORMATION (RFI)

A. Definition: A request seeking one of the following:

1. An interpretation, amplification, or clarification of some requirement of Contract Documents arising from inability to determine from them the exact material, process, or system to be installed; or when the elements of construction are required to occupy the same space (interference); or when an item of work is described differently at more than one place in Contract Documents.
2. A resolution to an issue which has arisen due to field conditions and affects design intent.

B. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

C. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.

1. Prepare a separate RFI for each specific item.
    a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
    b. Do not forward requests which solely require internal coordination between subcontractors.
2. Prepare using software provided by the Electronic Document Submittal Service.
3. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

D. Reason for the RFI: Prior to initiation of an RFI, carefully study all Contract Documents to confirm that information sufficient for their interpretation is definitely not included.

1. Include in each request Contractor's signature attesting to good faith effort to determine from Contract Documents information requiring interpretation.
2. Unacceptable Uses for RFIs: Do not use RFIs to request the following::
    a. Approval of submittals (use procedures specified elsewhere in this section).
    b. Approval of substitutions (see Section - 01 6000 - Product Requirements)
    c. Changes that entail change in Contract Time and Contract Sum (comply with provisions of the Conditions of the Contract).
3. Improper RFIs: Requests not prepared in compliance with requirements of this section, and/or missing key information required to render an actionable response. They will be returned without a response, with an explanatory notation.
4. Frivolous RFIs: Requests regarding information that is clearly indicated on, or reasonably inferable from, Contract Documents, with no additional input required to clarify the question. They will be returned without a response, with an explanatory notation.

a. The Owner reserves the right to assess the Contractor for the costs (on time-and-materials basis) incurred by the Architect, and any of its consultants, due to processing of such RFIs.

E. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.

1. Official Project name and number, and any additional required identifiers established in Contract Documents.
2. Owner's, Architect's, and Contractor's names.
3. Discrete and consecutive RFI number, and descriptive subject/title.
4. Issue date, and requested reply date.
5. Reference to particular Contract Document(s) requiring additional information/interpretation. Identify pertinent drawing and detail number and/or specification section number, title, and paragraph(s).
6. Annotations: Field dimensions and/or description of conditions which have engendered the request.
7. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

F. Attachments: Include sketches, coordination drawings, descriptions, photos, submittals, and other information necessary to substantiate the reason for the request.

G. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.

1. Indicate current status of every RFI. Update log promptly and on a regular basis.
2. Note dates of when each request is made, and when a response is received.
3. Highlight items requiring priority or expedited response.
4. Highlight items for which a timely response has not been received to date.
5. Identify and include improper or frivolous RFIs.

H. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.

1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

I. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.

1. Response may include a request for additional information, in which case the original RFI will be deemed as having been answered, and an amended one is to be issued forthwith. Identify the amended RFI with an R suffix to the original number.
2. Do not extend applicability of a response to specific item to encompass other similar conditions, unless specifically so noted in the response.
3. Upon receipt of a response, promptly review and distribute it to all affected parties, and update the RFI Log.
4. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.9. SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.

1. Submit at the same time as the preliminary schedule.
2. Coordinate with Contractor's construction schedule and schedule of values.
3. Format schedule to allow tracking of status of submittals throughout duration of construction.
4. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.
5. Account for time required for preparation, review, manufacturing, fabrication and delivery when establishing submittal delivery and review deadline dates.
    a. For assemblies, equipment, systems comprised of multiple components and/or requiring detailed coordination with other work, allow for additional time to make corrections or revisions to initial submittals, and time for their review.

3.10. SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:

1. Product data.
2. Shop drawings.
3. Samples for selection.
4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 01 7800 - Closeout Submittals.

3.11. SUBMITTALS FOR INFORMATION

A. When the following are specified in individual sections, submit them for information:

1. Design data.
2. Certificates.
3. Test reports.
4. Inspection reports.
5. Manufacturer's instructions.
6. Manufacturer's field reports.
7. Other types indicated.

B. Submit for Architect's knowledge as contract administrator or for Owner.

3.12. SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 01 7800 - Closeout Submittals:

1. Project record documents.
2. Operation and maintenance data.

3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.13. NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.

1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.

3.14. SUBMITTAL PROCEDURES

A. General Requirements:

1. Use a single transmittal for related items.
2. Transmit using approved form.
    a. Use form generated by Electronic Document Submittal Service software.
3. Sequentially identify each item. For revised submittals use original number and a sequential numerical suffix.
4. Identify: Project; Contractor; subcontractor or supplier; pertinent drawing and detail number; and specification section number and article/paragraph, as appropriate on each copy.
5. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
    a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
6. Schedule submittals to expedite the Project, and coordinate submission of related items.
    a. For each submittal for review, allow 15 days excluding delivery time to and from the Contractor.
    b. For sequential reviews involving Architect's consultants, Owner, or another affected party, allow an additional 7 days.
7. Identify variations from Contract Documents and product or system limitations that may be detrimental to successful performance of the completed work.
8. Provide space for Contractor and Architect review stamps.
9. When revised for resubmission, identify all changes made since previous submission.
10. Distribute reviewed submittals. Instruct parties to promptly report inability to comply with requirements.
11. Incomplete submittals will not be reviewed, unless they are partial submittals for distinct portion(s) of the work, and have received prior approval for their use.
12. Submittals not requested will be recognized, and will be returned "Not Reviewed",

B. Product Data Procedures:

1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.

3. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:

1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.

2. Do not reproduce Contract Documents to create shop drawings.

3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

3.15. SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

1. Notations may be made directly on submitted items and/or listed on appended Submittal Review cover sheet.

D. Architect's and consultants' actions on items submitted for review:

1. Authorizing purchasing, fabrication, delivery, and installation:

a. "No Exceptions Taken", or language with same legal meaning.

b. "Furnish as Corrected", or language with same legal meaning.

1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.

2. Not Authorizing fabrication, delivery, and installation:

a. "Revise and Resubmit".

1) Resubmit revised item, with review notations acknowledged and incorporated.

2) Non-responsive resubmittals may be rejected.

b. "Rejected".

1) Submit item complying with requirements of Contract Documents.

E. Architect's actions on items submitted for information:

1. Items for which no action was taken:

a. "Not Reviewed" - to notify the Contractor that the submittal has been received for record only.

2. Items for which action was taken:

a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

SECTION 01 3310 - CADD WAIVER OF LIABILITY

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section includes CADD waiver form.

1. For the Contractor to request CAD files to assist him/her with Shop Drawings, the CADD Waiver form must be completed and emailed to the Architect/Engineer.

B. Related Requirements:

1. Division 01 Section “Submittal Procedures” for submittal requirements and procedures.
2. Division 01 Section "Operation and Maintenance Data" for submitting operation and maintenance manuals.
3. Division 01 Section "Project Record Documents" for submitting record Drawings, record Specifications, and record Product Data.

1.3. SUBMITTAL ADMINISTRATIVE REQUIREMENTS

A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals. Refer to Division 01 Section 01 3000 “Administrative Requirements” for specific information.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

WAIVER OF LIABILITY AGREEMENT
(1 Page)

This waiver agreement is made between Farnsworth Group, Inc., of Normal, Illinois, and

_____

INSERT COMPANY NAME HERE – WHO IS RECEIVING THE DRAWINGS. Include address & phone contact info.

hereinafter referred to as SUBCONTRACTOR to _____for the Project.

Specific Intention/Application For Electronic Drawing Request: _____

Sheets Requested: _____

Format Requested: PDF _____-***OR***- AutoCAD Version Requested: _____
Options: 2013

In accepting and utilizing any drawings, reports and data on any form of electronic media generated and furnished by Farnsworth Group, Inc., the SUBCONTRACTOR agrees that all such electronic files are instruments of service of Farnsworth Group, Inc., who shall be deemed the author, and shall retain all common law, statutory law and other rights, without limitation, including copyrights.

The SUBCONTRACTOR, by signing this agreement, acknowledges and shall abide by the following:

- The paper & electronic media provided for the project shall be handled as one package, not to be distributed in part.
- The paper media is an accurate representation of the data furnished within the scope of the named project as of the date shown in the title block of the paper media.
- Farnsworth Group, Inc. does not guarantee the accuracy and does not assume any responsibility or liability for any reproductions produced by the SUBCONTRACTOR or its agents from the Electronic Data of the work.
- Electronic Data is not to be used for purposes other than those associated with the project named below, or outside of its intended scope.
- The SUBCONTRACTOR will at no time make any changes, modifications, deletions, or additions to the Electronic Data provided by Farnsworth Group, Inc. for distribution within or outside of its own organization.
- By your use of these electronic files, you are not relieved of your duty to fully comply with the contract documents, including, and without limitation, the need to check, confirm and coordinate all dimensions and details, take field measurements, verify field conditions and coordinate your work with that of other contractors for the project.
- Farnsworth Group, Inc. makes no representation regarding the accuracy or completeness of the electronic files you receive.
- The Electronic Data provided by Farnsworth Group, Inc. as shown on the paper media is not guaranteed to reproduce on the SUBCONTRACTOR's equipment, either on a computer screen or in a print.
- All reproductions, paper or electronic media, must be obtained from the General Contractor for bidding purposes and Farnsworth Group, Inc. for construction purposes. See information below for Farnsworth Group contact information.

Project: CRAWFORD MEMORIAL HOSPITAL RHC ADDITION AND RENO
Project Date: May 28, 2021
FGI Project Number: 0200708.00

Farnsworth Group, Inc.
By: Brooke M. McGuire, Assoc. AIA
Title: Architectural Designer III

_____
Subcontractor's Signature/Title

Submit completed form by Email (pdf format) attention to:
Brooke M. McGuire (email: bmcguire@f-w.com)
Farnsworth Group, Inc., 200 W. College Ave., Suite 301 Normal, Illinois 61761
Telephone: 309-663-8436

SECTION 01 4000 - QUALITY REQUIREMENTS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Submittals.

B. Quality assurance.

C. References and standards.

D. Testing and inspection agencies and services.

E. Contractor's construction-related professional design services.

F. Contractor's design-related professional design services.

G. Control of installation.

H. Mock-ups.

I. Tolerances.

J. Manufacturers' field services.

K. Defect Assessment.

1.2. RELATED REQUIREMENTS

A. Document 00 3100 - Available Project Information: Soil investigation data.

B. Document 00 7200 - General Conditions: Inspections and approvals required by public authorities.

C. Section 01 3000 - Administrative Requirements: Submittal procedures.

D. Section 01 6000 - Product Requirements: Requirements for material and product quality.

1.3. REFERENCE STANDARDS

A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2014).

B. ASTM C1077 - Standard Practice for Laboratories Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Laboratory Evaluation; 2014.

C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2013.

D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2012a.

E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and/or Testing; 2014a.

F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2013.

G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.

H. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2010.

1.4. DEFINITIONS

A. Contractor's Quality Control Plan: Contractor's management plan for executing the Contract for Construction.

B. Contractor's Professional Design Services: Design of some aspect or portion of the project by party other than the design professional of record. Provide these services as part of the Contract for Construction.

1. Design Services Types Required:

a. Construction-Related: Services Contractor needs to provide in order to carry out the Contractor's sole responsibilities for construction means, methods, techniques, sequences, and procedures.

b. Design-Related: Design services explicitly required to be performed by another design professional due to highly-technical and/or specialized nature of a portion of the project. Services primarily involve engineering analysis, calculations, and design, and are not intended to alter the aesthetic aspects of the design.

C. Design Data: Design-related, signed and sealed drawings, calculations, specifications, certifications, shop drawings and other submittals provided by the Contractor, and prepared directly by, or under direct supervision of, appropriately licensed design professional.

1.5. CONTRACTOR'S CONSTRUCTION-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

1.6. CONTRACTOR'S DESIGN-RELATED PROFESSIONAL DESIGN SERVICES

A. Coordination: Contractor's professional design services are subject to requirements of project's Conditions for Construction Contract.

B. Base design on performance and/or design criteria indicated in individual specification sections.

1.7. CONFLICTING REQUIREMENTS

A. Referenced Standards: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer conflicting requirements that are different, but apparently equal, to Architect for a decision before proceeding.

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

1.8. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Contractor's Quality-Control Plan: For quality-assurance and quality-control activities and responsibilities.

C. Contractor's Statement of Responsibility: When required by authorities having jurisdiction, submit copy of written statement of responsibility sent to authorities having jurisdiction before starting work on the following systems.

1. Seismic-force resisting system, designated seismic system, or component listed in the designated seismic system quality assurance plan prepared by the Architect.

2. Main wind-force resisting system or a wind-resisting component listed in the wind-force-resisting system quality assurance plan prepared by the Architect.

D. Test Reports: After each test/inspection, promptly submit two copies of report to Architect and to Contractor.

1. Include:

a. Date issued.

b. Project title and number.

c. Name of inspector.

d. Date and time of sampling or inspection.

e. Identification of product and specifications section.

f. Location in the Project.

g. Type of test/inspection.

h. Date of test/inspection.

i. Results of test/inspection.

j. Compliance with Contract Documents.

k. When requested by Architect, provide interpretation of results.

2. Test report submittals are for Architect's knowledge as contract administrator for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents, or for Owner's information.

E. Certificates: When specified in individual specification sections, submit certification by the manufacturer and Contractor or installation/application subcontractor to Architect, in quantities specified for Product Data.

1. Indicate material or product complies with or exceeds specified requirements. Submit supporting reference data, affidavits, and certifications as appropriate.

2. Certificates may be recent or previous test results on material or product, but must be acceptable to Architect.

F. Manufacturer's Instructions: When specified in individual specification sections, submit printed instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

G. Manufacturer's Field Reports: Submit reports for Architect's benefit as contract administrator or for Owner.

1. Submit report in duplicate within 30 days of observation to Architect for information.

2. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

H. Erection Drawings: Submit drawings for Architect's benefit as contract administrator or for Owner.

1. Submit for information for the limited purpose of assessing compliance with information given and the design concept expressed in the Contract Documents.

2. Data indicating inappropriate or unacceptable Work may be subject to action by Architect or Owner.

1.9. Quality Assurance

A. Testing Agency Qualifications:

1. Prior to start of work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.

2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.

3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

B. Designer Qualifications: Where professional engineering design services and design data submittals are specifically required of Contractor by Contract Documents, provide services of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Contractor's Quality Control (CQC) Plan:

1. Quality-Control Plan, General: Submit quality-control plan within 10 days of Notice to Proceed, and not less than five days prior to preconstruction conference. Submit in format acceptable to Architect. Identify personnel, procedures, controls, instructions, tests, records, and forms to be used to carry out Contractor's quality-assurance and quality-control responsibilities. Coordinate with Contractor's construction schedule.

2. Quality-Control Personnel Qualifications: Engage qualified full-time personnel trained and experienced in managing and executing quality-assurance and quality-control procedures similar in nature and extent to those required for Project.

3. Project quality-control manager may also serve as Project superintendent .

4. Submittal Procedure: Describe procedures for ensuring compliance with requirements through review and management of submittal process. Indicate qualifications of personnel responsible for submittal review.

5. Quality Issue Log: Maintain a project quality issue tracking matrix. This should include quality issues identified by the Owner, Architect/Engineer, Subcontractors, Material supplier/distributor personnel, Authorities having Jurisdiction, utilities, etc. This matrix should continue throughout construction and become the project punchlist. After Final Completion, the log should be maintained for any warranty items that arise.

6. Testing and Inspection: Include in quality-control plan a comprehensive schedule of Work requiring testing or inspection, including the following:

a. Contractor-performed tests and inspections including subcontractor-performed tests and inspections. Include required tests and inspections and Contractor-elected tests and inspections.

b. Special inspections required by authorities having jurisdiction and indicated on the "Statement of Special Inspections."

c. Owner-performed tests and inspections indicated in the Contract Documents.

D. Continuous Inspection of Workmanship: Describe process for continuous inspection during construction to identify and correct deficiencies in workmanship in addition to testing and inspection specified. Indicate types of corrective actions to be required to bring work into compliance with standards of workmanship established by Contract requirements and approved mockups.

E. Monitoring and Documentation: Maintain testing and inspection reports including log of approved and rejected results. Include work Architect has indicated as nonconforming or defective. Indicate corrective actions taken to bring nonconforming work into compliance with requirements. Comply with requirements of authorities having jurisdiction.

1.10. REFERENCES AND STANDARDS

A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.

B. Comply with reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.

C. Obtain copies of standards where required by product specification sections.

D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.

E. Should specified reference standards conflict with Contract Documents, request clarification from Architect before proceeding.

F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect shall be altered from Contract Documents by mention or inference otherwise in any reference document.

1.11. TESTING AND INSPECTION AGENCIES AND SERVICES

A. Owner will employ and pay for services of an independent testing agency to perform specified testing.

B. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing.

C. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.

D. Contractor Employed Agency:

1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
3. Laboratory Qualifications: Accredited by IAS according to IAS AC89.
4. Laboratory: Authorized to operate in the State in which the Project is located.
5. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
6. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1. CONTROL OF INSTALLATION

A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as minimum quality for the work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have work performed by persons qualified to produce required and specified quality.

F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.2. MOCK-UPS

A. Before installing portions of the Work where mock-ups are required, construct mock-ups in location and size indicated for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work. The purpose of mock-up is to demonstrate the proposed range of aesthetic effects and workmanship.

B. Accepted mock-ups establish the standard of quality the Architect will use to judge the Work.

C. Integrated Exterior Mock-ups: Construct integrated exterior mock-up as indicated on drawings. Coordinate installation of exterior envelope materials and products as required in individual Specification Sections. Provide adequate supporting structure for mock-up materials as necessary.

D. Notify Architect fifteen (15) working days in advance of dates and times when mock-ups will be constructed.

E. Provide supervisory personnel who will oversee mock-up construction. Provide workers that will be employed during the construction at Project.

F. Tests shall be performed under provisions identified in this section and identified in the respective product specification sections.

G. Assemble and erect specified items with specified attachment and anchorage devices, flashings, seals, and finishes.

H. Accepted mock-ups shall be a comparison standard for the remaining Work.

I. Where mock-up has been accepted by Architect and is specified in product specification sections to be removed, protect mock-up throughout construction, remove mock-up and clear area when directed to do so by Architect.

3.3. TOLERANCES

A. Monitor fabrication and installation tolerance control of products to produce acceptable Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust products to appropriate dimensions; position before securing products in place.

3.4. TESTING AND INSPECTION

A. See individual specification sections for testing and inspection required.

B. Testing Agency Duties:

1. Provide qualified personnel at site. Cooperate with Architect and Contractor in performance of services.
2. Perform specified sampling and testing of products in accordance with specified standards.
3. Ascertain compliance of materials and mixes with requirements of Contract Documents.
4. Promptly notify Architect and Contractor of observed irregularities or non-compliance of Work or products.
5. Perform additional tests and inspections required by Architect.
6. Submit reports of all tests/inspections specified.

C. Limits on Testing/Inspection Agency Authority:

1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Agency may not approve or accept any portion of the Work.
3. Agency may not assume any duties of Contractor.
4. Agency has no authority to stop the Work.

D. Contractor Responsibilities:

1. Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality-control activities required to verify that the Work complies with requirements, whether specified or not.
2. Deliver to agency at designated location, adequate samples of materials proposed to be used that require testing, along with proposed mix designs.
3. Cooperate with laboratory personnel, and provide access to the Work and to manufacturers' facilities.
4. Provide incidental labor and facilities:

a. To provide access to Work to be tested/inspected.

b. To obtain and handle samples at the site or at source of Products to be tested/inspected.

c. To facilitate tests/inspections.

d. To provide storage and curing of test samples.

5. Notify Architect and laboratory 24 hours prior to expected time for operations requiring testing/inspection services.

6. Employ services of an independent qualified testing laboratory and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

7. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.

8. Perform field inspections through the duration of installation of roofing, glass/glazing, and exterior skin systems. Field Inspections and associated services shall include the following:

a. Monthly field visits to collect data using the established, project specific protocol developed in above.

b. Documentation of reasonable compliance with construction documents using project specific inspection guidelines prepared as noted above.

c. Provide written reports (including photos) to summarize findings of each inspection and includes discussions with designated project field personnel to assure an understanding of the findings.

d. Confirm correction of noted nonconforming items by photographic confirmation by the Contractor.

e. Provide a draft summary of the field observations on the day of each inspection to the site representatives.

E. Re-testing required because of non-compliance with specified requirements shall be performed by the same agency on instructions by Architect.

F. Re-testing required because of non-compliance with specified requirements shall be paid for by Contractor.

3.5. TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.

2. Description of the Work tested or inspected.

3. Date test or inspection results were transmitted to Architect.

4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

3.6. MANUFACTURERS' FIELD SERVICES

A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, as applicable, and to initiate instructions when necessary.

B. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.7. DEFECT ASSESSMENT

A. Replace Work or portions of the Work not complying with specified requirements.

3.8. REPAIR AND PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Division 01 Section "Execution."

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

3.9. PROJECT CLOSEOUT

A. Warranties: Ensure a Warranty and Maintenance Schedule for distribution to the Project Team and Owner. This Warranty and Maintenance Schedule shall identify warranty periods, maintenance activities and other requirements as recommended by the manufacturer for each major system/material.

1. Facilitate at least one training seminar with the Owner to review the Warranty and Maintenance Schedule. Review the entire building envelope system in an effort to orientate the Owner with their new facility.

END OF SECTION

SECTION 01 5000 - TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Dewatering

B. Temporary utilities.

C. Temporary sanitary facilities.

D. Temporary Controls: Barriers, enclosures, and fencing.

E. Vehicular access and parking.

F. Waste removal facilities and services.

G. Project identification sign.

H. Field offices.

1.2. RELATED REQUIREMENTS

A. Section 015001 - Site Temporary Facilities.

1.3. REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

1.4. Dewatering

A. Provide temporary means and methods for dewatering all temporary facilities and controls.

B. Maintain temporary facilities in operable condition.

1.5. TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Maintain daily in clean and sanitary condition.

1.6. BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.7. FENCING

A. Construction: Contractor's option as coordinated with and acceptable to the Owner.

B. Provide 6 foot high fence around construction site; equip with vehicular and pedestrian gates with locks.

1.8. EXTERIOR ENCLOSURES

A. Provide temporary insulated weather tight closure of exterior openings to accommodate acceptable working conditions and protection for Products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual specification sections, and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.9. INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and gypsum board sheet materials with closed joints and sealed edges at intersections with existing surfaces:

1. Maximum flame spread rating of 75 in accordance with ASTM E84.

1.10. SECURITY

A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

B. Coordinate with Owner's security program.

1.11. VEHICULAR ACCESS AND PARKING

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Coordinate with Owner for identification of parking areas that can be used for Contractor parking and staging.

1.12. WASTE REMOVAL

A. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

B. Provide containers with lids. Remove trash from site periodically.

C. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

1.13. PROJECT IDENTIFICATION

A. Provide project identification sign of design, construction, and location approved by Owner.

1.14. FIELD OFFICES

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Locate offices a minimum distance of 30 feet from existing and new structures.

1.15. REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet. Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 6000 - PRODUCT REQUIREMENTS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. General product requirements.

B. Transportation, handling, storage and protection.

C. Product option requirements.

D. Substitution limitations.

E. Procedures for Owner-supplied products.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.2. RELATED REQUIREMENTS

A. Document 00 2110 - Instructions to Bidders: Product options and substitution procedures prior to bid date.

B. Section 01 1000 - Summary: Identification of Owner-supplied products.

C. Section 01 2500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

D. Section 01 4000 - Quality Requirements: Product quality monitoring.

E. Section 01 7419 - Construction Waste Management and Disposal: Waste disposal requirements potentially affecting product selection, packaging and substitutions.

1.3. SUBMITTALS

A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.

1. Submit within 15 days after date of Agreement.

2. For products specified only by reference standards, list applicable reference standards.

B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.

1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.1. EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.2. NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:

1. Containing lead, cadmium, or asbestos.

C. Where other criteria are met, Contractor shall give preference to products that:

1. Have longer documented life span under normal use.

2. Have a published GreenScreen Chemical Hazard Analysis.

D. Motors: Refer to Section 21 0513 - Common Motor Requirements for Fire Suppression Equipment, NEMA MG 1 Type. Specific motor type is specified in individual specification sections.

2.3. PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.4. MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver and place in location as directed; obtain receipt prior to final payment.

PART 3 EXECUTION

3.1. SUBSTITUTION LIMITATIONS

A. See Section 01 2500 - Substitution Procedures.

B. Instructions to Bidders specifies time restrictions for submitting requests for substitutions during the bidding period and the documents required. Comply with requirements specified in Section 00 2100.

3.2. OWNER-SUPPLIED PRODUCTS

A. See Section 01 1000 - Summary for identification of Owner-supplied products.

B. Owner's Responsibilities:

1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.

2. Arrange and pay for product delivery to site.

3. On delivery, inspect products jointly with Contractor.

4. Submit claims for transportation damage and replace damaged, defective, or deficient items.

5. Arrange for manufacturers' warranties, inspections, and service.

C. Contractor's Responsibilities:

1. Review Owner reviewed shop drawings, product data, and samples.

2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.

3. Handle, store, install and finish products.

4. Repair or replace items damaged after receipt.

3.3. TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.4. STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 01 7419.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Provide off-site storage and protection when site does not permit on-site storage or protection.

G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

H. Comply with manufacturer's warranty conditions, if any.

I. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

J. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.

K. Prevent contact with material that may cause corrosion, discoloration, or staining.

L. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

M. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 7000 - EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Examination, preparation, and general installation procedures.

B. Requirements for alterations work, including selective demolition.

C. Pre-installation meetings.

D. Cutting and patching.

E. Surveying for laying out the work.

F. Cleaning and protection.

G. Starting of systems and equipment.

H. Demonstration and instruction of Owner personnel.

I. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.

J. General requirements for maintenance service.

1.2. RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on working in existing building; continued occupancy; work sequence; identification of salvaged and relocated materials.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, Electronic document submittal service.

C. Section 01 4000 - Quality Requirements: Testing and inspection procedures.

D. Section 01 5000 - Temporary Facilities and Controls: Temporary exterior enclosures.

E. Section 01 7419 - Construction Waste Management and Disposal: Additional procedures for trash/waste removal, recycling, salvage, and reuse.

F. Section 01 7800 - Closeout Submittals: Project record documents, operation and maintenance data, warranties, and bonds.

G. Section 01 7900 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections

H. Section 02 4100 - Demolition: Selective demolition of existing building and site elements.

I. Section 07 8400 - Firestopping.

1.3. REFERENCE STANDARDS

A. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Survey work: Submit name, address, and telephone number of Surveyor before starting survey work.

1. On request, submit documentation verifying accuracy of survey work.

2. Submit a copy of site drawing signed by the Land Surveyor, that the elevations and locations of the work are in compliance with Contract Documents.

3. Submit surveys and survey logs for the project record.

C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:

1. Structural integrity of any element of Project.

2. Integrity of weather exposed or moisture resistant element.

3. Efficiency, maintenance, or safety of any operational element.
4. Visual qualities of sight exposed elements.
5. Work of Owner or separate Contractor.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.5. QUALIFICATIONS

A. For surveying work, employ a land surveyor registered in the State in which the Project is located and acceptable to Architect. Submit evidence of surveyor's Errors and Omissions insurance coverage in the form of an Insurance Certificate. Employ only individual(s) trained and experienced in collecting and recording accurate data relevant to ongoing construction activities,

B. For design of temporary shoring and bracing, employ a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1.6. PROJECT CONDITIONS

A. Use of explosives is not permitted.

B. Grade site to drain. Maintain excavations free of water. Provide, operate, and maintain pumping equipment.

C. Protect site from puddling or running water. Provide water barriers as required to protect site from soil erosion.

D. Perform dewatering activities, as required, for the duration of the project.

E. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.

F. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.

G. Erosion and Sediment Control: Plan and execute work by methods to control surface drainage from cuts and fills, from borrow and waste disposal areas. Prevent erosion and sedimentation.

1. Minimize amount of bare soil exposed at one time.
2. Provide temporary measures such as berms, dikes, and drains, to prevent water flow.
3. Construct fill and waste areas by selective placement to avoid erosive surface silts or clays.
4. Periodically inspect earthwork to detect evidence of erosion and sedimentation; promptly apply corrective measures.

H. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.

I. Pest and Rodent Control: Provide methods, means, and facilities to prevent pests and insects from damaging the work.

J. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.7. COORDINATION

A. See Section 01 1000 for occupancy-related requirements.

B. Each contractor shall coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.

1. Schedule construction operations in sequence required to obtain the best results where installation of one part of the Work depends on installation of other components, before or after its own installation.
2. Coordinate installation of different components with other contractors to ensure maximum performance and accessibility for required maintenance, service, and repair.

C. Notify affected utility companies and comply with their requirements.

D. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.

E. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on drawings. Follow routing indicated for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

F. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.

G. Coordinate completion and clean-up of work of separate sections.

H. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

1.8. PROJECT OPERATIONAL REQUIREMENTS

A. All employees and subcontractors are prohibited from using, possessing, distributing, dispensing, manufacturing, or being under the influence of Prohibited Substances and from abusing chemicals, controlled substances, or alcohol while working on this project.

B. All tobacco products, smokeless tobacco products, and e-cigarettes (nicotine or no nicotine) are prohibited in the project offices and on the project.

C. The General Contractor shall prepare a site specific Safety Plan. This plan should include sections for Spill Prevention, Hazard Communication, Housekeeping, Experience Modification Rate (EMR), Incident Reporting and Investigation, Personal Protection Equipment, Job Hazard Analysis, Regulatory Inspection Procedures, Project Team Members' Roles & Responsibilities relative to Safety, Silica Dust, Cranes, Electrical Hazards, Excavation, Fall Prevention, Fire Protection and Prevention, Hand and Power Tools, Lock Out / Tag Out, Scaffolds, Stairways and Ladders, Steel Erection, Carbon Monoxide Exposure Prevention, Subcontractor Safety Program Requirements, and Hot and Cold Temperature related Stress Prevention Plan at a minimum. This plan shall be maintained onsite.

D. The General Contractor shall prepare a Crisis Management Plan. This plan should include contact information for all project and management personnel. It should describe what steps will be taken for various potential safety / crisis related events. This plan shall be maintained onsite for review.

E. The General Contractor shall prepare a Mold and Moisture Mitigation Remediation and Inclement Weather Program. This plan should include the steps that will be taken by the Contractor in the event that mold and moisture takes place inside the building under construction. These plans shall be maintained onsite for review.

F. The General Contractor's Safety Manager and Subcontractors' Safety Managers shall hold a safety meeting consistent with General Contractor Safety Plan.

G. The General Contractor's Safety Manager shall visit the site and provide a report of any safety issues and corrections. These visits should be held on a monthly basis, at a minimum. These reports shall be maintained onsite.

PART 2 PRODUCTS

2.1. PATCHING MATERIALS

A. New Materials: As specified in product sections; match existing products and work for patching and extending work.

B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.

C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.

B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual specification sections.

D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.

E. Verify that utility services are available, of the correct characteristics, and in the correct locations.

F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.2. PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.3. PREINSTALLATION MEETINGS

A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.

B. Require attendance of parties directly affecting, or affected by, work of the specific section.

C. Notify Architect and Owner four days minimum in advance of meeting dates.

D. Prepare agenda and preside at meeting:

1. Review conditions of examination, preparation and installation procedures.

2. Review coordination with related work.

E. Record minutes and distribute copies within two days after meeting to participants, with electronic copies to Architect, Owner, participants, and those affected by decisions made.

3.4. LAYING OUT THE WORK

A. Verify locations of survey control points prior to starting work.

B. Promptly notify Architect of any discrepancies discovered.

C. Contractor shall locate and protect survey control and reference points.

D. Control datum for survey is that indicated on drawings.

E. Protect survey control points prior to starting site work; preserve permanent reference points during construction.

F. Promptly report to Architect the loss or destruction of any reference point or relocation required because of changes in grades or other reasons.

G. Replace dislocated survey control points based on original survey control. Make no changes without prior written notice to Architect.

H. Utilize recognized engineering survey practices.

I. Establish a minimum of two permanent bench marks on site, referenced to established control points. Record locations, with horizontal and vertical data, on project record documents.

J. Establish elevations, lines and levels. Locate and lay out by instrumentation and similar appropriate means:

1. Site improvements including pavements; stakes for grading, fill and topsoil placement; utility locations, slopes, and invert elevations.
2. Grid or axis for structures.
3. Building foundation, column locations, ground floor elevations.

K. Periodically verify layouts by same means.

L. Maintain a complete and accurate log of control and survey work as it progresses.

3.5. GENERAL INSTALLATION REQUIREMENTS

A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.

B. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.

C. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.

D. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.

E. Make neat transitions between different surfaces, maintaining texture and appearance.

3.6. ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

1. Verify that construction and utility arrangements are as indicated.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of alterations work constitutes acceptance of existing conditions.

B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.

1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 .

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

1. Where openings in exterior enclosure exist, provide construction to make exterior enclosure weatherproof.
2. Insulate existing ducts or pipes that are exposed to outdoor ambient temperatures by alterations work.

D. Remove existing work as indicated and as required to accomplish new work.

1. Remove items indicated on drawings.

2. Relocate items indicated on drawings.
3. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
4. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, Telecommunications, and Security): Remove, relocate, and extend existing systems to accommodate new construction.
1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
    a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
    b. See Section 01 1000 for other limitations on outages and required notifications.
    c. Provide temporary connections as required to maintain existing systems in service.
4. Verify that abandoned services serve only abandoned facilities.
5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.

F. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.

G. Adapt existing work to fit new work: Make as neat and smooth transition as possible.
1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect.
2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect review and request instructions.

H. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.

I. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.

J. Clean existing systems and equipment in areas of alteration and construction traffic.

K. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.

L. Do not begin new construction in alterations areas before demolition is complete.

M. Comply with all other applicable requirements of this section.

3.7. CUTTING AND PATCHING

A. Whenever possible, execute the work by methods that avoid cutting or patching.

B. See Alterations article above for additional requirements.

C. Perform whatever cutting and patching is necessary to:

1. Complete the work.
2. Fit products together to integrate with other work.
3. Provide openings for penetration of mechanical, electrical, and other services.
4. Match work that has been cut to adjacent work.
5. Repair areas adjacent to cuts to required condition.
6. Repair new work damaged by subsequent work.
7. Remove samples of installed work for testing when requested.
8. Remove and replace defective and non-complying work.

D. Execute work by methods that avoid damage to other work and that will provide appropriate surfaces to receive patching and finishing. In existing work, minimize damage and restore to original condition.

E. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.

F. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.

G. Restore work with new products in accordance with requirements of Contract Documents.

H. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

I. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 8400, to full thickness of the penetrated element.

J. Patching:

1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
2. Match color, texture, and appearance.
3. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.8. PROGRESS CLEANING

A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.

B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.

C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.

D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.9. PROTECTION OF INSTALLED WORK

A. Protect installed work from damage by construction operations.

B. Provide special protection where specified in individual specification sections.

C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.

D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.

E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.

F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.

G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.10. SYSTEM STARTUP

A. Coordinate schedule for start-up of various equipment and systems.

B. Notify Architect and Owner seven days prior to start-up of each item.

C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.

D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.

E. Verify that wiring and support components for equipment are complete and tested.

F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.

G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.11. DEMONSTRATION AND INSTRUCTION

A. See Section 01 7900 - Demonstration and Training.

3.12. ADJUSTING

A. Adjust operating products and equipment to ensure smooth and unhindered operation.

3.13. FINAL CLEANING

A. Execute final cleaning prior to Substantial Completion.

B. Use cleaning materials that are nonhazardous.

C. Clean interior and exterior glass, surfaces exposed to view; remove temporary labels, stains and foreign substances, polish transparent and glossy surfaces, vacuum carpeted and soft surfaces.

D. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.

E. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.

F. Replace filters of operating equipment.

G. Clean debris from roofs, gutters, downspouts, scuppers, overflow drains, area drains, and drainage systems.

H. Clean site; sweep paved areas, rake clean landscaped surfaces.

I. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.14. CLOSEOUT PROCEDURES

A. Make submittals that are required by governing or other authorities.

1. Provide copies to Architect and Owner.

B. Warranties: Ensure a Warranty and Maintenance Schedule for distribution to the Project Team and Owner. This Warranty and Maintenance Schedule shall identify warranty periods, maintenance activities and other requirements as recommended by the manufacturer for each major system/material.

1. Facilitate at least one training seminar with the Owner to review the Warranty and Maintenance Schedule. Review the entire building envelope system in an effort to orientate the Owner with their new facility.

C. Accompany Project Coordinator on preliminary inspection to determine items to be listed for completion or correction in the Contractor's Correction Punch List for Contractor's Notice of Substantial Completion.

D. Notify Architect when work is considered ready for Architect's Substantial Completion inspection.

E. Submit written certification containing Contractor's Correction Punch List, that Contract Documents have been reviewed, work has been inspected, and that work is complete in accordance with Contract Documents and ready for Architect's Substantial Completion inspection.

F. Conduct Substantial Completion inspection and create Final Correction Punch List containing Architect's and Contractor's comprehensive list of items identified to be completed or corrected and submit to Architect.

G. Correct items of work listed in Final Correction Punch List and comply with requirements for access to Owner-occupied areas.

H. Notify Architect when work is considered finally complete and ready for Architect's Substantial Completion final inspection.

I. Complete items of work determined by Architect listed in executed Certificate of Substantial Completion.

3.15. MAINTENANCE

A. Provide service and maintenance of components indicated in specification sections.

B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.

C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.

D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.

E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

SECTION 01 7419 - CONSTRUCTION WASTE MANAGEMENT AND DISPOSAL

PART 1 GENERAL

1.1. WASTE MANAGEMENT REQUIREMENTS

A. Owner requires that this project generate the least amount of trash and waste possible.

B. Employ processes that ensure the generation of as little waste as possible due to error, poor planning, breakage, mishandling, contamination, or other factors.

C. Minimize trash/waste disposal in landfills; reuse, salvage, or recycle as much waste as economically feasible.

D. Owner may decide to pay for additional recycling, salvage, and/or reuse based on Landfill Alternatives Proposal specified below.

E. Contractor shall submit periodic Waste Disposal Reports; all landfill disposal, incineration, recycling, salvage, and reuse must be reported regardless of to whom the cost or savings accrues; use the same units of measure on all reports.

F. Contractor shall develop and follow a Waste Management Plan designed to implement these requirements.

G. The following sources may be useful in developing the Waste Management Plan:

1. Illinois Department of Central Management Services, at https://www.illinois.gov/cms/agency/recycling/Pages/default.aspx.

2. Illinois Environmental Protection Agency, at http://www.epa.illinois.gov/topics/waste-management/.

H. Methods of trash/waste disposal that are not acceptable are:

1. Burning on the project site.

2. Burying on the project site.

3. Dumping or burying on other property, public or private.

4. Other illegal dumping or burying.

I. Regulatory Requirements: Contractor is responsible for knowing and complying with regulatory requirements, including but not limited to Federal, state and local requirements, pertaining to legal disposal of all construction and demolition waste materials.

1.2. DEFINITIONS

A. Clean: Untreated and unpainted; not contaminated with oils, solvents, caulk, or the like.

B. Construction and Demolition Waste: Solid wastes typically including building materials, packaging, trash, debris, and rubble resulting from construction, remodeling, repair and demolition operations.

C. Hazardous: Exhibiting the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity or reactivity.

D. Nonhazardous: Exhibiting none of the characteristics of hazardous substances, i.e., ignitibility, corrosivity, toxicity, or reactivity.

E. Nontoxic: Neither immediately poisonous to humans nor poisonous after a long period of exposure.

F. Recyclable: The ability of a product or material to be recovered at the end of its life cycle and remanufactured into a new product for reuse by others.

G. Recycle: To remove a waste material from the project site to another site for remanufacture into a new product for reuse by others.

H. Recycling: The process of sorting, cleansing, treating and reconstituting solid waste and other discarded materials for the purpose of using the altered form. Recycling does not include burning, incinerating, or thermally destroying waste.

I. Return: To give back reusable items or unused products to vendors for credit.

J. Reuse: To reuse a construction waste material in some manner on the project site.

K. Salvage: To remove a waste material from the project site to another site for resale or reuse by others.

L. Sediment: Soil and other debris that has been eroded and transported by storm or well production run-off water.

M. Source Separation: The act of keeping different types of waste materials separate beginning from the first time they become waste.

N. Toxic: Poisonous to humans either immediately or after a long period of exposure.

O. Trash: Any product or material unable to be reused, returned, recycled, or salvaged.

P. Waste: Extra material or material that has reached the end of its useful life in its intended use. Waste includes salvageable, returnable, recyclable, and reusable material.

1.3. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Landfill Alternatives Proposal: Within 10 calendar days after receipt of Notice of Award of Bid, or prior to any trash or waste removal, whichever occurs sooner, submit a projection of trash/waste that will require disposal and alternatives to landfilling, with net costs.

1. Submit to Architect for Owner's review and approval.
2. If Owner wishes to implement any cost alternatives, the Contract Sum will be adjusted as specified elsewhere.
3. Include an analysis of trash/waste to be generated and landfill options as specified for Waste Management Plan described below.
4. Describe as many alternatives to landfilling as possible:
    a. List each material proposed to be salvaged, reused, or recycled.
    b. List the proposed local market for each material.
    c. State the estimated net cost resulting from each alternative, after subtracting revenue from sale of recycled or salvaged materials and landfill tipping fees saved due to diversion of materials from the landfill.
5. Provide alternatives to landfilling for at least the following materials:
    a. Aluminum and plastic beverage containers.
    b. Corrugated cardboard.
    c. Wood pallets.
    d. Clean dimensional wood.
    e. Metals, including packaging banding, metal studs, sheet metal, structural steel, piping, reinforcing bars, door frames, and other items made of steel, iron, galvanized steel, stainless steel, aluminum, copper, zinc, lead, brass, and bronze.
    f. Glass.
    g. Plastic buckets.

h. Carpet, carpet cushion, carpet tile, and carpet remnants: DuPont (http://flooring.dupont.com) and Interface (www.interfaceinc.com) conduct reclamation programs.

C. Once Owner has determined which of the landfill alternatives addressed in the Proposal above are acceptable, prepare and submit Waste Management Plan; submit within 10 calendar days after notification by Architect.

D. Waste Management Plan: Include the following information:

1. Analysis of the trash and waste projected to be generated during the entire project construction cycle, including types and quantities.
2. Landfill Options: The name, address, and telephone number of the landfill(s) where trash/waste will be disposed of, the applicable landfill tipping fee(s), and the projected cost of disposing of all project trash/waste in the landfill(s).
3. Landfill Alternatives: List all waste materials that will be diverted from landfills by reuse, salvage, or recycling.
   a. List each material proposed to be salvaged, reused, or recycled.
   b. List the local market for each material.
   c. State the estimated net cost, versus landfill disposal.
4. Meetings: Describe regular meetings to be held to address waste prevention, reduction, recycling, salvage, reuse, and disposal.
5. Materials Handling Procedures: Describe the means by which materials to be diverted from landfills will be protected from contamination and prepared for acceptance by designated facilities; include separation procedures for recyclables, storage, and packaging.
6. Transportation: Identify the destination and means of transportation of materials to be recycled; i.e. whether materials will be site-separated and self-hauled to designated centers, or whether mixed materials will be collected by a waste hauler.
7. Recycling Incentives: Describe procedures required to obtain credits, rebates, or similar incentives.

E. Waste Disposal Reports: Submit at specified intervals, with details of quantities of trash and waste, means of disposal or reuse, and costs; show both totals to date and since last report.

1. Submit updated Report with each Application for Progress Payment; failure to submit Report will delay payment.
2. Submit Report on a form acceptable to Owner.
3. Landfill Disposal: Include the following information:
   a. Identification of material.
   b. Amount, in tons or cubic yards, of trash/waste material from the project disposed of in landfills.
   c. State the identity of landfills, total amount of tipping fees paid to landfill, and total disposal cost.
   d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.
4. Incinerator Disposal: Include the following information:
   a. Identification of material.
   b. Amount, in tons or cubic yards, of trash/waste material from the project delivered to incinerators.

c. State the identity of incinerators, total amount of fees paid to incinerator, and total disposal cost.

d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

5. Recycled and Salvaged Materials: Include the following information for each:

a. Identification of material, including those retrieved by installer for use on other projects.

b. Amount, in tons or cubic yards, date removed from the project site, and receiving party.

c. Transportation cost, amount paid or received for the material, and the net total cost or savings of salvage or recycling each material.

d. Include manifests, weight tickets, receipts, and invoices as evidence of quantity and cost.

e. Certification by receiving party that materials will not be disposed of in landfills or by incineration.

6. Other Disposal Methods: Include information similar to that described above, as appropriate to disposal method.

F. Recycling Incentive Programs:

1. Where revenue accrues to Contractor, submit copies of documentation required to qualify for incentive.

2. Where revenue accrues to Owner, submit any additional documentation required by Owner in addition to information provided in periodic Waste Disposal Report.

PART 2 PRODUCTS

2.1. PRODUCT SUBSTITUTIONS

A. See Section 01 6000 - Product Requirements for substitution submission procedures.

B. For each proposed product substitution, submit the following information in addition to requirements specified in Section 01 6000:

1. Relative amount of waste produced, compared to specified product.

2. Cost savings on waste disposal, compared to specified product, to be deducted from the Contract Sum.

3. Proposed disposal method for waste product.

4. Markets for recycled waste product.

PART 3 EXECUTION

3.1. WASTE MANAGEMENT PROCEDURES

A. See Section 01 3000 for additional requirements for project meetings, reports, submittal procedures, and project documentation.

B. See Section 01 5000 for additional requirements related to trash/waste collection and removal facilities and services.

C. See Section 01 6000 for waste prevention requirements related to delivery, storage, and handling.

D. See Section 01 7000 for trash/waste prevention procedures related to cutting and patching, installation, protection, and cleaning.

3.2. WASTE MANAGEMENT PLAN IMPLEMENTATION

A. Manager: Designate an on-site person or persons responsible for instructing workers and overseeing and documenting results of the Waste Management Plan.

B. Communication: Distribute copies of the Waste Management Plan to job site foreman, each subcontractor, Owner, and Architect.

C. Instruction: Provide on-site instruction of appropriate separation, handling, and recycling, salvage, reuse, and return methods to be used by all parties at the appropriate stages of the project.

D. Meetings: Discuss trash/waste management goals and issues at project meetings.

1. Prebid meeting.
2. Preconstruction meeting.
3. Regular job-site meetings.

E. Facilities: Provide specific facilities for separation and storage of materials for recycling, salvage, reuse, return, and trash disposal, for use by all contractors and installers.

1. Provide containers as required.
2. Provide adequate space for pick-up and delivery and convenience to subcontractors.
3. Keep recycling and trash/waste bin areas neat and clean and clearly marked in order to avoid contamination of materials.

F. Hazardous Wastes: Separate, store, and dispose of hazardous wastes according to applicable regulations.

G. Recycling: Separate, store, protect, and handle at the site identified recyclable waste products in order to prevent contamination of materials and to maximize recyclability of identified materials. Arrange for timely pickups from the site or deliveries to recycling facility in order to prevent contamination of recyclable materials.

H. Reuse of Materials On-Site: Set aside, sort, and protect separated products in preparation for reuse.

I. Salvage: Set aside, sort, and protect products to be salvaged for reuse off-site.

END OF SECTION

SECTION 01 7800 - CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Project Record Documents.

B. Operation and Maintenance Data.

C. Warranties and bonds.

1.2. RELATED REQUIREMENTS

A. Section 00 7200 - General Conditions and 00 7300 - Supplementary Conditions: Performance bond and labor and material payment bonds, warranty, and correction of work.

B. Section 01 3000 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.

C. Section 01 7000 - Execution and Closeout Requirements: Contract closeout procedures.

D. Individual Product Sections: Specific requirements for operation and maintenance data.

E. Individual Product Sections: Warranties required for specific products or Work.

1.3. SUBMITTALS

A. Project Record Documents: Submit documents to Architect prior to claim for final Application for Payment.

B. Operation and Maintenance Data:

1. Submit two copies of preliminary draft or proposed formats and outlines of contents before start of Work. Architect will review draft and return one copy with comments.

2. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.

3. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection, with Architect comments. Revise content of all document sets as required prior to final submission.

4. Submit two sets of revised final documents in final form within 10 days after final inspection.

C. Warranties and Bonds:

1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.

2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.

3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1. PROJECT RECORD DOCUMENTS

A. Maintain on site one set of the following record documents; record actual revisions to the Work:

1. Drawings.

2. Specifications.

3. Addenda.

4. Change Orders and other modifications to the Contract.

5. Reviewed shop drawings, product data, and samples.
6. Manufacturer's instruction for assembly, installation, and adjusting.

B. Ensure entries are complete and accurate, enabling future reference by Owner.

C. Store record documents separate from documents used for construction.

D. Record information concurrent with construction progress.

E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
1. Manufacturer's name and product model and number.
2. Product substitutions or alternates utilized.
3. Changes made by Addenda and modifications.

F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
1. Measured depths of foundations in relation to finish first floor datum.
2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
4. Field changes of dimension and detail.
5. Details not on original Contract drawings.

3.2. OPERATION AND MAINTENANCE DATA

A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.

B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.

C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.

D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.3. OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

A. For Each Product, Applied Material, and Finish:
1. Product data, with catalog number, size, composition, and color and texture designations.
2. Information for re-ordering custom manufactured products.

B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.

C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.

D. Additional information as specified in individual product specification sections.

E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.4. OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

A. For Each Item of Equipment and Each System:

1. Description of unit or system, and component parts.
2. Identify function, normal operating characteristics, and limiting conditions.
3. Include performance curves, with engineering data and tests.
4. Complete nomenclature and model number of replaceable parts.

B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

D. Include color coded wiring diagrams as installed.

E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.

F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.

G. Provide servicing and lubrication schedule, and list of lubricants required.

H. Include manufacturer's printed operation and maintenance instructions.

I. Include sequence of operation by controls manufacturer.

J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.

K. Provide control diagrams by controls manufacturer as installed.

L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.

M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.

N. Include test and balancing reports.

O. Additional Requirements: As specified in individual product specification sections.

3.5. ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.

B. Where systems involve more than one specification section, provide separate tabbed divider for each system.

C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.

D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.

E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect, Consultants, Contractor and subcontractors, with names of responsible parties.

F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.

G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.

H. Text: Manufacturer's printed data, or typewritten data on 20 pound paper.

I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.

J. Arrangement of Contents: Organize each volume in parts as follows:

1. Project Directory.
2. Table of Contents, of all volumes, and of this volume.
3. Operation and Maintenance Data: Arranged by system, then by product category.
    a. Source data.
    b. Product data, shop drawings, and other submittals.
    c. Operation and maintenance data.
    d. Field quality control data.
    e. Photocopies of warranties and bonds.

3.6. WARRANTIES AND BONDS

A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.

B. Verify that documents are in proper form, contain full information, and are notarized.

C. Co-execute submittals when required.

D. Retain warranties and bonds until time specified for submittal.

E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.

F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.

G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.

H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

I. Include additional copies of each warranty in operation and maintenance manuals, indexed within respective sections.

END OF SECTION

SECTION 01 7900 - DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.1. SUMMARY

A. Demonstration of products and systems where indicated in specific specification sections.

B. Training of Owner personnel in operation and maintenance is required for:

1. All software-operated systems.
2. HVAC systems and equipment.
3. Plumbing equipment.
4. Electrical systems and equipment.
5. Items specified in individual product Sections.

C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:

1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
2. Finishes, including flooring, wall finishes, ceiling finishes.
3. Fixtures and fittings.
4. Items specified in individual product Sections.

1.2. RELATED REQUIREMENTS

A. Section 01 7800 - Closeout Submittals: Operation and maintenance manuals.

B. Other Specification Sections: Additional requirements for demonstration and training.

1.3. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.

1. Submit to Architect for transmittal to Owner.
2. Submit not less than two weeks prior to start of training.
3. Revise and resubmit until acceptable.
4. Provide an overall schedule showing all training sessions.
5. Include at least the following for each training session:
    a. Identification, date, time, and duration.
    b. Description of products and/or systems to be covered.
    c. Name of firm and person conducting training; include qualifications.
    d. Intended audience, such as job description.
    e. Objectives of training and suggested methods of ensuring adequate training.
    f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
    g. Media to be used, such a slides, hand-outs, etc.
    h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.

C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.

1. Include applicable portion of O&M manuals.

2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
3. Provide one extra copy of each training manual to be included with operation and maintenance data.

D. Training Reports:
1. Identification of each training session, date, time, and duration.
2. Sign-in sheet showing names and job titles of attendees.
3. List of attendee questions and written answers given, including copies of and references to supporting documentation required for clarification; include answers to questions that could not be answered in original training session.

E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.
1. Format: DVD Disc or USB flash drive.
2. Label each disc and container with session identification and date.

1.4. QUALITY ASSURANCE

A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1. DEMONSTRATION - GENERAL

A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.

B. Demonstration may be combined with Owner personnel training if applicable.

C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.
2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.

D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.2. TRAINING - GENERAL

A. Conduct training on-site unless otherwise indicated.

B. Owner will provide classroom and seating at no cost to Contractor.

C. Provide training in minimum two hour segments.

D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to

conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.

E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:

1. The location of the O&M manuals and procedures for use and preservation; backup copies.
2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
3. Typical uses of the O&M manuals.

F. Product- and System-Specific Training:

1. Review the applicable O&M manuals.
2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
4. Provide hands-on training on all operational modes possible and preventive maintenance.
5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
6. Discuss common troubleshooting problems and solutions.
7. Discuss any peculiarities of equipment installation or operation.
8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
9. Review recommended tools and spare parts inventory suggestions of manufacturers.
10. Review spare parts and tools required to be furnished by Contractor.
11. Review spare parts suppliers and sources and procurement procedures.

G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

SECTION 02 4100 - DEMOLITION

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Selective demolition of built site elements.

B. Selective demolition of building elements for alteration purposes.

1.2. RELATED REQUIREMENTS

A. Section 01 1000 - Summary: Limitations on Contractor's use of site and premises.

B. Section 01 5000 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.

C. Section 01 7000 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.

D. Section 01 7419 - Construction Waste Management and Disposal: Limitations on disposal of removed materials; requirements for recycling.

1.3. REFERENCE STANDARDS

A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.

B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2013.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

PART 2 PRODUCTS -- NOT USED

PART 3 EXECUTION

3.1. SCOPE

A. Remove paving and curbs as required to accomplish new work.

3.2. GENERAL PROCEDURES AND PROJECT CONDITIONS

A. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.

1. Obtain required permits.

2. Take precautions to prevent catastrophic or uncontrolled collapse of structures to be removed; do not allow worker or public access within range of potential collapse of unstable structures.

3. Provide, erect, and maintain temporary barriers and security devices.

4. Conduct operations to minimize effects on and interference with adjacent structures and occupants.

5. Do not close or obstruct roadways or sidewalks without permit.

6. Conduct operations to minimize obstruction of public and private entrances and exits; do not obstruct required exits at any time; protect persons using entrances and exits from removal operations.

7. Obtain written permission from owners of adjacent properties when demolition equipment will traverse, infringe upon or limit access to their property.

B. Do not begin removal until receipt of notification to proceed from Owner.

C. Protect existing structures and other elements that are not to be removed.

1. Provide bracing and shoring.
2. Prevent movement or settlement of adjacent structures.
3. Stop work immediately if adjacent structures appear to be in danger.

D. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.

E. Partial Removal of Paving and Curbs: Neatly saw cut at right angle to surface.

3.3. EXISTING UTILITIES

A. Coordinate work with utility companies; notify before starting work and comply with their requirements; obtain required permits.

B. Protect existing utilities to remain from damage.

C. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.

D. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.

E. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.

F. Remove exposed piping, valves, meters, equipment, supports, and foundations of disconnected and abandoned utilities.

3.4. SELECTIVE DEMOLITION FOR ALTERATIONS

A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.

1. Verify that construction and utility arrangements are as indicated.
2. Report discrepancies to Architect before disturbing existing installation.
3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.

B. Separate areas in which demolition is being conducted from other areas that are still occupied.

1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 5000 in locations indicated on drawings.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; take care to prevent water and humidity damage.

D. Remove existing work as indicated and as required to accomplish new work.

E. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.

1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components.
2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
3. Verify that abandoned services serve only abandoned facilities before removal.
4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.

F. Protect existing work to remain.

1. Prevent movement of structure; provide shoring and bracing if necessary.
2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
3. Repair adjacent construction and finishes damaged during removal work.
4. Patch as specified for patching new work.

3.5. DEBRIS AND WASTE REMOVAL

A. Remove debris, junk, and trash from site.

B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 7419 - Waste Management.

C. Leave site in clean condition, ready for subsequent work.

D. Clean up spillage and wind-blown debris from public and private lands.

END OF SECTION

SECTION 03 0505 - UNDERSLAB VAPOR BARRIER

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Sheet vapor barrier under concrete slabs on grade.

1.2. RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 2000 - Concrete Reinforcing.

C. Section 03 3000 - Cast-in-Place Concrete: Preparation of subgrade, granular fill, placement of concrete.

1.3. REFERENCE STANDARDS

A. ASTM E1643 - Standard Practice for Selection, Design, Installation and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs; 2011.

B. ASTM E1745 - Standard Specification for Plastic Water Vapor Retarders Used in Contact with Soil or Granular Fill under Concrete Slabs; 2011.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products.

C. Manufacturer's Installation Instructions: Indicate installation procedures and interface required with adjacent construction.

PART 2 PRODUCTS

2.1. MATERIALS

A. Underslab Vapor Barrier:

1. Water Vapor Permeance: Not more than 0.010 perms, maximum.

2. Thickness: 15 mils.

3. Basis of Design:

a. Stego Industries LLC; Stego Wrap Vapor Barrier (15-mil): www.stegoindustries.com.

b. Substitutions: See Section 01 6000 - Product Requirements.

1) BARRIER-BAC IntePlus XF Filk VB-350 (16 mil) is an approved substitution.

2) ISI Building Products Viper II 15-mil Class A vapor barrier is an approved substitution.

B. Accessory Products: Vapor barrier manufacturer's recommended tape, adhesive, mastic, etc., for sealing seams and penetrations in vapor barrier.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that surface over which vapor barrier is to be installed is complete and ready before proceeding with installation of vapor barrier.

3.2. INSTALLATION

A. Install vapor barrier in accordance with manufacturer's instructions and ASTM E1643.

B. Install vapor barrier under interior slabs on grade; lap sheet over footings and seal to foundation walls.

C. Lap joints minimum 6 inches.

D. Seal joints, seams and penetrations watertight with manufacturer's recommended products and follow manufacturer's written instructions.

E. No penetration of vapor barrier is allowed except for reinforcing steel and permanent utilities.

F. Repair damaged vapor retarder before covering with other materials.

END OF SECTION

SECTION 03 1000 - CONCRETE FORMING AND ACCESSORIES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Formwork for cast-in place concrete, with shoring, bracing and anchorage.

B. Form accessories.

C. Form stripping.

1.2. RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing.

B. Section 03 3000 - Cast-in-Place Concrete.

C. Section 05 1200 - Structural Steel Framing: Placement of embedded steel anchors and plates in cast-in-place concrete.

1.3. REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; 2010.

B. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International; 2010 (Errata 2012).

C. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute; 2011.

D. ACI 347 - Guide to Formwork for Concrete; American Concrete Institute; 2004.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

1.5. DELIVERY, STORAGE, AND HANDLING

A. Deliver prefabricated forms and installation instructions in manufacturer's packaging.

B. Store prefabricated forms off ground in ventilated and protected manner to prevent deterioration from moisture.

PART 2 PRODUCTS

2.1. FORMWORK - GENERAL

A. Provide concrete forms, accessories, shoring, and bracing as required to accomplish cast-in-place concrete work.

B. Design and construct to provide resultant concrete that conforms to design with respect to shape, lines, and dimensions.

C. Comply with applicable state and local codes with respect to design, fabrication, erection, and removal of formwork.

D. Comply with relevant portions of ACI 347R, ACI 301, and ACI 318.

2.2. WOOD FORM MATERIALS

A. Plywood: Douglas Fir species; solid one side grade; sound undamaged sheets with clean, true edges.

2.3. REMOVABLE PREFABRICATED FORMS

A. Preformed Steel Forms: Minimum 16 gage, 0.0598 inch thick, matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

B. Preformed Plastic Forms: Thermoplastic polystyrene form liner, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished surfaces.

C. Glass Fiber Fabric Reinforced Plastic Forms: Matched, tight fitting, stiffened to support weight of concrete without deflection detrimental to tolerances and appearance of finished concrete surfaces.

D. Void Forms: Moisture resistant treated paper faces, biodegradable, structurally sufficient to support weight of wet concrete mix until initial set; 2 inches thick. .

2.4. FORMWORK ACCESSORIES

A. Form Ties: Factory-fabricated, removeable, or snap-off type, fiber reinforced plastic or metal form, fixed length, free of defects that could leave holes larger than 1 inch in concrete surface.

1. Ties shall be designed to resist lateral pressure of fresh concrete on forms.

2. Furnish ties with integral water-barrier plates to walls indicated to receive dampproofing or waterproofing.

B. Form Release Agent: Capable of releasing forms from hardened concrete without staining or discoloring concrete or forming bugholes and other surface defects, compatible with concrete and form materials, and not requiring removal for satisfactory bonding of coatings to be applied.

1. Formulate form-release agent with rust inhibitor for steel form-facing materials.

C. Embedded Anchor Shapes, Plates, Angles and Bars: As specified in Section 05 1200.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify lines, levels and centers before proceeding with formwork. Ensure that dimensions agree with drawings.

3.2. EARTH FORMS

A. Hand trim sides and bottom of earth forms. Remove loose soil prior to placing concrete.

3.3. ERECTION - FORMWORK

A. Erect formwork, shoring and bracing to achieve design requirements, in accordance with requirements of ACI 301 to support vertical, lateral, static, and dynamic loads, and construction loads that might be applied, until structure can support such loads.

B. Provide bracing to ensure stability of formwork. Shore or strengthen formwork subject to overstressing by construction loads.

C. Construct formwork so concrete members and structures are of size, shape, alignment, elevation, and position indicated, within tolerance limits of ACI 117.

D. Limit concrete surface irregularities, designated by ACI 347 as abrupt or gradual, as follows:

1. Class A, 1/8 inch (3.2 mm) for smooth-formed finished surfaces.

2. Class C, 1/2 inch (13 mm) for rough-formed finished surfaces.

E. Construct forms for easy removal without hammering or prying against concrete surfaces. Provide crush or wrecking plates where stripping may damage cast-concrete surfaces. Provide top forms for inclined surfaces steeper than 1.5 horizontal to 1 vertical.

1. Install keyways, reglets, recesses, and the like, for easy removal.

2. Do not use rust-stained steel form-facing material.

F. Align joints and make watertight. Keep form joints to a minimum.

G. Set edge forms, bulkheads, and intermediate screed strips for slabs to achieve required elevations and slopes in finished concrete surfaces. Provide and secure units to support screed strips; use strike-off templates or compacting-type screeds.

H. Provide temporary openings for cleanouts and inspection ports where interior area of formwork is inaccessible. Close openings with panels tightly fitted to forms and securely braced to prevent loss of concrete mortar. Locate temporary openings in forms at inconspicuous locations.

I. Obtain approval before framing openings in structural members that are not indicated on drawings.

J. Clean forms and adjacent surfaces to receive concrete. Remove chips, wood, sawdust, dirt, and other debris just before placing concrete.

K. Retighten forms and bracing before placing concrete, as required, to prevent mortar leaks and maintain proper alignment.

L. Install void forms in accordance with manufacturer's recommendations. Protect forms from moisture or crushing.

M. Coordinate this section with other sections of work that require attachment of components to formwork.

3.4. APPLICATION - FORM RELEASE AGENT

A. Apply form release agent on formwork in accordance with manufacturer's recommendations.

B. Apply prior to placement of reinforcing steel, anchoring devices, and embedded items.

3.5. INSERTS, EMBEDDED PARTS, AND OPENINGS

A. Locate and set in place items that will be cast directly into concrete.

B. Coordinate with work of other sections in forming and placing openings, slots, reglets, recesses, sleeves, bolts, anchors, other inserts, and components of other work.

C. Place and secure anchorage devices and other embedded items required for adjoining work that is attached to or supported by cast-in-place concrete. Use setting drawings, templates, diagrams, instructions, and directions furnished with items to be embedded.

1. Install anchor rods, accurately located, to elevations required and complying with tolerances in Section 7.5 of AISC 303.

D. Close temporary openings with tight fitting panels, flush with inside face of forms, and neatly fitted so joints will not be apparent in exposed concrete surfaces.

3.6. FORM CLEANING

A. Clean forms as erection proceeds, to remove foreign matter within forms.

B. Clean formed cavities of debris prior to placing concrete.

3.7. FORMWORK TOLERANCES

A. Construct formwork to maintain tolerances required by ACI 117, unless otherwise indicated.

3.8. FORM REMOVAL AND REUSE

A. Do not remove forms or bracing until concrete has achieved at least 70 percent of its 28-day design compressive strength.

1. Formwork for sides of beams, walls, columns, and similar parts of the Work that does not support weight of concrete may be removed after cumulatively curing at not less than 50 deg F for 24 hours after placing concrete. Concrete has to be hard enough to not be damaged by form-removal operations, and curing and protection operations need to be maintained.

2. Remove forms only if shores have been arranged to permit removal of forms without loosening or disturbing shores.

B. Loosen forms carefully. Do not wedge pry bars, hammers, or tools against finish concrete surfaces scheduled for exposure to view.

C. Store removed forms to prevent damage to form materials or to fresh concrete. Discard damaged forms.

D. Clean and repair surfaces of forms to be reused in the Work. Split, frayed, delaminated, or otherwise damaged form-facing material are not acceptable for exposed surfaces. Apply new form-release agent.

E. When forms are reused, clean surfaces, remove fins and laitance, and tighten to close joints. Align and secure joints to avoid offsets. Do not use patched forms for exposed concrete surfaces unless approved by Architect.

END OF SECTION

SECTION 03 2000 - CONCRETE REINFORCING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Reinforcing steel for cast-in-place concrete.

B. Supports and accessories for steel reinforcement.

1.2. RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories.

B. Section 03 3000 - Cast-in-Place Concrete.

1.3. REFERENCE STANDARDS

A. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International; 2010 (Errata 2012).

B. ACI 318 - Building Code Requirements For Structural Concrete and Commentary; American Concrete Institute International; 2011.

C. ACI SP-66 - ACI Detailing Manual; American Concrete Institute International; 2004.

D. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2015.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

F. AWS D1.4/D1.4M - Structural Welding Code - Reinforcing Steel; American Welding Society; 2011.

G. CRSI (DA4) - Manual of Standard Practice; Concrete Reinforcing Steel Institute; 2009.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Comply with requirements of ACI SP-66. Include placing Drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement.

C. Manufacturer's Certificate: Certify that reinforcing steel and accessories supplied for this project meet or exceed specified requirements.

1.5. QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Steel Reinforcement: Deliver, store, and handle steel reinforcement to prevent bending and damage.

PART 2 PRODUCTS

2.1. REINFORCEMENT

A. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi).

1. Plain billet-steel bars.

B. Stirrup Steel: ASTM A1064/A1064M steel wire, unfinished.

C. Steel Welded Wire Reinforcement (WWR): Plain type; ASTM A1064/A1064M.

1. Form: as drawn steel wire into Flat Sheets.

D. Reinforcement Accessories:

1. Tie Wire: Annealed, minimum 16 gage, 0.0508 inch.

2. Joint Dowel Bars: ASTM A 615/A 615M, Grade 60 (Grade 420), plain-steel bars, cut true to length with ends square and free of burrs.
3. Bar Supports: Bolsters, chairs, spacers, and other devices for spacing, supporting, and fastening reinforcing bars and welded-wire reinforcement in place. Manufacture bar supports from steel wire, plastic, or precast concrete according to CRSI's "Manual of Standard Practice," of greater compressive strength than concrete and as follows:
    a. For concrete surfaces exposed to view, where legs of wire bar supports contact forms, use CRSI Class 1 plastic-protected steel wire or CRSI Class 2 stainless-steel bar supports.

2.2. FABRICATION

A. Fabricate concrete reinforcing in accordance with CRSI (DA4) - Manual of Standard Practice.

B. Welding of reinforcement is not permitted.

C. Locate reinforcing splices not indicated on drawings at point of minimum stress.

PART 3 EXECUTION

3.1. PLACEMENT

A. General: Comply with CRSI's "Manual of Standard Practice" for fabricating, placing, and supporting reinforcement.

B. Clean reinforcement of loose rust and mill scale, earth, ice, and other foreign materials that reduce bond to concrete.

C. Accurately position, support, and secure reinforcement against displacement. Locate and support reinforcement with bar supports to maintain minimum concrete cover. Do not tack weld crossing reinforcing bars.
    1. Set wire ties with ends directed into concrete, not toward exposed concrete surfaces.

D. Install welded-wire reinforcement in longest practicable lengths on bar supports spaced to minimize sagging. Lap edges and ends of adjoining sheets at least one mesh spacing. Offset laps of adjoining sheet widths to prevent continuous laps in either direction. Lace overlaps with wire.

E. Do not displace or damage vapor barrier.

F. Accommodate placement of formed openings.

G. Maintain concrete cover around reinforcing according to Construction Drawings.

3.2. FIELD QUALITY CONTROL

A. An independent testing agency, as specified in Section 01 4000, will inspect installed reinforcement for conformance to contract documents before concrete placement.
    1. Steel reinforcement placement.
    2. Steel reinforcement welding.

END OF SECTION

SECTION 03 3000 - CAST-IN-PLACE CONCRETE

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Floors and slabs on grade.

B. Concrete foundation walls and footings.

C. Miscellaneous concrete elements, including but not limited to equipment pads, light pole bases, flagpole bases, thrust blocks, and manholes.

D. Concrete curing.

1.2. RELATED REQUIREMENTS

A. Section 03 1000 - Concrete Forming and Accessories: Forms and accessories for formwork.

B. Section 03 2000 - Concrete Reinforcing.

C. Section 07 9200 - Joint Sealants: Products and installation for sealants for saw cut joints and isolation joints in slabs.

1.3. REFERENCE STANDARDS

A. ACI 117 - Standard Specifications for Tolerances for Concrete Construction and Materials; American Concrete Institute International; 2010.

B. ACI 211.1 - Standard Practice for Selecting Proportions for Normal, Heavyweight, and Mass Concrete; American Concrete Institute International; 1991 (Reapproved 2009).

C. ACI 301 - Specifications for Structural Concrete; American Concrete Institute International; 2010 (Errata 2012).

D. ACI 302.1R - Guide for Concrete Floor and Slab Construction; American Concrete Institute International; 2004 (Errata 2007).

E. ACI 304R - Guide for Measuring, Mixing, Transporting, and Placing Concrete; American Concrete Institute International; 2000.

F. ACI 305R - Hot Weather Concreting; American Concrete Institute International; 2010.

G. ACI 306R - Cold Weather Concreting; American Concrete Institute International; 2010.

H. ACI 308R - Guide to Curing Concrete; American Concrete Institute International; 2001 (Reapproved 2008).

I. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; American Concrete Institute International; 2011.

J. ASTM C39/C39M - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens; 2014.

K. ASTM C94/C94M - Standard Specification for Ready-Mixed Concrete; 2014.

L. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.

M. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2012.

N. ASTM C150/C150M - Standard Specification for Portland Cement; 2012.

O. ASTM C173/C173M - Standard Test Method for Air Content of Freshly Mixed Concrete by the Volumetric Method; 2014.

P. ASTM C260/C260M - Standard Specification for Air-Entraining Admixtures for Concrete; 2010a.

Q. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete; 2011.

R. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.

S. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete; 2012.

T. ASTM C881/C881M - Standard Specification for Epoxy-Resin-Base Bonding Systems for Concrete; 2013.

U. ASTM C1059/C1059M - Standard Specification for Latex Agents for Bonding Fresh to Hardened Concrete; 2013.

V. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.

W. ASTM C1315 - Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete; 2011.

1.4. ACTION SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturers' data on manufactured products showing compliance with specified requirements and installation instructions.

1. For curing compounds, provide data on method of removal in the event of incompatibility with floor covering adhesives.

C. Mix Design: Submit proposed concrete mix design.

1. For each concrete mixture, indicate proposed mix design complies with requirements of ACI 301, Section 4 - Concrete Mixtures.

2. For each concrete mixture, indicate proposed mix design complies with requirements of ACI 318, Chapter 5 - Concrete Quality, Mixing and Placing.

3. Indicate amounts of mixing water to be withheld for later addition at the Project site.

D. Construction Joint Layout: Indicate proposed construction joints required to construct the structure.

1. Location of construction joints is subject to approval of the Architect.

1.5. INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer, manufacturer, and testing agency.

B. Material Certificates: For each of the following, signed by manufacturers:

1. Cementitious materials.

2. Admixtures.

3. Curing compounds.

4. Bonding agents.

5. Adhesives.

6. Repair materials.

C. Material Test Reports: For the following, from a qualified testing agency:

1. Aggregates: Include service record data indicating absence of deleterious expansion of concrete due to alkali aggregate reactivity.

D. Field quality-control reports.

1.6. QUALITY ASSURANCE

A. Perform work of this section in accordance with ACI 301 and ACI 318.

B. Follow recommendations of ACI 305R when concreting during hot weather.

C. Follow recommendations of ACI 306R when concreting during cold weather.

D. Manufacturer Qualifications: A firm experienced in manufacturing ready-mixed concrete products and that complies with ASTM C 94/C 94M requirements for production facilities and equipment.

1. Manufacturer certified according to NRMCA's "Certification of Ready Mixed Concrete Production Facilities."

E. Testing Agency Qualifications: An independent agency, acceptable to authorities having jurisdiction, qualified according to ASTM C 1077 and ASTM E 329 for testing indicated.

1. Personnel conducting field tests shall be qualified as ACI Concrete Field Testing Technician, Grade 1, according to ACI CP-1 or an equivalent certification program.

2. Personnel performing laboratory tests shall be ACI-certified Concrete Strength Testing Technician and Concrete Laboratory Testing Technician, Grade I. Testing agency laboratory supervisor shall be an ACI-certified Concrete Laboratory Testing Technician, Grade II.

1.7. PRECONSTRUCTION TESTING

A. Preconstruction Testing Service: Engage a qualified testing agency to perform preconstruction testing on concrete mixtures.

1.8. FIELD CONDITIONS

A. Cold-Weather Placement: Comply with ACI 306.1 and as follows. Protect concrete work from physical damage or reduced strength that could be caused by frost, freezing actions, or low temperatures.

1. When average high and low temperature is expected to fall below 40 deg F for three successive days, maintain delivered concrete mixture temperature within the temperature range required by ACI 301.

2. Do not use frozen materials or materials containing ice or snow. Do not place concrete on frozen subgrade or on subgrade containing frozen materials.

3. Do not use calcium chloride, salt, or other materials containing antifreeze agents or chemical accelerators unless otherwise specified and approved in mixture designs.

B. Hot-Weather Placement: Comply with ACI 301 and as follows:

1. Maintain concrete temperature below 90 deg F at time of placement. Chilled mixing water or chopped ice may be used to control temperature, provided water equivalent of ice is calculated to total amount of mixing water. Using liquid nitrogen to cool concrete is Contractor's option.

2. Fog-spray forms, steel reinforcement, and subgrade just before placing concrete. Keep subgrade uniformly moist without standing water, soft spots, or dry areas.

PART 2 PRODUCTS

2.1. FORMWORK

A. Comply with requirements of Section 03 1000.

2.2. REINFORCEMENT

A. Comply with requirements of Section 03 2000.

2.3. CONCRETE MATERIALS

A. Cement: ASTM C150, Type I/II Portland type, gray.

1. Acquire all cement for entire project from same source.

B. Normal-Weight Fine and Coarse Aggregates: ASTM C 33 or better, graded.

1. Acquire all aggregates for entire project from same source with documented service record data of at least 10 years' satisfactory service in similar applications and service conditions using similar aggregates and cementitious materials.

2. Maximum Coarse-Aggregate Size: 1-1/2 inches unless noted otherwise per design mix.

3. Fine Aggregate: Free of materials with deleterious reactivity to alkali in cement.

C. Fly Ash: ASTM C618, Class C.

D. Water: ASTM C 94/C 94M and potable.

2.4. ADMIXTURES

A. Chemical Admixtures: Certified by manufacturer to be compatible with other admixtures and that do not contribute water-soluble chloride ions exceeding those permitted in hardened concrete. Do not use calcium chloride or admixtures containing calcium chloride.

B. Do not use chemicals that will result in soluble chloride ions in excess of 0.1 percent by weight of cement.

C. Air Entrainment Admixture: ASTM C260/C260M.

D. High Range Water Reducing and Retarding Admixture: ASTM C494/C494M Type G.

E. High Range Water Reducing Admixture: ASTM C494/C494M Type F.

F. Water Reducing and Retarding Admixture: ASTM C494/C494M Type D.

G. Retarding Admixture: ASTM C494/C494M Type B.

H. Water Reducing Admixture: ASTM C494/C494M Type A.

2.5. ACCESSORY MATERIALS

A. Non-Shrink Cementitious Grout: Premixed compound consisting of non-metallic aggregate, cement, water reducing and plasticizing agents.

1. ASTM C1107/C1107M; Grade A, B, or C.

2. Minimum Compressive Strength at 48 Hours, ASTM C109/C109M: 2,000 pounds per square inch.

3. Minimum Compressive Strength at 28 Days, ASTM C109/C109M: 7,000 pounds per square inch.

2.6. CURING MATERIALS

A. Evaporation Reducer: Liquid thin-film-forming compound that reduces rapid moisture loss caused by high temperature, low humidity, and high winds; intended for application immediately after concrete placement.

B. Curing Compound, Naturally Dissipating: Clear, water-based, liquid membrane-forming compound; complying with ASTM C309, Type 1, Class B.

C. Curing and Sealing Compound, Moisture Emission Reducing: Liquid, membrane-forming, clear sealer, for application to newly placed concrete; capable of providing adequate bond for flooring adhesives, initially and over the long term; with sufficient moisture vapor impermeability to prevent deterioration of flooring adhesives due to moisture emission.

1. Use this product to cure and seal all slabs to receive adhesively applied flooring or roofing.

2. Comply with ASTM C309 and ASTM C1315 Type I Class A.

3. VOC Content: Less than 100 g/L.

4. Solids Content: 25 percent, minimum.

D. Moisture-Retaining Sheet: ASTM C171.

1. Polyethylene film, clear, minimum nominal thickness of 0.0040 in..

2. White-burlap-polyethylene sheet, weighing not less than 10 oz/per linear yd, 40 inches wide.

E. Water: Potable, not detrimental to concrete.

2.7. REPAIR MATERIALS

A. Repair Underlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/8 inch and that can be feathered at edges to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of underlayment manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by underlayment manufacturer.
4. Compressive Strength: Not less than 4100 psi at 28 days when tested according to ASTM C 109/C 109M.

B. Repair Overlayment: Cement-based, polymer-modified, self-leveling product that can be applied in thicknesses from 1/4 inch and that can be filled in over a scarified surface to match adjacent floor elevations.

1. Cement Binder: ASTM C 150/C 150M, portland cement or hydraulic or blended hydraulic cement as defined in ASTM C 219.
2. Primer: Product of topping manufacturer recommended for substrate, conditions, and application.
3. Aggregate: Well-graded, washed gravel, 1/8 to 1/4 inch or coarse sand as recommended by topping manufacturer.
4. Compressive Strength: Not less than 5000 psi at 28 days when tested according to ASTM C 109/C 109M.

2.8. CONCRETE MIX DESIGN

A. Proportioning Normal Weight Concrete: Comply with ACI 211.1 recommendations.

1. Cementitious Materials: Limit percentage, by weight, of cementitious materials other than portland cement in concrete as follows:
   a. Fly Ash: 25 percent.
2. Limit water-soluble, chloride-ion content in hardened concrete to 0.30 percent by weight of cement.

B. Concrete Strength: Establish required average strength for each type of concrete on the basis of field experience or trial mixtures, or both, as specified in ACI 301.

1. For trial mixtures method, employ independent testing agency acceptable to Architect for preparing and reporting proposed mix designs.

C. Admixtures: Add acceptable admixtures as recommended in ACI 211.1 and at rates recommended or required by manufacturer.

D. Normal Weight Concrete for Isolated Footings and Continuous Footings:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.
2. Total Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for 1-1/2-inch nominal maximum aggregate size
3. Maximum Slump: 5 inches for concrete without a water-reducing or plasticizing admixture. 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch
4. Maximum Aggregate Size: 1-1/2 inch.

E. Normal Weight Concrete for Foundation Walls and Pedestals:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.

2. Total Air Content: 5.5 percent, plus or minus 1.5 percent at point of delivery for1-1/2 inch nominal maximum aggregate size.
3. Maximum Slump: 4 inches for concrete without high-range water-reducing or plasticizing admixture; or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Maximum Aggregate Size: 1-1/2 inch.

F. Normal Weight Concrete for Interior Slabs on Grade:

1. Compressive Strength, when tested in accordance with ASTM C39/C39M at 28 days: As indicated on drawings.
2. Total Air Content: Do not allow air content of trowel-finished floors to exceed 3 percent.
3. Maximum Slump: 4 inches for concrete without a high-range water-reducing or plasticizing admixture; or 8 inches for concrete with verified slump of 2 to 4 inches before adding high-range water-reducing admixture or plasticizing admixture, plus or minus 1 inch.
4. Maximum Aggregate Size: 3/4 inch.

2.9. MIXING

A. Transit Mixers: Measure, batch, mix, and deliver concrete according to ASTM C94/C94M, and furnish batch ticket information.

1. Ticket to show amount of water required or allowed to be added on site.
2. When air temperature is between 85 and 90 deg F, reduce mixing and delivery time from 1-1/2 hours to 75 minutes; when air temperature is above 90 deg F, reduce mixing and delivery time to 60 minutes.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify lines, levels, and dimensions before proceeding with work of this section.

3.2. JOINTS

A. General: Construct joints true to line with faces perpendicular to surface plane of concrete.

B. Construction Joints: Install so strength and appearance of concrete are not impaired, at locations indicated or as approved by Architect.

1. Place joints perpendicular to main reinforcement. Continue reinforcement across construction joints unless otherwise indicated. Do not continue reinforcement through sides of strip placements of floors and slabs.
2. Form keyed joints as indicated. Embed keys at least 1-1/2 inches into concrete.
3. Locate vertical joints in walls beside pedestals integral with walls, near corners, and in concealed locations where possible.
4. Use epoxy-bonding adhesive at locations where fresh concrete is placed against hardened or partially hardened concrete surfaces.

3.3. PREPARATION

A. Where new concrete is to be bonded to previously placed concrete, prepare existing surface by cleaning with steel brush and applying bonding agent in accordance with manufacturer's instructions.

1. Use epoxy bonding system for bonding to damp surfaces, for structural load-bearing applications, and where curing under humid conditions is required.
2. Use latex bonding agent only for non-load-bearing applications.

B. Interior Slabs on Grade: Install vapor retarder under interior slabs on grade. Lap joints minimum 6 inches. See Specification Section 03 0505.

C. Before placing concrete, verify that installation of formwork, reinforcement, and embedded items is complete and that required inspections are completed.

D. Before test sampling and placing concrete, water may be added at Project site, subject to limitations of ACI 301.

1. Do not add water to concrete after adding high-range water-reducing admixtures to mixture.

E. Deposit concrete continuously in one layer or in horizontal layers of such thickness that no new concrete is placed on concrete that has hardened enough to cause seams or planes of weakness. If a section cannot be placed continuously, provide construction joints as indicated. Deposit concrete to avoid segregation.

1. Deposit concrete in horizontal layers of depth not to exceed formwork design pressures and in a manner to avoid inclined construction joints.

2. Consolidate placed concrete with mechanical vibrating equipment according to ACI 301.

3. Do not use vibrators to transport concrete inside forms. Insert and withdraw vibrators vertically at uniformly spaced locations to rapidly penetrate placed layer and at least 6 inches into preceding layer. Do not insert vibrators into lower layers of concrete that have begun to lose plasticity. At each insertion, limit duration of vibration to time necessary to consolidate concrete and complete embedment of reinforcement and other embedded items without causing mixture constituents to segregate.

3.4. PLACING CONCRETE

A. Place concrete in accordance with ACI 304R.

B. Place concrete for floor slabs in accordance with ACI 302.1R.

C. Notify Architect not less than 24 hours prior to commencement of placement operations.

D. Maintain records of concrete placement. Record date, location, quantity, air temperature, and test samples taken.

E. Ensure reinforcement, inserts, waterstops, embedded parts, and formed construction joint devices will not be disturbed during concrete placement.

F. Finish floors level and flat, unless otherwise indicated, within the tolerances specified below.

3.5. SLAB JOINTING

A. Locate joints as indicated on the drawings.

B. Anchor joint fillers and devices to prevent movement during concrete placement.

C. Isolation Joints: Use preformed joint filler with removable top section for joint sealant, total height equal to thickness of slab, set flush with top of slab.

D. Load Transfer Construction and Contraction Joints: Install load transfer devices as indicated; saw cut joint at surface as indicated for contraction joints.

E. Saw Cut Contraction Joints: Saw cut joints before concrete begins to cool, within 4 to 12 hours after placing; use 3/16 inch thick blade and cut at least 1 inch deep but not less than one quarter (1/4) the depth of the slab.

3.6. FLOOR FLATNESS AND LEVELNESS TOLERANCES

A. An independent testing agency, as specified in Section 01 4000, will inspect finished slabs for conformance to specified tolerances.

B. Measure floor and slab flatness and levelness within 24 hours of finishing.

C. Maximum Variation of Surface Flatness:

1. Exposed Concrete Floors: 1/8 inch in 10 ft.
2. Under Seamless Resilient Flooring: 1/8 inch in 10 ft.
3. Under Carpeting: 1/8 inch in 10 ft.

D. Correct the slab surface if tolerances are less than specified.

E. Correct defects by grinding or by removal and replacement of the defective work. Areas requiring corrective work will be identified. Re-measure corrected areas by the same process.

3.7. CONCRETE FINISHING

A. Repair surface defects, including tie holes, immediately after removing formwork.

1. Fill in holes and openings left in concrete structures after work of other trades is in place unless otherwise indicated. Mix, place, and cure concrete, as specified, to blend with in-place construction. Provide other miscellaneous concrete filling indicated or required to complete the Work.

B. Unexposed Form Finish: Rub down or chip off fins or other raised areas 1/4 inch or more in height.

C. Exposed Form Finish: Rub down or chip off and smooth fins or other raised areas 1/4 inch or more in height. Provide finish as follows:

1. Smooth Rubbed Finish: Wet concrete and rub with carborundum brick or other abrasive, not more than 24 hours after form removal.

D. Concrete Slabs: Finish to requirements of ACI 302.1R for screeding, restraightening, and finishing operations for concrete surfaces. Do not wet concrete surfaces.

1. Scratch Finish: While still plastic, texture concrete surface that has been screeded and bull-floated or darbied. Use stiff brushes, brooms, or rakes to produce a profile amplitude of 1/4 inch in one direction.
    a. Surfaces to Receive Scratch Finish include quarry tile, ceramic tile, and terrazzo (ADD 01)with full bed setting system.
2. Float Finish: Consolidate surface with power-driven floats or by hand floating if area is small or inaccessible to power-driven floats. Restraighten, cut down high spots, and fill low spots. Repeat float passes and restraightening until surface is left with a uniform, smooth, granular texture.
3. Trowel Finish: After applying float finish, apply first troweling and consolidate concrete by hand or power-driven trowel. Continue troweling passes and restraighten until surface is free of trowel marks and uniform in texture and appearance. Grind smooth any surface defects that would telegraph through applied coatings or floor coverings.
    a. Surfaces to Receive Trowel Finish include carpeting, resilient flooring, seamless flooring, thin set quarry tile, and thin set ceramic tile.
4. Trowel and Fine-Broom Finish: Apply a first trowel finish to surfaces where ceramic or quarry tile is to be installed by either thickset or thinset method. While concrete is still plastic, slightly scarify surface with a fine broom.
5. Other Surfaces to Be Left Exposed: Trowel Finish, minimizing burnish marks and other appearance defects.

E. 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.

3.8. CURING AND PROTECTION

A. Comply with requirements of ACI 308R. Immediately after placement, protect concrete from premature drying, excessively hot (ACI 301) or cold temperatures (ACI 306.1), and mechanical injury.

B. Maintain concrete with minimal moisture loss at relatively constant temperature for period necessary for hydration of cement and hardening of concrete.

1. Normal concrete: Not less than 7 days.

C. Evaporation Retarder: Apply evaporation retarder to unformed concrete surfaces if hot, dry, or windy conditions cause moisture loss approaching 0.2 lb/sq. ft. x h before and during finishing operations. Apply according to manufacturer's written instructions after placing, screeding, and bull floating or darbying concrete, but before float finishing.

D. Formed Surfaces: Cure by moist curing. If forms remain during curing period, moist cure after loosening forms. If removing forms before end of curing period, continue curing for remainder of curing period.

E. Surfaces Not in Contact with Forms:

1. Slabs and Floors To Receive Adhesive-Applied Flooring: Curing compounds and other surface coatings are usually considered unacceptable by flooring and adhesive manufacturers. If such materials must be used, either obtain the approval of the flooring and adhesive manufacturers prior to use or remove the surface coating after curing to flooring manufacturer's satisfaction.

2. Initial Curing: Start as soon as free water has disappeared and before surface is dry. Keep continuously moist for not less than four days by water ponding, water-fog spray, or absorptive cover.

a. Ponding: Maintain 100 percent coverage of water over floor slab areas, continuously for 4 days.

b. Spraying: Spray water continuously over floor slab areas and maintain wet.

c. Saturated Burlap or Absorptive Cover: Saturate cover and place over concrete surfaces, lapping ends and sides a minimum of 12 inches; maintain in place and keep continuously wet.

3. Final Curing: Begin after initial curing but before surface is dry.

a. Moisture-Retaining Sheet: Cover concrete surfaces with moisture-retaining cover for curing concrete, placed in widest practicable width, with sides and ends lapped at least 12 inches, and sealed by waterproof tape or adhesive. Cure for not less than three days. Immediately repair any holes or tears during curing period, using cover material and waterproof tape.

b. Curing Compound: Apply uniformly in continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Maintain continuity of coating and repair damage during curing period.

1) Removal: After curing period has elapsed, remove curing compound without damaging concrete surfaces by method recommended by curing compound manufacturer unless manufacturer certifies curing compound does not interfere with bonding of floor covering used on Project.

c. Curing and Sealing Compound: Apply uniformly to floors and slabs indicated in a continuous operation by power spray or roller according to manufacturer's written instructions. Recoat areas subjected to heavy rainfall within three hours after initial application. Repeat process 24 hours later and apply a second coat. Maintain continuity of coating and repair damage during curing period.

3.9. FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000. The contractor shall be responsible for scheduling all required tests.

B. Provide free access to concrete operations at project site and cooperate with appointed firm.

C. Contractor shall notify the owner's representative a minimum of 48 hours prior to all placement of concrete.

D. Submit proposed mix design of each class of concrete to inspection and testing firm for review prior to commencement of concrete operations.

E. Inspections:

1. Verification of use of required design mixture.
2. Concrete placement, including conveying and depositing.
3. Curing procedures and maintenance of curing temperature.

F. Concrete Tests: Testing of composite samples of fresh concrete obtained according to ASTM C 172/C 172M shall be performed according to the following requirements:

1. Testing Frequency: Obtain one composite sample for each day's pour of each concrete mixture exceeding 5 cu. yd., but less than 25 cu. yd., plus one set for each additional 50 cu. yd. or fraction thereof.
    a. When frequency of testing provides fewer than five compressive-strength tests for each concrete mixture, testing shall be conducted from at least five randomly selected batches or from each batch if fewer than five are used.
2. Slump: ASTM C 143/C 143M; one test at point of placement for each composite sample, but not less than one test for each day's pour of each concrete mixture. Perform additional tests when concrete consistency appears to change.
3. Air Content: ASTM C 231/C 231M, pressure method, for normal-weight concrete; one test for each composite sample, but not less than one test for each day's pour of each concrete mixture.
4. Compressive Strength Tests: ASTM C39/C39M. Test one set of two laboratory-cured specimens at 7 days and one set of two specimens at 28 days.
    a. 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.
    b. Strength of each concrete mixture will be satisfactory if every average of any three consecutive compressive-strength tests equals or exceeds specified compressive strength and no compressive-strength test value falls below specified compressive strength by more than 500 psi.
5. Concrete Temperature: ASTM C 1064/C 1064M; one test hourly when air temperature is 40 deg F and below or 80 deg F and above, and one test for each composite sample.
6. Nondestructive Testing: Impact hammer, sonoscope, or other nondestructive device may be permitted by Architect but will not be used as sole basis for approval or rejection of concrete.

G. Test results shall be reported in writing to Architect, concrete manufacturer, and Contractor within 48 hours of testing. Reports of compressive-strength tests shall contain Project identification name and number, date of concrete placement, name of concrete testing and inspecting agency, location of concrete batch in Work, design compressive strength at 28 days, concrete mixture proportions and materials, compressive breaking strength, and type of break for both 7- and 28-day tests.

H. Additional Tests: Testing and inspecting agency shall make additional tests of concrete when test results indicate that slump, air entrainment, compressive strengths, or other requirements have not been met, as directed by Architect. Testing and inspecting agency may conduct tests to determine adequacy of concrete by cored cylinders complying with ASTM C 42/C 42M or by other methods as directed by Architect.

I. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

J. Correct deficiencies in the Work that test reports and inspections indicate do not comply with the Contract Documents.

3.10. 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 1 part portland cement to 2-1/2 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 to solid concrete. Limit cut depth to 3/4 inch. 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 matches 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 (0.25 mm) 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 (6 mm) 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.

3.11. PROTECTION

A. Do not permit traffic over unprotected concrete floor surface until fully cured.

END OF SECTION

SECTION 04 2000 - UNIT MASONRY

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Common Brick.

B. Mortar and Grout.

C. Reinforcement and Anchorage.

D. Flashings.

E. Lintels.

F. Accessories.

1.2. RELATED REQUIREMENTS

A. Section 07 7200 - Cast Stone Masonry.

B. Section 07 9200 - Joint Sealants: Sealing control and expansion joints.

1.3. REFERENCE STANDARDS

A. ACI 530/530.1/ERTA - Building Code Requirements and Specification for Masonry Structures and Related Commentaries; American Concrete Institute International; 2011.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

D. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2009a (Reapproved 2014).

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

F. ASTM C62 - Standard Specification for Building Brick (Solid Masonry Units Made From Clay or Shale); 2013.

G. ASTM C67 - Standard Test Methods for Sampling and Testing Brick and Structural Clay Tile; 2014.

H. ASTM C91/C91M - Standard Specification for Masonry Cement; 2012.

I. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2011.

J. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

K. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2006 (Reapproved 2011).

L. ASTM C216 - Standard Specification for Facing Brick (Solid Masonry Units Made From Clay or Shale); 2014.

M. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

N. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2011b.

O. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2011.

P. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

Q. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2012.

R. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2014.

S. ASTM C1357 - Standard Test Methods for Evaluating Masonry Bond Strength; 2009.

T. BIA Technical Notes No. 7 - Water Penetration Resistance - Design and Detailing; 2005.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data for masonry units, mortar, and masonry accessories.

C. Samples: Submit four samples of facing brick units to illustrate color, texture, and extremes of color range.

1. Submit sample of pigmented and colored-aggregate mortar. Make Samples using same sand and mortar ingredients to be used on Project.

D. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

E. Cold-Weather and Hot-Weather Procedures: Detailed description of methods, materials, and equipment to be used to comply with requirements.

1.5. QUALITY ASSURANCE

A. Comply with provisions of ACI 530/530.1/ERTA, except where exceeded by requirements of the contract documents.

1.6. MOCK-UP

A. Construct a masonry wall as an exterior wall mock-up panel sized 6 feet long by 6 feet high; include mortar, accessories, structural backup, and flashings (with lap joint, corner, and end dam) in mock-up.

1. Include lower corner of glazing opening framed at upper corner of exterior wall mockup. Make opening approximately 12 inches wide by 16 inches high.

2. Include through-wall flashing installed for a 24-inch length in corner of exterior wall mockup approximately 16 inches down from top of mockup, with a 12-inch length of flashing left exposed to view (omit masonry above half of flashing).

3. Include metal studs, sheathing, sheathing joint-and-penetration treatment air barrier, veneer anchors, flashing, and weep holes in exterior masonry-veneer wall mockup.

B. Approval of mockups is for color, texture, and blending of masonry units; relationship of mortar and sealant colors to masonry unit colors; tooling of joints; and aesthetic qualities of workmanship.

C. Approved mock-up may remain as part of the Work.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

PART 2 PRODUCTS

2.1. BRICK UNITS

A. Buff Brick (Brick "A"):

1. Basis of Design: Belden 691-693.

2. ASTM C216, Smooth, Type FBX.

3. Compressive strength: 10,986 psi, measured in accordance with ASTM C67.

4. Initial Rate of Aborption: Less than 3.5g/30 sq.in. per minute when tested per ASTM C67.

5. Efflorescence: Provide brick that has been tested according to ASTM C 67 and is rated "not effloresced."

6. Nominal size: modular.

B. Red Brick (Brick "B"):

1. Basis of Design: Meridian Brick Company "Dark Red Wirecut", Columbia plant (formerly Hanson 350).

2.2. **MORTAR AND GROUT MATERIALS**

A. Masonry Cement: ASTM C91/C91M, Type N.

1. Colored Mortar: Premixed cement as required to match Architect's color sample.
2. Manufacturers:
   a. Capital Materials Corporation; Riverton Portland Cement Lime Custom Color.
   b. Holcim (US) Inc.; Rainbow Mortamix Custom Color Cement/Lime.
   c. Lafarge North America Inc.; Eaglebond Portland & Lime.
   d. Lehigh Cement Company; Lehigh Custom Color Portland/Lime Cement.
   e. Substitutions: See Section 01 6000 - Product Requirements.

B. Portland Cement: ASTM C150/C150M, Type I; color as required to produce approved color sample.

C. Hydrated Lime: ASTM C207, Type S.

D. Mortar Aggregate: ASTM C144.

E. Grout Aggregate: ASTM C404.

F. Water: Clean and potable.

G. Cold-Weather Admixture: Nonchloride, noncorrosive, accelerating admixture complying with ASTM C 494/C 494M, Type C, and recommended by manufacturer for use in masonry mortar of composition indicated.

1. See Editing Instruction No. 1 in the Evaluations for cautions about naming manufacturers and products. See Section 016000 "Product Requirements."
2. Products: Subject to compliance with requirements, provide one of the following:
   a. Euclid Chemical Company (The); Accelguard 80.
   b. Grace Construction Products, W. R. Grace & Co. - Conn.; Morset.
   c. Sonneborn Products, BASF Aktiengesellschaft; Trimix-NCA.

2.3. REINFORCEMENT AND ANCHORAGE

A. Manufacturers:

1. Blok-Lok Limited: www.blok-lok.com.
2. Hohmann & Barnard, Inc; 2-Seal Tie: www.h-b.com/sle.
3. WIRE-BOND: www.wirebond.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Seismic Adjustable Masonry-Veneer Anchors:

1. General: Provide anchors that allow vertical adjustment but resist tension and compression forces perpendicular to plane of wall, for attachment over sheathing to wood or metal studs, and as follows:
   a. Structural Performance Characteristics: Capable of withstanding a 100-lbf load in both tension and compression without deforming or developing play in excess of 0.05 inch.
2. Wire Ties: Triangular-, rectangular-, or T-shaped wire ties fabricated from 0.187-inch diameter, hot-dip galvanized-steel wire unless otherwise indicated.
3. Screw-Attached, Masonry-Veneer Seismic Anchors: Units consisting of a wire tie and a metal anchor section.

a. Products: Subject to compliance with requirements, provide the following:

1) Masonry ties: Hohmann and Banard HB-213 SIS. Field verify from mock up the required depth.

b. Anchor Section: Corrosion-resistant, self-drilling, eye-screw designed to receive wire tie. Eye-screw has spacer that seats directly against framing and is same thickness as sheathing and has gasketed, washer head that covers hole in sheathing.

C. Masonry Veneer Anchors: 2-piece anchors that permit differential movement between masonry veneer and structural backup, hot dip galvanized to ASTM A 153/A 153M, Class B.

1. Anchor plates: Not less than 0.075 inch thick, designed for fastening to structural backup through sheathing by two fasteners; provide design with legs that penetrate sheathing and insulation to provide positive anchorage.

2. Wire ties: Manufacturer's standard shape, 0.1875 inch thick.

3. Vertical adjustment: Not less than 3-1/2 inches.

2.4. FLASHINGS

A. Metal Flashing: Provide metal flashing complying with SMACNA's "Architectural Sheet Metal Manual"" and as follows:

1. Stainless Steel: ASTM A 240/A 240M, Type 304, 0.016 inch thick.

2. Fabricate continuous flashings in sections 96 inches long minimum, but not exceeding 12 feet. Provide splice plates at joints of formed, smooth metal flashing.

3. Fabricate through-wall metal flashing embedded in masonry from stainless steel, with ribs at 3-inch intervals along length of flashing to provide an integral mortar bond.

4. Fabricate through-wall flashing with drip edge unless otherwise indicated. Fabricate by extending flashing 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

5. Fabricate metal drip edges for ribbed metal flashing from plain metal flashing of same metal as ribbed flashing and extending at least 3 inches into wall with hemmed inner edge to receive ribbed flashing and form a hooked seam. Form hem on upper surface of metal so that completed seam will shed water.

6. Metal Drip Edge: Fabricate from stainless steel. Extend at least 3 inches into wall and 1/2 inch out from wall, with outer edge bent down 30 degrees and hemmed.

7. Metal Sealant Stop: Fabricate from stainless steel. Extend at least 3 inches into wall and out to exterior face of wall. At exterior face of wall, bend metal back on itself for 3/4 inch and down into joint 1/4 inch to form a stop for retaining sealant backer rod.

8. Metal Expansion-Joint Strips: Fabricate from stainless steel to shapes indicated.

B. Flexible Flashing: Use the following unless otherwise indicated:

1. EPDM Flashing: Sheet flashing product made from ethylene-propylene-diene terpolymer, complying with ASTM D 4637, 0.040 inch thick.

a. Products: Subject to compliance with requirements, provide one of the following:

1) Carlisle Coatings & Waterproofing; Pre-Kleened EPDM Thru-Wall Flashing.

2) Firestone Specialty Products; FlashGuard.

3) Heckmann Building Products Inc.; No. 81 EPDM Thru-Wall Flashing.

4) Hohmann & Barnard, Inc.; Epra-Max EPDM Thru-Wall Flashing.

5) Sandell Manufacturing Co., Inc.; EPDM Flashing.

2. Stainless Steel Flashing

a. Products: York Flashings

C. Application: Unless otherwise indicated, use the following:

1. Where flashing is indicated to receive counterflashing, use metal flashing.
2. Where flashing is indicated to be turned down at or beyond the wall face, use metal flashing.
3. Where flashing is fully concealed, use flexible flashing.

D. Adhesives, Primers, and Seam Tapes for Flashings: Flashing manufacturer's standard products or products recommended by flashing manufacturer for bonding flashing sheets to each other and to substrates.

2.5. ACCESSORIES

A. Preformed Control Joints: Rubber material. Provide with corner and tee accessories, fused joints.

1. Manufacturers:
   a. Blok-Lok Limited: www.blok-lok.com.
   b. Hohmann & Barnard, Inc: www.h-b.com/sle.
   c. WIRE-BOND: www.wirebond.com.
   d. Substitutions: See Section 01 6000 - Product Requirements.

B. Joint Filler: Closed cell polyvinyl chloride: oversized 50 percent to joint width; self expanding.

C. Cavity Mortar Control: Semi-rigid polyethylene or polyester mesh panels, sized to thickness of wall cavity, and designed to prevent mortar droppings from clogging weeps and cavity vents and allow proper cavity drainage.

1. Full-Height Airspace Maintenance and Drainage Material: Mesh panels, fitted between masonry ties.
   a. Manufacturers:
      1) Advanced Building Products, Inc.; Mortairvent-CW: www.advancedbuildingproducts.com/sle.
      2) CavClear/Archovations, Inc; CavClear Masonry Mat: www.cavclear.com.
      3) Substitutions: See Section 01 6000 - Product Requirements.

D. Drip Edge: Stainless steel; compatible with membrane and adhesives.

E. Weeps:

1. Type: Polyester mesh.
   a. Manufacturers:
      1) Blok-Lok Limited: www.blok-lok.com.
      2) CavClear/Archovations, Inc: www.cavclear.com.
      3) Mortar Net Solutions: www.mortarnet.com.
      4) Substitutions: See Section 01 6000 - Product Requirements.

F. Cavity Vents:

1. Type: Polyethylene tubing.
   a. Manufacturers:
      1) Blok-Lok Limited: www.blok-lok.com.
      2) Hohmann & Barnard, Inc: www.h-b.com/sle.
      3) WIRE-BOND: www.wirebond.com.
      4) Substitutions: See Section 01 6000 - Product Requirements.

G. Cleaning Solution: Non-acidic, not harmful to masonry work or adjacent materials.

2.6. LINTELS

A. Provide lintels as shown on the Drawings.

2.7. MORTAR AND GROUT MIXES

A. Mortar for Unit Masonry: ASTM C270, using the Proportion Specification.

1. Interior, loadbearing masonry: Type N.

B. Grout: ASTM C476; consistency required to fill completely volumes indicated for grouting; fine grout for spaces with smallest horizontal dimension of 2 inches or less; coarse grout for spaces with smallest horizontal dimension greater than 2 inches.

C. Admixtures: Add to mixture at manufacturer's recommended rate and in accordance with manufacturer's instructions; mix uniformly.

D. Mixing: Use mechanical batch mixer and comply with referenced standards.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive masonry.

B. Verify that related items provided under other sections are properly sized and located.

C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

3.2. PREPARATION

A. Direct and coordinate placement of metal anchors supplied for installation under other sections.

B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

3.3. COLD AND HOT WEATHER REQUIREMENTS

A. Comply with requirements of ACI 530/530.1/ERTA or applicable building code, whichever is more stringent.

3.4. COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Brick Units:

1. Bond: Running, typically and soldier course at locations noted.
2. Coursing: Three units and three mortar joints to equal 8 inches.
3. Mortar Joints: Concave.

3.5. PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.

D. Remove excess mortar and mortar smears as work progresses.

E. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.

F. Interlock intersections and external corners, except for units laid in stack bond.

G. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.

H. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.

I. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.

3.6. WEEPS/CAVITY VENTS

A. Install weeps in veneer and cavity walls at 24 inches on center horizontally above through-wall flashing, above shelf angles and lintels, and at bottom of walls.

B. Install cavity vents in veneer and cavity walls at 32 inches on center horizontally below shelf angles and lintels and near top of walls.

3.7. CAVITY MORTAR CONTROL

A. Do not permit mortar to drop or accumulate into cavity air space or to plug weep/cavity vents.

B. Install cavity mortar control panels continuously throughout full height of exterior masonry cavities during construction of exterior wythe, complying with manufacturer's installation instructions. Verify that airspace width is no more than 3/8 inch greater than panel thickness. Install horizontally between joint reinforcement. Stagger end joints in adjacent rows. Fit to perimeter construction and penetrations without voids.

3.8. REINFORCEMENT AND ANCHORAGE - MASONRY VENEER

A. Stud Back-Up: Secure veneer anchors to stud framed back-up and embed into masonry veneer at maximum 16 inches on center vertically and 24 inches on center horizontally. Place additional anchors at perimeter of openings and ends of panels, so maximum spacing of anchors is 8 inches on center.

3.9. MASONRY FLASHINGS

A. Whether or not specifically indicated, install masonry flashing to divert water to exterior at all locations where downward flow of water will be interrupted.

1. Extend flashings full width at such interruptions and at least 6 inches into adjacent masonry or turn up at least 8 inches to form watertight pan at non-masonry construction.

2. Remove or cover protrusions or sharp edges that could puncture flashings.

3. Seal lapped ends and penetrations of flashing before covering with mortar.

B. Extend metal flashings through exterior face of masonry and turn down to form drip. Install joint sealer below drip edge to prevent moisture migration under flashing.

C. Extend plastic, laminated, and EPDM flashings to within 1/4 inch of exterior face of masonry.

3.10. LINTELS

A. Install lintels as shown on the Drawings.

3.11. CONTROL AND EXPANSION JOINTS

A. Do not continue horizontal joint reinforcement through control or expansion joints.

B. Install preformed control joint device in continuous lengths. Seal butt and corner joints in accordance with manufacturer's instructions.

C. Size control joints as indicated on drawings; if not shown, 3/4 inch wide and deep.

3.12. BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

1. Fill adjacent masonry cores with grout minimum 12 inches from framed openings.

D. Do not build into masonry construction organic materials that are subject to deterioration.

3.13. TOLERANCES

A. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.

B. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.

C. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.

D. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.

E. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.

F. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

3.14. FIELD QUALITY CONTROL

A. An independent testing agency will perform field quality control tests, as specified in Section 01 4000 - Quality Requirements.

B. Clay Masonry Unit Tests: Test each variety of clay masonry in accordance with ASTM C67 requirements, sampling 5 randomly chosen units for each 50,000 installed.

C. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

3.15. CLEANING

A. Remove excess mortar and mortar droppings.

B. Replace defective mortar. Match adjacent work.

C. Clean soiled surfaces with cleaning solution.

3.16. PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 04 7200 - CAST STONE MASONRY

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Architectural cast stone.

B. Units required are indicated on drawings as "stone trim".

1.2. RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Installation of cast stone in conjunction with masonry.

1.3. REFERENCE STANDARDS

A. ACI 318 - Building Code Requirements for Structural Concrete and Commentary; 2011.

B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon Steel Bars for Concrete Reinforcement; 2015.

C. ASTM A767/A767M - Standard Specification for Zinc-Coated (Galvanized) Steel Bars for Concrete Reinforcement; 2009.

D. ASTM A884/A884M - Standard Specification for Epoxy-Coated Steel Wire and Welded Wire Reinforcement; 2014.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2015.

F. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

G. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2014a.

H. ASTM C494/C494M - Standard Specification for Chemical Admixtures for Concrete; 2013.

I. ASTM C642 - Standard Test Method for Density, Absorption, and Voids in Hardened Concrete; 2013.

J. ASTM C1364 - Standard Specification for Architectural Cast Stone; 2018.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Test results of cast stone components made previously by the manufacturer.

C. Shop Drawings: Include elevations, dimensions, layouts, profiles, cross sections, reinforcement, exposed faces, arrangement of joints, anchoring methods, anchors, and piece numbers.

D. Verification Samples: Pieces of actual cast stone components not less than 6 inches square, illustrating range of color and texture to be anticipated in components furnished for the project.

1.5. QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. A firm with a minimum of 5 years experience producing cast stone of types required for project.

2. Adequate plant capacity to furnish quality, sizes, and quantity of cast stone required without delaying progress of the work.

1.6. MOCK-UP

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Approved mock-up will become standard for appearance and workmanship.

C. Mock-up may remain as part of the completed work.

D. Remove mock-up not incorporated into the work and dispose of debris.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Deliver cast stone components secured to shipping pallets and protected from damage and discoloration. Protect corners from damage.

B. Store cast stone components and installation materials in accordance with manufacturer's instructions.

C. Store cast stone components on pallets with nonstaining, waterproof covers. Ventilate under covers to prevent condensation. Prevent contact with dirt.

D. Protect cast stone components during handling and installation to prevent chipping, cracking, or other damage.

E. Store mortar materials where contamination can be avoided.

F. Schedule and coordinate production and delivery of cast stone components with unit masonry work to optimize on-site inventory and to avoid delaying the work.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Architectural Cast Stone:

1. Continental Cast Stone; Kirkwood, Missouri.
2. Midwest Cast Stone; Kirkwood, Missouri.
3. Edwards Cast Stone Company; Dubuque, Iowa.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.2. ARCHITECTURAL CAST STONE

A. Cast Stone: Architectural concrete product manufactured to simulate appearance of natural granite, complying with ASTM C1364.

1. Basis of Design for stone sills: Continental Cast Stone: SIL11JS1.
2. Compressive Strength: As specified in ASTM C1364; calculate strength of pieces to be field cut at 80 percent of uncut piece.
3. Freeze-Thaw Resistance: Demonstrated by laboratory testing in accordance with ASTM C1364.
4. Surface Texture: Fine grained texture, with no bugholes, air voids, or other surface blemishes visible from distance of 20 feet.
5. Color: Continental cast stone color “Whitestone”.
6. Remove cement film from exposed surfaces before packaging for shipment.

B. Shapes: Provide shapes indicated on drawings.

1. Variation from Any Dimension, Including Bow, Camber, and Twist: Maximum of plus/minus 1/8 inch or length divided by 360, whichever is greater, but not more than 1/4 inch.
2. Unless otherwise indicated on drawings, provide:
   a. Wash or slope of 1:12 on exterior horizontal surfaces.
   b. Drips on projecting components, wherever possible.
   c. Outside corner shapes.

C. Reinforcement: Provide reinforcement as required to withstand handling and structural stresses; comply with ACI 318.

2.3. MATERIALS

A. Portland Cement: ASTM C150/C150M.

1. For Units: Type I or II, white.

2. For Mortar: Type I or II, except Type III may be used in cold weather.

B. Coarse Aggregate: ASTM C33/C33M, except for gradation; granite, quartz, or limestone.

C. Fine Aggregate: ASTM C33/C33M, except for gradation; natural or manufactured sands.

D. Admixtures: ASTM C494/C494M.

E. Water: Potable.

F. Reinforcing Bars: ASTM A615/A615M deformed bars, galvanized.

1. Galvanized in accordance with ASTM A767/A767M, Class I.

G. Steel Welded Wire Reinforcement: ASTM A1064/A1064M, galvanized or ASTM A884/A884M, epoxy coated.

H. Embedded Anchors, Dowels, and Inserts: Type 304 stainless steel, of type and size as required for conditions.

I. Mortar: Portland cement-lime, as specified in Section 04 0511; do not use masonry cement.

J. Cleaner: General-purpose cleaner designed for removing mortar and grout stains, efflorescence, and other construction stains from new masonry surfaces without discoloring or damaging masonry surfaces; approved for intended use by cast stone manufacturer and by cleaner manufacturer for use on cast stone and adjacent masonry materials.

2.4. SOURCE QUALITY CONTROL

A. Test compressive strength and absorption of specimens selected at random from plant production.

1. Test in accordance with ASTM C642.

2. Select specimens at rate of 3 per 500 cubic feet, with a minimum of 3 per production week.

PART 3 EXECUTION

3.1. EXAMINATION

A. Examine construction to receive cast stone components. Notify Architect if construction is not acceptable.

B. Do not begin installation until unacceptable conditions have been corrected.

3.2. INSTALLATION

A. Install cast stone components in conjunction with masonry, complying with requirements of Section 04 2000.

B. Mechanically anchor cast stone units indicated; set remainder in mortar.

C. Setting:

1. Drench cast stone components with clear, running water immediately before installation.

2. Set units in a full bed of mortar unless otherwise indicated.

3. Fill vertical joints with mortar.

4. Fill dowel holes and anchor slots completely with mortar or non-shrink grout.

3.3. TOLERANCES

A. Installation Tolerances:

1. Variation from Plumb: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet or more.

2. Variation from Level: Not more than 1/8 inch in 10 feet or 1/4 inch in 20 feet, or 3/8 inch maximum.

3. Variation in Joint Width: Not more than 1/8 inch in 36 inches or 1/4 of nominal joint width, whichever is less.

4. Variation in Plane Between Adjacent Surfaces (Lipping): Not more than 1/16 inch difference between planes of adjacent units or adjacent surfaces indicated to be flush with units.

3.4. REPAIR

A. Repair chips and other surface damage noticeable when viewed in direct daylight at 20 feet.

B. Repair with matching touch-up material provided by the manufacturer and in accordance with manufacturer's instructions.

C. Repair methods and results subject to Architect 's approval.

3.5. CLEANING

A. Keep cast stone components clean as work progresses.

B. Clean completed exposed cast stone after mortar is thoroughly set and cured.

1. Wet surfaces with water before applying cleaner.
2. Apply cleaner to cast stone in accordance with manufacturer's instructions.
3. Remove cleaner promptly by rinsing thoroughly with clear water.
4. Do not use acidic cleaners.

3.6. PROTECTION

A. Protect completed work from damage.

B. Clean, repair, or restore damaged or mortar-splashed work to condition of new work.

END OF SECTION

SECTION 05 1200 - STRUCTURAL STEEL FRAMING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Structural steel framing members, support members.

B. Loose lintels.

C. Base plates.

D. Grouting under base plates.

1.2. RELATED REQUIREMENTS

A. Section 05 2100 - Steel Joist Framing.

B. Section 05 3100 - Steel Decking: Support framing for small openings in deck.

C. Section 07 8100 - Applied Fire Protection: Fireproof protection to framing and metal deck systems.

D. Section 07 8123 - Intumescent Fire Protection: Fireproof protection to framing in selected areas.

E. Section 09 9113 - Exterior Painting and Section 09 9123 - Interior Painting: surface preparation and priming requirements.

1.3. REFERENCE STANDARDS

A. AISC (MAN) - Steel Construction Manual; American Institute of Steel Construction, Inc.; 2011.

B. AISC S303 - Code of Standard Practice for Steel Buildings and Bridges; American Institute of Steel Construction, Inc.; 2010.

C. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

D. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

E. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2010.

F. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2013.

G. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2013.

H. ASTM A529/A529M - Standard Specification for High-Strength Carbon-Manganese Steel of Structural Quality; 2005 (Reapproved 2009).

I. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).

J. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.

K. ASTM A992/A992M - Standard Specification for Structural Steel Shapes; 2011.

L. ASTM C1107/C1107M - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink); 2014.

M. ASTM E94 - Standard Guide for Radiographic Examination; 2004 (Reapproved 2010).

N. ASTM E164 - Standard Practice for Contact Ultrasonic Testing of Weldments; 2013.

O. ASTM E165/E165M - Standard Test Method for Liquid Penetrant Examination for General Industry; 2012.

P. ASTM E709 - Standard Guide for Magnetic Particle Testing; 2014.

Q. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.

R. ASTM F959 - Standard Specification for Compressible-Washer-Type Direct Tension Indicators for Use with Structural Fasteners; 2013.

S. ASTM F1554 - Standard Specification for Anchor Bolts, Steel, 36, 55, and 105-ksi Yield Strength; 2007a.

T. ASTM F1852 - Standard Specification for "Twist Off" Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2011.

U. ASTM F2280 - Standard Specification for “Twist Off” Type Tension Control Structural Bolt/Nut/Washer Assemblies, Steel, Heat Treated, 150 ksi Minimum Tensile Strength; 2012.

V. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; American Welding Society; 2012.

W. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2011 w/Errata.

X. RCSC (HSBOLT) - Specification for Structural Joints Using High-Strength Bolts; Research Council on Structural Connections; 2009.

1.4. COORDINATION

A. Coordinate selection of shop primers with topcoats to be applied over them. Comply with paint and coating manufacturers' written recommendations to ensure that shop primers and topcoats are compatible with one another.

B. Coordinate installation of anchorage items to be embedded in or attached to other construction without delaying the Work. Provide setting diagrams, sheet metal templates, instructions, and directions for installation.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate profiles, sizes, spacing, locations of structural members, openings, attachments, and cuts.
2. Connections, connections not detailed, splices, and holes.
3. Indicate welded connections with AWS A2.4 welding symbols. Distinguish between shop and field welds, and show size, length, and type of each weld. Show backing bars that are to be removed and supplemental fillet welds where backing bars are to remain.
4. Indicate type, size, and length of bolts. Distinguish between shop and field bolts. Identify pretensioned and slip-critical, high-strength bolted connections.
5. Include embedment Drawings.

C. Manufacturer's Mill Certificate: Certify that products meet or exceed specified requirements.

D. Mill Test Reports for structural steel: Indicate structural strength, and chemical and physical properties.

E. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months.

F. Product Data: For each type of product. Include Test Reports for the following:

1. Bolts, nuts, and washers including mechanical properties and chemical analysis.
2. Direct-tension indicators.
3. Tension-control, high-strength, bolt-nut-washer assemblies.
4. Shop Primers.
5. Non-shrink grout.

G. Paint Compatibility Certificates: From manufacturers of topcoats applied over shop primers, certifying that shop primers are compatible with topcoats.

H. Source quality-control reports.

1.6. QUALITY ASSURANCE

A. Fabricate structural steel members in accordance with AISC "Steel Construction Manual."

B. Fabricate steel fasteners in accordance with RCSC "Specification for Structural Joints Using ASTM A325 or A490 Bolts."

C. Fabricator: Company specializing in performing the work of this section with minimum 5 years of documented experience.

D. Erector: Company specializing in performing the work of this section with minimum 5 years of documented experience.

E. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

F. Design connections not detailed on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Store materials to permit easy access for inspection and identification. Keep steel members off ground and spaced by using pallets, dunnage, or other supports and spacers. Protect steel members and packaged materials from corrosion and deterioration.

1. Do not store materials on structure in a manner that might cause distortion, damage, or overload to members or supporting structures. Repair or replace damaged materials or structures as directed.

B. Store fasteners in a protected place in sealed containers with manufacturer's labels intact.

1. Fasteners may be repackaged provided Owner's testing and inspecting agency observes repackaging and seals containers.

2. Clean and relubricate bolts and nuts that become dry or rusty before use.

3. Comply with manufacturers' written recommendations for cleaning and lubricating ASTM F 1852 fasteners and for retesting fasteners after lubrication.

PART 2 PRODUCTS

2.1. MATERIALS

A. Steel Angles, Plates, and Channels: ASTM A36/A36M.

B. Steel W Shapes and Tees: ASTM A992/A992M.

C. Rolled Steel Structural Shapes: ASTM A992/A992M.

D. Steel Bars: ASTM A529/A529M high-strength, carbon-manganese structural steel, Grade 50.

E. Cold-Formed Structural Tubing: ASTM A500/A500M, Grade B.

F. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325 or A325M, Type 1, medium carbon, plain, with matching compatible ASTM A563 Grade C or A563M Class 8S heavy-hex carbon-steel nuts and ASTM F436 Type 1 hardened carbon-steel washers.

1. Direct-Tension Indicators: ASTM F 959, Type 325 (ASTM F 959M, Type 8.8), compressible-washer type with plain finish.

G. Tension Control Bolts: Twist-off type; ASTM F1852 or ASTM F2280.

H. Unheaded Anchor Rods: ASTM F1554, per Documents (Grade 36 minimum), plain. Provide Hot-dip zinc coating, ASTM A 153/A 153M, Class C at exterior conditions. Provide matching ASTM A563 or A563M heavey-hex carbon-steel nuts and ASTM F436 Type 1 hardened carbon-steel washers.

I. Load Indicator Washers: Provide washers complying with ASTM F959 at connections requiring high-strength bolts.

J. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

2.2. GROUT

A. Grout: Non-shrink, non-metallic aggregate type, complying with ASTM C1107/C1107M and capable of developing a minimum compressive strength of 7,000 psi at 28 days. Use factory-packaged, nonmetallic aggregate grout, noncorrosive and nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

B. See Specification Section 03 3000.

2.3. PRIMER

A. Shop and Touch-Up Primer: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

B. Touch-Up Primer for Galvanized Surfaces: Fabricator's standard, complying with VOC limitations of authorities having jurisdiction.

2.4. FABRICATION

A. Shop fabricate to greatest extent possible. Fabricate according to AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," and to AISC 360.

1. Identify high-strength structural steel according to ASTM A 6/A 6M and maintain markings until structural steel has been erected.

2. Mark and match-mark materials for field assembly.

3. Complete structural-steel assemblies, including welding of units, before starting shop- priming operations.

B. Thermal Cutting: Perform thermal cutting by machine to greatest extent possible.

1. Plane thermally cut edges to be welded to comply with requirements in AWS D1.1/D1.1M.

C. Holes: Provide holes required for securing other work to structural steel and for other work to pass through steel members.

1. Cut, drill, or punch holes perpendicular to steel surfaces. Do not thermally cut bolt holes or enlarge holes by burning.

2. Baseplate Holes: Cut, drill, mechanically thermal cut, or punch holes perpendicular to steel surfaces.

3. Weld threaded nuts to framing and other specialty items indicated to receive other work.

D. Bolt Holes: Cut, drill, mechanically thermal cut, or punch standard bolt holes perpendicular to metal surfaces.

2.5. SHOP CONNECTIONS

A. High-Strength Bolts: Shop install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A 325 or A 490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened shear connections, Pretension moment connections.

B. Weld Connections: Comply with AWS D1.1/D1.1M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.

1. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303 for mill material.

2.6. FINISH

A. Finishing: Accurately finish ends of columns and other members transmitting bearing loads.

B. Prepare structural component surfaces in accordance with SSPC SP 6. Remove loose rust and mill scale and spatter, slag or flux deposits.

C. Priming: Immediately after surface preparation, apply primer according to manufacturer's written instructions and at rate recommended by SSPC to provide a minimum dry film thickness of 1.5 mils. Use priming methods that result in full coverage of joints, corners, edges, and exposed surfaces.

1. Stripe paint corners, crevices, bolts, welds, and sharp edges.
2. Apply two coats of shop paint to surfaces that are inaccessible after assembly or erection. Change color of second coat to distinguish it from first.

D. Shop prime structural steel members. Do not prime surfaces that will be galvanized, fireproofed, field welded, high strength bolted, or embedded in concrete or mortar..

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

1. Fill vent and drain holes that are exposed in the finished Work unless they function as weep holes, by plugging with zinc solder and filing off smooth.
2. Galvanize lintels and shelf angles attached to structural-steel frame and located in exterior walls.
3. Galvanize all exterior steel members and connectors.

2.7. SOURCE QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform shop tests and inspections.

1. Provide testing agency with access to places where structural-steel work is being fabricated or produced to perform tests and inspections.

B. High-Strength Bolts: Provide testing and verification of shop-bolted connections in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts."

C. Welded Connections: Visually inspect all shop-welded connections using one of the following at the testing agency's option:

1. Radiographic testing performed in accordance with ASTM E94.
2. Ultrasonic testing performed in accordance with ASTM E164.
3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
4. Magnetic particle inspection performed in accordance with ASTM E709.

D. In addition to visual inspection, test and inspect shop-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 according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

E. Prepare test and inspection reports.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify, with certified steel erector present, elevations of concrete- and masonry-bearing surfaces and locations of anchor rods, bearing plates, and other embedments for compliance with requirements.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. PREPARATION

A. Provide temporary shores, guys, braces, and other supports during erection to keep structural steel secure, plumb, and in alignment against temporary construction loads and loads equal in intensity to

design loads. Remove temporary supports when permanent structural steel, connections, and bracing are in place unless otherwise indicated.

3.3. ERECTION

A. Erect structural steel in compliance with AISC "Code of Standard Practice for Steel Buildings and Bridges," accurately in locations and to elevations indicated.

B. Baseplates, Bearing Plates, and Leveling Plates: Clean concrete- and masonry-bearing surfaces of bond-reducing materials, and roughen surfaces prior to setting plates. Clean bottom surface of plates.

1. Set plates for structural members on wedges, shims, or setting nuts as required.
2. Weld plate washers to top of baseplate.
3. Snug-tighten anchor rods after supported members have been positioned and plumbed unless indicated to be pretensioned. Do not remove wedges or shims but, if protruding, cut off flush with edge of plate before packing with grout.
4. Promptly pack grout solidly between bearing surfaces and plates so no voids remain. Neatly finish exposed surfaces; protect grout and allow to cure. Comply with manufacturer's written installation instructions for shrinkage-resistant grouts

C. Allow for erection loads, and provide sufficient temporary bracing to maintain structure in safe condition, plumb, and in true alignment until completion of erection and installation of permanent bracing.

D. Align and adjust various members that form part of complete frame or structure before permanently fastening. Before assembly, clean bearing surfaces and other surfaces that are in permanent contact with members. Perform necessary adjustments to compensate for discrepancies in elevations and alignment.

1. Level and plumb individual members of structure.
2. Make allowances for difference between temperature at time of erection and mean temperature when structure is completed and in service.

E. Splice members where indicated.

F. Do not use thermal cutting during erection unless approved by Construction Representative. Finish thermally cut sections within smoothness limits in AWS D1.1/D1.1M.

G. High-Strength Bolts: Install high-strength bolts according to RCSC's "Specification for Structural Joints Using ASTM A325 or A490 Bolts" for type of bolt and type of joint specified.

1. Joint Type: Snug tightened shear connections and Pretensioned moment connections.
2. Do not enlarge unfair holes in members by burning or using drift pins. Ream holes that must be enlarged to admit bolts.

H. Field weld components indicated on shop drawings.

1. Comply with AWS D1.1/D1.1M and AWS D1.8/D1.8M for tolerances, appearances, welding procedure specifications, weld quality, and methods used in correcting welding work.
2. Comply with AISC 303 and AISC 360 for bearing, alignment, adequacy of temporary connections, and removal of paint on surfaces adjacent to field welds.
3. Remove backing bars or runoff tabs, back gouge, and grind steel smooth.
4. Assemble and weld built-up sections by methods that maintain true alignment of axes without exceeding tolerances in AISC 303, "Code of Standard Practice for Steel Buildings and Bridges," for mill material.

I. Do not field cut or alter structural members without approval of Architect.

J. After erection, prime welds, abrasions, and surfaces not shop primed, except surfaces to be in contact with concrete.

K. Grout solidly between column plates and bearing surfaces, complying with manufacturer's instructions for nonshrink grout. Trowel grouted surfaces smooth, splaying neatly to 45 degrees.

3.4. TOLERANCES

A. Maintain erection tolerances of structural steel within AISC 303, "Code of Standard Practice for Steel Buildings and Bridges."

3.5. FIELD QUALITY CONTROL

A. Owner shall engage an independent testing agency to perform field quality control tests, as specified in Section 01 4000 to include the following inspections:

1. Verify structural-steel materials and inspect steel frame joint details.
2. Verify weld materials and inspect welds.
3. Verify connection materials and inspect high-strength bolted connections.

B. High-Strength Bolts: Provide testing and verification of field-bolted connections in accordance with RCSC "Specification for Structural Joints Using High-Strength Bolts."____

C. Welded Connections: Visually inspect all field-welded connections in accordance with AWS D.1./D1.1M and test using one of the following, at the testing agency's option:

1. Radiographic testing performed in accordance with ASTM E94.
2. Ultrasonic testing performed in accordance with ASTM E164.
3. Liquid penetrant inspection performed in accordance with ASTM E165/E165M.
4. Magnetic particle inspection performed in accordance with ASTM E709.

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 according to requirements in AWS D1.1/D1.1M on additional shear connectors if weld fracture occurs on shear connectors already tested.

3.6. REPAIRS AND PROTECTION

A. Galvanized Surfaces: Clean areas where galvanizing is damaged or missing and repair galvanizing to comply with ASTM A 780/A 780M.

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

SECTION 05 2100 - STEEL JOIST FRAMING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Open web steel joists, with bridging, attached seats and anchors.

B. Loose bearing members, such as plates or angles, and anchor bolts for site placement.

C. Supplementary framing for roof openings greater than 18 inches.

1.2. RELATED REQUIREMENTS

A. Section 05 1200 - Structural Steel Framing: Superstructure framing.

B. Section 05 3100 - Steel Decking: Bearing plates and angles.

C. Section 05 5000 - Metal Fabrications: Non-framing steel fabrications attached to joists.

1.3. REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014.

C. ASTM A325 - Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength; 2010.

D. ASTM A325M - Standard Specification for Structural Bolts, Steel, Heat Treated 830 MPa Minimum Tensile Strength (Metric); 2014.

E. ASTM A563 - Standard Specification for Carbon and Alloy Steel Nuts; 2007a (Reapproved 2014).

F. ASTM A563M - Standard Specification for Carbon and Alloy Steel Nuts [Metric]; 2007.

G. ASTM F436 - Standard Specification for Hardened Steel Washers; 2011.

H. AWS B2.1/B2.1M - Specification for Welding Procedure and Performance Qualification; 2014.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2011 w/Errata.

J. SJI (SPEC) - Catalog of Standard Specifications and Load Tables for Steel Joists and Joist Girders; Steel Joist Institute; 2011.

K. SJI Technical Digest No. 9 - Handling and Erection of Steel Joists and Joist Girders; Steel Joist Institute; 2008.

L. SSPC-Paint 15 - Steel Joist Shop Primer; Society for Protective Coatings; 1999 (Ed. 2004).

M. SSPC-SP 2 - Hand Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

N. SSPC-SP 3 - Power Tool Cleaning; Society for Protective Coatings; 1982 (Ed. 2004).

1.4. DEFINITIONS

A. SJI's "Specifications": Steel Joist Institute's "Standard Specifications, Load Tables and Weight Tables for Steel Joists and Joist Girders."

B. Special Joists: Steel joists or joist girders requiring modification by manufacturer to support nonuniform, unequal, or special loading conditions that invalidate load tables in SJI's "Specifications."

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: For each type of joist, accessory, and product.

C. Shop Drawings: Indicate standard designations, joist coding, configurations, sizes, spacings, cambers, joist leg extensions, bridging, connections, attachments, and layout referencing and dimensioning

Structural Grid from Drawings. Include splice and connection locations and details. Indicate locations and details of bearing plates to be embedded in other construction.

D. Welders' Certificates: Submit manufacturer's certificates, certifying welders employed on the Work, verifying AWS qualification within the previous 12 months.

E. Manufacturer certificates.

F. Mill Certificates: For each type of bolt.

G. Comprehensive engineering analysis of joist girders and special joists signed and sealed by the qualified structural engineer responsible for its preparation.

1.6. QUALITY ASSURANCE

A. Design connections not detailed on the drawings under direct supervision of a Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located.

B. Perform Work, including that for headers and other supplementary framing, in accordance with SJI Standard Specifications Load Tables and SJI Technical Digest No.9.

C. Manufacturer Qualifications: A manufacturer certified by SJI to manufacture joists complying with applicable standard specifications and load tables in SJI's "Specifications."

1. Manufacturer's responsibilities include providing professional engineering services for designing joist girders and special joists to comply with performance requirements.

D. Welding Qualifications: Qualify field-welding procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

1.7. DELIVERY, STORAGE, AND HANDLING

A. Transport, handle, store, and protect products to SJI requirements.

B. Protect joists from corrosion, deformation, and other damage during delivery, storage, and handling.

1.8. SEQUENCING

A. Deliver steel bearing plates to be built into cast-in-place concrete and masonry construction.

PART 2 PRODUCTS

2.1. PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide special joists and connections capable of withstanding design loads indicated.

1. Use ASD; data are given at service-load level.

2. Design special joists to withstand design loads with live-load deflections no greater than the following:

a. Roof Joists: Vertical deflection of l/240 of the span for total load.

2.2. MATERIALS

A. Open Web Joists: SJI Type K Joists:

1. Provide bottom chord extensions as indicated.

2. Minimum End Bearing on Steel Supports: Comply with referenced SJI standard.

3. Minimum End Bearing on Concrete or Masonry Supports: Comply with referenced SJI standard.

4. Extended Ends: Extend bearing ends of joists with SJI's Type R extended ends where indicated, complying with SJI's "Specifications."

5. Finish: Shop primed.

B. Steel Joist Substitutes: Manufacture according to "Standard Specifications for Open Web Steel Joists, K-Series" in SJI's "Specifications," with steel-angle or -channel members.

C. Camber joists according to referenced SJI standards.

D. Provide holes in chord members for connecting and securing other construction to joists.

E. High-Strength Structural Bolts, Nuts, and Washers: ASTM A325 or ASTM A325M, Type 1, medium carbon, galvanized, with matching compatible ASTM A563 or ASTM A563M nuts and ASTM F436 washers.

F. Structural Steel For Supplementary Framing and Joist Leg Extensions: ASTM A36/A36M.

G. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

H. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.

1. Primer: Provide shop primer that complies with Section 09 9113 - Exterior Painting and Section 09 9123 - Interior Painting.

2.3. JOIST ACCESSORIES

A. Bridging: Provide bridging anchors and number of rows of horizontal or diagonal bridging of material, size, and type required by SJI's "Specifications" for type of joist, chord size, spacing, and span. Furnish additional erection bridging if required for stability.

B. Fabricate steel bearing plates from ASTM A 36/A 36M steel with integral anchorages of sizes and thicknesses indicated.

C. Steel bearing plates with integral anchorages are specified in Section 05 5000 - Metal Fabrications.

D. Furnish ceiling extensions, either extended bottom-chord elements or a separate extension unit of enough strength to support ceiling construction. Extend ends to within 1/2 inch of finished wall surface unless otherwise indicated.

E. Carbon-Steel Bolts and Threaded Fasteners: ASTM A 307, Grade A (ASTM F 568M, Property Class 4.6), carbon-steel, hex-head bolts and threaded fasteners; carbon-steel nuts; and flat, unhardened steel washers.

1. Finish: Plain, uncoated.

F. Furnish miscellaneous accessories including splice plates and bolts required by joist manufacturer to complete joist assembly.

2.4. FABRICATION

A. Frame special sized openings in joist web framing as detailed.

2.5. FINISH

A. Shop prime joists as specified in Section 09 9113 - Exterior Painting and Section 09 9123 - Interior Painting.

1. Do not prime surfaces that will be fireproofed.

2. Apply one coat of shop primer to joists and joist accessories to be primed to provide a continuous, dry paint film not less than 1 mil thick.

B. Prepare surfaces to be finished in accordance with SSPC-SP 2.

PART 3 EXECUTION

3.1. EXAMINATION

A. Examine supporting substrates, embedded bearing plates, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. ERECTION

A. Erect joists with correct bearing on supports.

B. Allow for erection loads. Provide sufficient temporary bracing to maintain framing safe, plumb, and in true alignment. Do not install joists until supporting construction is in place and secured.

C. Install joists and accessories plumb, square, and true to line; securely fasten to supporting construction according to SJI's "Specifications," joist manufacturer's written recommendations, and requirements in this Section.

1. Before installation, splice joists delivered to Project site in more than one piece.

2. Space, adjust, and align joists accurately in location before permanently fastening.

3. Delay rigidly connecting bottom-chord extensions to columns or supports until dead loads are applied.

D. Coordinate the placement of anchors for securing loose bearing members furnished as part of the work of this section.

E. After joist alignment and installation of framing, field weld joist seats to steel bearing surfaces. Comply with AWS requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work,

F. Bolt joists to supporting steel framework using carbon-steel bolts.

G. Install and connect bridging concurrently with joist erection, before construction loads are applied. Anchor ends of bridging lines at top and bottom chords if terminating at walls or beams.

H. Install supplementary framing for floor and roof openings greater than 18 inches.

I. Do not permit erection of decking until joists are braced, bridged, and secured or until completion of erection and installation of permanent bridging and bracing.

J. Do not field cut or alter structural members without approval of joist manufacturer.

K. After erection, prime welds, damaged shop primer, damaged galvanizing, and surfaces not shop primed, except surfaces specified not to be primed.

3.3. FIELD QUALITY CONTROL

A. Owner shall engage an independent testing agency to inspect field welds and bolted connections and to perform field quality control tests, and prepare test and inspection reports, as specified in Section 01 4000 - Quality Requirements.

B. Visually inspect field welds according to AWS D1.1/D1.1M.

C. Visually inspect bolted connections.

D. Correct deficiencies in Work that test and inspection reports have indicated are not in compliance with specified requirements.

E. Perform additional testing or inspection at contractor’s expense to determine compliance of corrected Work with specified requirements.

3.4. PROTECTION

A. Touchup Painting: After installation, promptly clean, prepare, and prime or reprime field connections, rust spots, and abraded surfaces of prime-painted joists, bearing plates, abutting structural steel, and accessories.

1. Clean and prepare surfaces by hand-tool cleaning according to SSPC-SP 2, or power-tool cleaning according to SSPC-SP 3.

2. Apply a compatible primer of same type as primer used on adjacent surfaces.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and installer that ensures that joists and accessories are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 3100 - STEEL DECKING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Roof deck.

B. Metal form deck.

C. Supplementary framing for openings up to and including 12 inches.

1.2. RELATED REQUIREMENTS

A. Section 03 2000 - Concrete Reinforcing.

B. Section 03 3000 - Cast-in-Place Concrete: Concrete topping over metal deck.

C. Section 05 1200 - Structural Steel Framing: Support framing for openings larger than 12 inches .

D. Section 05 2100 - Steel Joist Framing: Support framing for openings larger than 18 inches and shear stud connectors.

E. Section 07 8100 - Applied Fire Protection: Spray applied fireproofing.

1.3. REFERENCE STANDARDS

A. ASTM A510/A510M - Standard Specification for General Requirements for Wire Rods and Coarse Round Wire, Carbon Steel, and Alloy Steel; 2013.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2013.

D. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2011 w/Errata.

E. ICC-ES AC43 - Acceptance Criteria for Steel Deck Roof and Floor Systems; ICC Evaluation Service, Inc.; 2010 (R2013).

F. ICC-ES AC70 - Acceptance Criteria for Fasteners Power Driven into Concrete, Steel and Masonry Elements; ICC Evaluation Service, Inc.; 2013.

G. SDI (DM) - Publication No.31, Design Manual for Composite Decks, Form Decks, Roof Decks; Steel Deck Institute; 2007.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Shop Drawings: Indicate deck plan and layout, types of deck panels, anchorage details and attachment to other construction, support locations, projections, openings, reinforcement, pertinent details, and accessories.

C. Product Data: Provide deck profile characteristics, dimensions, structural properties, and finishes.

D. Product Test Reports: Based on evaluation of comprehensive tests performed by a qualified testing agency, indicating that each of the following complies with requirements:

1. Power-actuated mechanical fasteners.

E. Certificates: Certify that products furnished meet or exceed specified requirements.

F. Welders Certificates: Certify welders employed on the Work, verifying AWS qualification within the previous 12 months with the gage(s) of material specified.

G. Field quality-control reports.

1.5. QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.3, "Structural Welding Code - Sheet Steel."

1.6. DELIVERY, STORAGE, AND HANDLING

A. Protect steel deck from corrosion, deformation, and other damage during delivery, storage, and handling.

B. Store deck on dry wood sleepers, platforms, or pallets; slope for positive drainage. Protect with a waterproof covering and ventilate to avoid condensation.

PART 2 PRODUCTS

2.1. PERFORMANCE REQUIREMENTS

A. AISI Specifications: Comply with calculated structural characteristics of steel deck according to AISI's "North American Specification for the Design of Cold-Formed Steel Structural Members."

2.2. STEEL DECK

A. Roof Deck: Non-composite type, fluted steel sheet, fabricated panels without top-flange stiffening grooves:

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
2. Structural Properties:
    a. Span Design: 3-span or more.
3. Minimum Base Metal Thickness: 20 gage, 0.0359 inch or as indicated in Drawings.
4. Nominal Height: 1-1/2 inch.
5. Profile: As indicated.
6. Side Joints: Lapped, mechanically fastened
7. End Joints: as indicated.

B. Metal Form Deck: Corrugated sheet steel, with provision for ventilation of concrete:

1. Galvanized Steel Sheet: ASTM A653/A653M, Structural Steel (SS) Grade 33/230, with G90/Z275 galvanized coating.
2. Minimum Base Metal Thickness: 20 gage, 0.00359 inch.
3. Nominal Height: 1-1/2 inch.
4. Formed Sheet Width: 24 inch.
5. Side Joints: Lapped, mechanically fastened.
6. End Joints: as indicated.

2.3. ACCESSORY MATERIALS

A. Welding Materials: AWS D1.1/D1.1M.

B. Fasteners: Galvanized hardened steel, self tapping.

C. Powder Actuated Mechanical Fasteners: Steel; with knurled shank and forged ballistic point. Comply with applicable requirements of ICC-ES AC70.

1. Material: Steel; ASTM A510/A510M, Grade 1077.
    a. Washers:
        1) Steel Bar Joist Framing Applications: 0.472 inch diameter, minimum.
    b. Corrosion Resistance:
        1) Steel Bar Joist Framing Applications: ASTM B 633, SC1, Type III zinc electroplate..

D. Mechanical Fasteners: Steel; hex washer head, self-drilling, self-tapping.

1. Side-Lap Fasteners: Corrosion-resistant, hexagonal washer head; self-drilling, carbon-steel screws, No. 10 minimum diameter.

E. Weld Washers: Mild steel, uncoated, 3/4 inch outside diameter, 1/8 inch thick.

F. Galvanizing Repair Paint: ASTM A 780.

G. Flute Closures: Closed cell vulcanized, synthetic rubber, minimum 1 inch thick; profiled to fit tight to the deck.

2.4. FABRICATED DECK ACCESSORIES

A. Miscellaneous Sheet Metal Deck Accessories: Steel sheet, minimum yield strength of 33,000 psi, not less than 0.0359-inch design uncoated thickness, of same material and finish as deck; of profile indicated or required for application.

B. Sheet Metal Deck Accessories: Metal closure strips, wet concrete stops, and cover plates, 22 gage, 0.0299 inch thick sheet steel; of profile and size as indicated; finished same as deck.

C. Column Closures, End Closures, Z-Closures, and Cover Plates: Steel sheet, of same material, finish, and thickness as deck unless otherwise indicated.

D. Pour Stops and Girder Fillers: Steel sheet, minimum yield strength of 33,000 psi, of same material and finish as deck, and of thickness and profile recommended by SDI Publication No. 31 for overhang and slab depth.

PART 3 EXECUTION

3.1. EXAMINATION

A. Examine supporting frame and field conditions for compliance with requirements for installation tolerances and other conditions affecting performance.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. INSTALLATION, GENERAL

A. Erect metal deck in accordance with SDI Design Manual and manufacturer's instructions. Align and level.

B. Install temporary shoring before placing deck panels if required to meet deflection limitations.

C. Locate deck bundles to prevent overloading of supporting members.

D. Place deck panels on supporting frame and adjust to final position with ends accurately aligned and bearing on supporting frame before being permanently fastened. Do not stretch or contract side-lap interlocks.

E. Place deck panels flat and square and fasten to supporting frame without warp or deflection.

F. Cut and neatly fit deck panels and accessories around openings and other work projecting through or adjacent to deck.

G. Provide additional reinforcement and closure pieces at openings as required for strength, continuity of deck, and support of other work.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding, appearance and quality of welds, and methods used for correcting welding work.

I. Mechanical fasteners shall be used in lieu of welding to fasten deck where indicated. Locate mechanical fasteners and install according to deck manufacturer's written instructions.

3.3. FLOOR-DECK INSTALLATION

A. Fasten floor-deck panels to steel supporting members as indicated

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of half of the span or 36 inches, and indicated on the drawings.

C. On steel supports and at end bearing provide minimum 1-1/2 inch bearing with end joints lapped.

D. Fasten deck to steel support members at ends and intermediate supports at 12 inches on center maximum, parallel with the deck flute and at each transverse flute using methods specified.

E. At mechanically fastened male/female side laps fasten at 24 inches on center maximum.

F. Drive mechanical sidelap connectors completely through adjacent lapped sheets; positively engage adjacent sheets with minimum three-thread penetration.

G. Pour Stops and Girder Fillers: Weld steel sheet pour stops and girder fillers to supporting structure according to SDI recommendations unless otherwise indicated. Provide stops of sufficient strength to remain stationary without distortion.

H. Floor-Deck Closures: Weld steel sheet column closures, cell closures, and Z-closures to deck, according to SDI recommendations, to provide tight-fitting closures at open ends of ribs and sides of deck.

I. Close openings above walls and partitions perpendicular to deck flutes with single row of foam cell closures.

3.4. ROOF-DECK INSTALLATION

A. Fasten roof-deck panels to steel supporting members as indicated.

B. Side-Lap and Perimeter Edge Fastening: Fasten side laps and perimeter edges of panels between supports, at intervals as indicated.

C. End Bearing: Install deck ends over supporting frame with a minimum end bearing of 1-1/2 inches, with end joints as follows:

1. End Joints: Lapped 2 inches minimum.

D. Miscellaneous Roof-Deck Accessories: Install finish strips, end closures, and reinforcing channels according to deck manufacturer's written instructions. Weld or mechanically fasten to substrate to provide a complete deck installation.

3.5. FIELD QUALITY CONTROL

A. Testing Agency: Owner will engage a qualified testing agency to perform tests and inspections.

B. Field welds will be subject to inspection.

C. Testing agency will report inspection results promptly and in writing to Contractor and Construction Representative.

D. Remove and replace work that does not comply with specified requirements.

E. Additional inspecting, at Contractor's expense, will be performed to determine compliance of corrected work with specified requirements.

3.6. PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on both surfaces of deck with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions to ensure that steel deck is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 4000 - COLD-FORMED METAL FRAMING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Formed steel stud exterior wall and interior wall framing.

B. Formed steel joist and purlin framing and bridging.

1.2. RELATED REQUIREMENTS

A. Section 05 3100 - Steel Decking.

B. Section 09 2116 - Gypsum Board Assemblies: Lightweight, non-load bearing metal stud framing.

1.3. REFERENCE STANDARDS

A. AISI S100-12 - North American Specification for the Design of Cold-Formed Steel Structural Members; American Iron and Steel Institute; 2012.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2009.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2013.

D. ASTM C955 - Standard Specification for Load-Bearing (Transverse and Axial) Steel Studs, Runners (Tracks), and Bracing or Bridging for Screw Application of Gypsum Panel Products and Metal Plaster Bases; 2011c.

E. ASTM C1007 - Standard Specification for Installation of Load Bearing (Transverse and Axial) Steel Studs and Related Accessories; 2011a.

F. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2011 w/Errata.

G. AWS D1.3/D1.3M - Structural Welding Code - Sheet Steel; American Welding Society; 2008.

H. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); Society for Protective Coatings; 2002 (Ed. 2004).

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordinate with work of other sections that is to be installed in or adjacent to the metal framing system, including but not limited to structural anchors, cladding anchors, utilities, insulation, and firestopping.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on standard framing members; describe materials and finish, product criteria, limitations .

C. Product Data: Provide manufacturer's data on factory-made framing connectors, showing compliance with requirements.

D. Shop Drawings: Indicate component details, framed openings, bearing, anchorage, loading, welds, and type and location of fasteners, and accessories or items required of related work.

1. Indicate stud and ceiling joist layout, spacing, sizes, thickness, and types of cold-formed steel framing.

2. Describe method for securing studs to tracks and for bolted, welded, or screwed framing connections.

3. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

4. Provide design engineer's stamp on shop drawings.

E. Delegated-Design Submittal: For cold-formed steel framing members and connections including calculations and drawings sealed by a licensed Structural Engineer in the State of Illinois.

F. Manufacturer's Installation Instructions: Indicate special procedures, conditions requiring special attention .

G. Qualification Data: For testing agency.

1.6. QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Designer Qualifications: Design framing system under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."

2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

1.7. DELIVERY, STORAGE, AND HANDLING

A. Protect cold-formed steel framing from corrosion, moisture staining, deformation, and other damage during delivery, storage, and handling.

PART 2 PRODUCTS

2.1. PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 01 4000 - Quality Requirements, to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on GENERAL STRUCTURAL NOTES sheet in the Drawings.

2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:

a. Non-Gravity, Lateral Load-Bearing Wall Framing: Horizontal deflection of 1/600 of the wall height.

3. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Design Standards:

1. Floor and Roof Systems: AISI S210.

2. Wall Studs: AISI S211.

3. Headers: AISI S212.

4. Lateral Design: AISI S213.

D. AISI Specifications and Standards: Unless more stringent requirements are indicated, comply with AISI S100 and AISI S200.

2.2. FRAMING SYSTEM

A. Provide primary and secondary framing members, bridging, bracing, plates, gussets, clips, fittings, reinforcement, and fastenings as required to provide a complete framing system.

B. Shop fabricate framing system to the greatest extent possible.

C. Deliver to site in largest practical sections.

2.3. FRAMING MATERIALS

A. Sizes and thicknesses indicated are minimums. See Drawings for sizes and thicknesses.

B. Studs and Track: ASTM C955; studs formed to channel, "C", or "Sigma" shape with punched web; U-shaped track, unpunched, in matching nominal depth and compatible height.

1. Gage and Depth: As indicated on the drawings.
2. Stud Flange Width:: 1-5/8 inch minimum
3. Track Flange Width: 1-1/4 inch minimum

C. Steel Box or Back-to-Back Headers: Manufacturer's standard C-shapes used to form header beams, of web depths indicated, unpunched, with stiffened flanges, and as indicated on drawings

D. Exterior Soffit Frame: Manufacturer's standard C-shaped steel sections, of web depths indicated, with stiffened flanges, and as indicated on drawings

E. Joists and Purlins: Fabricated from ASTM A653/A653M steel sheet, with G90/Z275 hot dipped galvanized coating.

1. Gage and Depth: As indicated on the drawings.

F. Framing Connectors: Factory-made, formed steel sheet.

1. Material: ASTM A653/A653M SS Grade 33 and 40 (minimum), with G90/Z275 hot dipped galvanized coating for base metal thickness less than 10 gage, 0.1345 inch, and factory punched holes and slots.
2. Structural Performance: Maintain load and movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
3. Movement Connections: Provide mechanical anchorage devices that accommodate movement using slotted holes, shouldered screws or screws and anti-friction or stepped bushings, while maintaining structural performance of framing. Provide movement connections where indicated on drawings.
4. Fixed Connections: Provide non-movement connections for tie-down to foundation, floor-to-floor tie-down, roof-to-wall tie-down, joist hangers, gusset plates, and stiffeners.
5. Wall Stud Bridging Connections: Provide mechanical load-transferring devices that accommodate wind load torsion and weak axis buckling induced by axial compression loads. Provide bridging connections where indicated on the drawings.

2.4. ACCESSORIES

A. Fabricate steel-framing accessories from steel sheet, ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of same grade and coating weight used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.

9. Hole reinforcing plates.
10. Backer plates.

C. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

D. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

2.5. FASTENERS

A. Self-Drilling, Self-Tapping Screws, Bolts, Nuts and Washers: Hot dip galvanized per ASTM A153/A153M.

1. Head Type: Low-profile head beneath sheathing, manufacturer's standard elsewhere.

B. Anchorage Devices: Powder actuated.

1. Fabricate from corrosion-resistant materials, with allowable load capacities calculated according to ICC- ES AC70, greater than or equal to the design load, as determined by testing per ASTM E 1190 conducted by a qualified testing agency.

C. Expansion Anchors: Fabricated from corrosion-resistant materials, with allowable load or strength design capacities calculated according to ICC-ES AC193 and ACI 318 greater than or equal to the design load, as determined by testing per ASTM E 488 conducted by a qualified testing agency.

D. Anchor Bolts: ASTM F 1554, Grade 36 hex-headed bolts and carbon-steel nuts; and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

E. Welding: In conformance with AWS D1.1/D1.1M.

2.6. FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.
    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners and install according to Shop Drawings, with screw penetrating joined members by no fewer than three exposed screw threads.
4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies to prevent damage or permanent distortion.

C. Fabrication Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of- square tolerance of 1/8 inch.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify supporting substrates and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. PREPARATION

A. Install load bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3. INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200 and to manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch.

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.

b. Locate mechanical fasteners and install according to Shop Drawings, and complying with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads comparable in intensity to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in Section 07 2100 - Thermal Insulation, in built-up exterior framing members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4. INSTALLATION OF STUDS

A. Install components in accordance with manufacturers' instructions and ASTM C1007 requirements.

B. Align floor and ceiling tracks; locate to wall layout. Secure in place with fasteners along the ceiling per Drawings or Shop drawings. Securely anchor at corners and ends, spaced at maximum 24 inches unless noted otherwise on Drawings or Shop Drawings. Coordinate installation of sealant with floor and ceiling tracks.

C. Squarely seat studs against top and bottom tracks with gap not exceeding of 1/8 inch between the end of wall framing member and the web of track. Place studs at 16 inches on center; not more than 2 inches from abutting walls and at each side of openings. Connect studs to tracks using fastener method.

1. Set studs plumb, except as needed for diagonal bracing or required for nonplumb walls or warped surfaces and similar configurations.

D. Construct corners using minimum of three studs. Install double studs at wall openings, door and window jambs unless noted otherwise on Drawings or Shop Drawings.

1. Install headers over wall openings wider than stud spacing. Locate headers above openings as indicated. Fabricate headers of compound shapes indicated or required to transfer load to supporting studs, complete with clip-angle connectors, web stiffeners, or gusset plates.
2. Fasten jamb members together to uniformly distribute loads.
3. Install runner tracks and jack studs above and below wall openings. Anchor tracks to jamb studs with clip angles or by welding, and space jack studs same as full-height wall studs.

E. Anchor studs abutting structural columns or walls, including masonry walls, to supporting structure as indicated.

F. Install load bearing studs full length in one piece. Splicing of studs is not permitted.

G. Install load bearing studs, brace, and reinforce to develop full strength and achieve design requirements.

H. Coordinate placement of insulation in multiple stud spaces made inaccessible after erection.

I. Install intermediate studs above and below openings to align with wall stud spacing.

J. Align studs vertically where floor framing interrupts wall-framing continuity.

K. Provide deflection allowance in stud track, directly below horizontal building framing at non-load bearing framing.

L. Install supplementary framing, blocking, and bracing in stud framing indicated to support fixtures, equipment, services, casework, heavy trim, furnishings, and similar work requiring attachment to framing.

1. If type of supplementary support is not indicated, comply with stud manufacturer’s written recommendations and industry standards in each case, considering weight or load resulting from item supported.

M. Install horizontal bridging in stud system, spaced vertically as indicated on Shop Drawings. Fasten at each stud intersection.

1. Bridging: Cold-rolled steel channel, welded or mechanically fastened to webs of punched studs with a minimum of two screws into each flange of the clip angle for framing members up to 6 inches deep.
2. Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and stud-track solid blocking of width and thickness to match studs. Fasten flat straps to stud flanges and secure solid blocking to stud webs or flanges.
3. Bridging: Proprietary bridging bars installed according to manufacturer's written instructions.

N. Install steel sheet diagonal bracing straps to both stud flanges, terminate at and fasten to reinforced top and bottom tracks. Fasten clip-angle connectors to multiple studs at ends of bracing and anchor to structure.

O. Install miscellaneous framing and connections, including supplementary framing, web stiffeners, clip angles, continuous angles, anchors, and fasteners, to provide a complete and stable wall-framing system.

3.5. INSTALLATION OF JOISTS AND PURLINS

A. Install framing components in accordance with manufacturer's instructions.

B. Make provisions for erection stresses. Provide temporary alignment and bracing.

3.6. WALL SHEATHING

A. Wall Sheathing: Secure with long dimension perpendicular to wall studs, with ends over firm bearing and staggered, using self-tapping screws.

3.7. TOLERANCES

A. Maximum Variation from True Position: 1/8 inch in 10 feet.

B. Maximum Variation of any Member from Plane: 1/8 inch.

3.8. FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Remove and replace work where test results indicate that it does not comply with specified requirements.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.9. REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780 and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 05 5100 - METAL STAIRS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Stairs with concrete treads.

B. Structural steel stair framing and supports.

C. Handrails and guards.

1.2. RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete fill in stair pans; mesh reinforcement for landings.

B. Section 03 3000 - Cast-in-Place Concrete: Placement of metal anchors in concrete.

C. Section 04 2000 - Unit Masonry: Placement of metal fabrications in masonry.

D. Section 05 5000 - Metal Fabrications.

E. Section 09 9123 - Interior Painting: Paint finish.

1.3. REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. AISC 201 - AISC Certification Program for Structural Steel Fabricators, Standard for Steel Building Structures; 2006.

C. ASTM A6/A6M - Standard Specification for General Requirements for Rolled Structural Steel Bars, Plates, Shapes, and Sheet Piling; 2019.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

F. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

G. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

H. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.

I. ASTM A307 - Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength; 2014, with Editorial Revision (2017).

J. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2020.

K. ASTM A501/A501M - Standard Specification for Hot-Formed Welded and Seamless Carbon Steel Structural Tubing; 2014.

L. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

M. ASTM A786/A786M - Standard Specification for Hot-Rolled Carbon, Low-Alloy, High-Strength Low-Alloy, and Alloy Steel Floor Plates; 2015.

N. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2018.

O. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

P. ASTM E935 - Standard Test Methods for Performance of Permanent Metal Railing Systems and Rails for Buildings; 2013, with Editorial Revision.

Q. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019.

R. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.

S. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

T. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

U. NAAMM AMP 510 - Metal Stairs Manual; 1992.

V. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).

W. SSPC-SP 2 - Hand Tool Cleaning; 2018.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.

2. Include the design engineer's seal and signature on each sheet of shop drawings.

1.5. QUALITY ASSURANCE

A. Structural Designer Qualifications: Professional Structural Engineer experienced in design of this work and licensed in the State in which the Project is located, or personnel under direct supervision of such an engineer.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Prefabricated Metal Stairs:

1. Lapeyre Stair, Inc: www.lapeyrestair.com/#sle.

2. Substitutions: See Section 01 6000 - Product Requirements.

2.2. METAL STAIRS - GENERAL

A. Metal Stairs: Provide stairs of the design specified, complete with landing platforms, vertical and horizontal supports, railings, and guards, fabricated accurately for anchorage to each other and to building structure.

1. Regulatory Requirements: Provide stairs and railings that comply with most stringent requirements of local, state, and federal regulations; where requirements of Contract Documents exceed those of regulations, comply with Contract Documents.

2. Handrails: Comply with applicable accessibility requirements of ADA Standards.

3. Structural Design: Provide complete stair and railing assemblies that comply with the applicable local code.

4. Dimensions: As indicated on drawings.

5. Shop assemble components; disassemble into largest practical sections suitable for transport and access to site.

6. No sharp or rough areas on exposed travel surfaces and surfaces accessible to touch.

7. Separate dissimilar metals using paint or permanent tape.

B. Metal Jointing and Finish Quality Levels:

1. Service: Exposed joints tight with face surfaces aligned; underside of stair not covered by soffit is not considered exposed to view.

a. Welded Joints: Welded on back side wherever possible.

b. Welds Exposed to View: Ground smooth; not required to be flush.

c. Bolts Exposed to View: Countersunk flat or oval head bolts; no exposed nuts or screw threads.

d. Metal Surfaces to be Painted: Sanded smooth, suitable for satin or matte finish.

C. Fasteners: Same material or compatible with materials being fastened; type consistent with design and specified quality level.

D. Anchors and Related Components: Same material and finish as item to be anchored, except where specifically indicated otherwise; provide all anchors and fasteners required.

2.3. METAL STAIRS WITH CONCRETE TREADS

A. Jointing and Finish Quality Level: Architectural, as defined above.

B. Risers: Closed.

C. Treads: Metal pan with field-installed concrete fill.

1. Concrete Depth: 1-1/2 inches, minimum.

2. Tread Pan Material: Steel sheet.

3. Tread Pan Thickness: As required by design; 14 gauge, 0.075 inch minimum.

4. Concrete Reinforcement: Welded wire mesh.

5. Concrete Finish: Applied abrasive grit.

D. Risers: Same material and thickness as tread pans.

1. Nosing Depth: Not more than 1-1/2 inch overhang.

E. Stringers: Rolled steel channels.

1. Stringer Depth: 10 inches.

2. End Closure: Sheet steel of same thickness as risers welded across ends.

F. Landings: Similar construction, using corrugated steel decking, supported and reinforced as required to achieve design load capacity.

G. Railings: Steel pipe railings.

H. Finish: Shop- or factory-prime painted.

2.4. HANDRAILS AND GUARDS

A. Wall-Mounted Rails: Round pipe or tube rails unless otherwise indicated.

1. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.

B. Guards:

1. Top Rails: Round pipe or tube rails unless otherwise indicated.

a. Outside Diameter: 1-1/4 inch, minimum, to 1-1/2 inches, maximum.

2. Infill at Picket Railings: Vertical pickets.

a. Horizontal Spacing: Maximum 4 inches on center.

b. Material: Solid steel bar.

c. Shape: Square.

d. Size: 1/2 inch square.

e. Top Mounting: Welded to underside of top rail.

f. Bottom Mounting: Welded to top surface of stringer.

3. End and Intermediate Posts: Same material and size as top rails.

a. Horizontal Spacing: As indicated on drawings.

b. Mounting: Welded to top surface of stringer.

2.5. MATERIALS

A. Steel Sections: ASTM A36/A36M.

B. Steel Tubing: ASTM A500/A500M or ASTM A501/A501M structural tubing, round and shapes as indicated.

C. Steel Plates: ASTM A6/A6M or ASTM A283/A283M.

D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.

E. Ungalvanized Steel Sheet: Hot- or cold-rolled, except use cold-rolled where finished work will be exposed to view.

1. Hot-Rolled Steel Sheet: ASTM A1011/A1011M, Designation CS (commercial steel).

2. Cold-Rolled Steel Sheet: ASTM A1008/A1008M, Designation CS (commercial steel).

F. Concrete Reinforcement: Mesh type as detailed, galvanized.

2.6. ACCESSORIES

A. Steel Bolts, Nuts, and Washers: ASTM A307, Grade A, plain.

B. Steel Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, and galvanized to ASTM A153/A153M where connecting galvanized components.

C. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.

D. Shop and Touch-Up Primer: SSPC-Paint 15, and comply with VOC limitations of authorities having jurisdiction.

2.7. SHOP FINISHING

A. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.

B. Do not prime surfaces in direct contact with concrete or where field welding is required.

C. Prime Painting: Use specified shop- and touch-up primer.

1. Preparation of Steel: In accordance with SSPC-SP 2, Hand Tool Cleaning.

2. Number of Coats: One.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that field conditions are acceptable and are ready to receive work.

3.2. PREPARATION

A. When field welding is required, clean and strip primed steel items to bare metal.

B. Supply items required to be cast into concrete and embedded in masonry with setting templates.

3.3. INSTALLATION

A. Install components plumb and level, accurately fitted, free from distortion or defects.

B. Allow for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.

C. Provide welded field joints where specifically indicated on drawings. Perform field welding in accordance with AWS D1.1/D1.1M.

D. Other field joints may be either welded or bolted provided the result complies with the limitations specified for jointing quality levels.

E. Obtain approval prior to site cutting or creating adjustments not scheduled.

F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

3.4. TOLERANCES

A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.

B. Maximum Offset From True Alignment: 1/4 inch.

END OF SECTION

SECTION 06 1000 - ROUGH CARPENTRY

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Roof-mounted curbs.

B. Roofing nailers.

C. Roofing cant strips.

D. Preservative treated wood materials.

E. Fire retardant treated wood materials.

F. Communications and electrical room mounting boards.

G. Concealed wood blocking, nailers, and supports.

H. Miscellaneous wood nailers, furring, and grounds.

1.2. RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.

B. Section 07 7200 - Roof Accessories: Prefabricated roof curbs.

C. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based exterior sheathing.

1.3. REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

E. ASTM D2898 - Standard Test Methods for Accelerated Weathering of Fire-Retardant-Treated Wood for Fire Testing; 2010.

F. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

G. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

H. AWPA U1 - Use Category System: User Specification for Treated Wood; 2012.

I. PS 20 - American Softwood Lumber Standard; 2010.

J. SPIB (GR) - Grading Rules; 2014.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide technical data on wood preservative materials and fire retardant treated materials.

C. Manufacturer's Certificate: Certify that wood products supplied for rough carpentry meet or exceed specified requirements.

1.5. DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, or installation.

1.6. 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

2.1. GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.

1. Species: Douglas Fir-Larch, unless otherwise indicated.

2. If no species is specified, provide any species graded by the agency specified; if no grading agency is specified, provide lumber graded by any grading agency meeting the specified requirements.

3. Grading Agency: Any grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee (www.alsc.org) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

4. Lumber of other species or grades is acceptable provided structural and appearance characteristics are equivalent to or better than products specified.

B. Lumber fabricated from old growth timber is not permitted.

2.2. DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:

1. Lumber: S4S, No. 2 or Standard Grade.

2. All wood materials used within the building shall be fire treated.

2.3. ACCESSORIES

A. Fasteners and Anchors:

1. Metal and Finish: Hot-dipped galvanized steel complying with ASTM A153/A153M for high humidity and preservative-treated wood locations, unfinished steel elsewhere.

2.4. FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.

1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.

2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:

1. Manufacturers:

a. Lonza Group: www.wolmanizedwood.com/#sle.

b. Hoover Treated Wood Products, Inc: www.frtw.com.

c. Koppers, Inc: www.koppersperformancechemicals.com/#sle.

d. Viance, LLC; D-Blaze: www.treatedwood.com/#sle.

2. Exterior Type: AWPA U1, Category UCFB, Commodity Specification H, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes both before and after accelerated weathering test performed in accordance with ASTM D2898.
    a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
    b. Treat all exterior rough carpentry items.
    c. Do not use treated wood in direct contact with the ground.
3. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
    a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
    b. All interior rough carpentry items are to be fire retardant treated.
    c. Treat rough carpentry items as indicated .
    d. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
1. Manufacturers:
    a. Lonza Group: www.wolmanizedwood.com/#sle.
    b. Koppers Performance Chemicals, Inc: www.koppersperformancechemicals.com/#sle.
    c. Viance, LLC; Preserve ACQ: www.treatedwood.com/#sle.
    d. Substitutions: See Section 01 6000 - Product Requirements.
2. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
    a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
    b. Treat lumber in contact with roofing, flashing, or waterproofing.
    c. Treat lumber in contact with masonry or concrete.
3. Preservative Pressure Treatment of Plywood Above Grade: AWPA U1, Use Category UC2 and UC3B, Commodity Specification F using waterborne preservative.
    a. Kiln dry plywood after treatment to maximum moisture content of 19 percent.
    b. Treat plywood in contact with roofing, flashing, or waterproofing.
    c. Treat plywood in contact with masonry or concrete.

PART 3 EXECUTION

3.1. PREPARATION

A. Coordinate installation of rough carpentry members specified in other sections.

3.2. INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.3. BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

C. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

D. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

E. Provide the following specific non-structural framing and blocking:

1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

3.4. ROOF-RELATED CARPENTRY

A. Coordinate installation of roofing carpentry with deck construction, framing of roof openings, and roofing assembly installation.

B. Provide wood curb at all roof openings except where specifically indicated otherwise. Form corners by alternating lapping side members.

3.5. TOLERANCES

A. Framing Members: 1/4 inch from true position, maximum.

B. Variation from Plane (Other than Floors): 1/4 inch in 10 feet maximum, and 1/4 inch in 30 feet maximum.

3.6. CLEANING

A. Waste Disposal: Comply with the requirements of Section 01 7419 - Construction Waste Management and Disposal.

1. Comply with applicable regulations.
2. Do not burn scrap on project site.
3. Do not burn scraps that have been pressure treated.
4. Do not send materials treated with pentachlorophenol, CCA, or ACA to co-generation facilities or “waste-to-energy” facilities.

B. Do not leave any wood, shavings, sawdust, etc. on the ground or buried in fill.

C. Prevent sawdust and wood shavings from entering the storm drainage system.

END OF SECTION

SECTION 06 4100 - ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Specially fabricated cabinet units.

B. Hardware.

C. Preparation for installing utilities.

1.2. RELATED REQUIREMENTS

A. Section 06 1000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

B. Section 12 3600 - Countertops.

1.3. REFERENCE STANDARDS

A. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

B. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

C. BHMA A156.9 - American National Standard for Cabinet Hardware; 2010.

D. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.

2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).

3. Include certification program label.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 8 inches square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, locksets, and surface materials, demonstrating hardware design, quality, and finish.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.6. QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.

1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.

2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.

B. Quality Certification:

1. AWI Certification is desired but not required upon the Bidder’s presentation of a quality control program acceptable to the Owner.

a. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.

2. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

3. Replace, repair, or rework all work for which certification is refused.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.8. FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.1. CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Plastic Laminate Faced Cabinets: Custom grade.

C. Cabinets:

1. Finish - Exposed Exterior Surfaces: Decorative laminate.

2. Finish - Exposed Interior Surfaces: Decorative laminate.

3. Finish - Semi-Exposed Surfaces: Thermoset decorative panels.

a. Edges of Thermoset Decorative Panel Shelves: PVC or polyester edge banding.

b. For semi-exposed backs of panels with exposed plastic laminate surfaces, provide surface of high-pressure decorative laminate, NEMA LD 3 Grade VGS.

4. Door and Drawer Front Edge Profiles: Square edge with thin applied band.

5. Casework Construction Type: Type A - Frameless.

6. Interface Style for Cabinet and Door: Style 1 - Overlay; flush overlay.

7. Layout for Cabinet and Door Fronts: Flush panel.

a. Custom Grade: Doors, drawer fronts and false fronts wood grain to run and match vertically within each cabinet unit.

8. Adjustable Shelf Loading: 50 lbs. per sq. ft.

9. Cabinet Style: Flush overlay.

10. Cabinet Doors and Drawer Fronts: Flush style.

11. Drawer Side Construction: Glued rabbeted joints supplemented by mechanical fasteners or glued dovetail joints. Metal drawer system sides also acceptable..

12. Drawer Construction Technique: Dovetail joints.

2.2. WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

B. Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Wood moisture content: 5 to 10 percent.

C. Composite Wood and Agrifiber Products: Provide materials that comply with requirements of referenced quality standard for each type of woodwork and quality grade specified unless otherwise indicated.

1. Particleboard: ANSI A208.1, Grade M-2.
2. Softwood Plywood: DOC PS 1, medium-density overlay.
3. Thermoset Decorative Panels: Particleboard or medium-density fiberboard finished with thermallyl fused, melamine-impregnated decorative paper and complying with requirements of NEMA LD 3, Grade VGJL, for test methods 3.3, 3.4, 3.6, 3.8 and 3.10.

2.3. LAMINATE MATERIALS

A. Manufacturers:

1. Basis of Design: Formica Corporation: www.formica.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Architect to select color from full range of manufacturer's line.

C. High Pressure Decorative Laminate (HPDL): NEMA LD 3, types as recommended for specific applications.

D. Provide specific types as follows:

1. Edges: PVC edge banding, 1mm thick PVC on Cabinet, 3mm PVC on all Doors and Drawer fronts, matchint laminate in color, pattern and finish.

2.4. COUNTERTOPS

A. Countertops are specified in Section 12 3600.

2.5. ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.

B. Plastic Edge Banding: Extruded PVC, convex shaped; smooth finish; self locking serrated tongue; of width to match component thickness.

C. Fasteners: Size and type to suit application.

D. Bolts, Nuts, Washers, Lags, Pins, and Screws: Of size and type to suit application; galvanized or chrome-plated finish in concealed locations and stainless steel or chrome-plated finish in exposed locations.

E. Concealed Joint Fasteners: Threaded steel.

F. Grommets: Standard plastic grommets for cut-outs, in color to be selected by Architect from manufacturer's full range.

1. Basis of Design: Bainbridge Manufacturing, Inc.; Plastic Cord Grommet #1035, 2" diameter.
2. Locate grommets per Owner. Coordinate prior to order and installation.

G. Aluminum Reveal on face of casework; Fry Reglet 1/2 inch thick reveal molding.

2.6. HARDWARE

A. Hardware: BHMA A156.9, types as recommended by fabricator for quality grade specified.

B. Adjustable Shelf Supports: Standard side-mounted system using multiple holes for pin supports and coordinated self rests, satin chrome finish, for nominal 1 inch spacing adjustments.

C. Fixed Standard Shelf, Countertop, and Workstation Brackets:

1. Material: Steel.
2. Finish: Manufacturer's standard, factory-applied powder coat.
3. Color: Selected by Architect from manufacturer's standard range.

4. Products:
    a. A&M Hardware, Inc; Standard Brackets: http://www.aandmhardware.com/#sle.

D. Drawer and Door Pulls: "U" shaped wire pull, steel with satin finish, 4 inch centers.

E. Cabinet Locks: Keyed cylinder, two keys per lock, master keyed, steel with chrome finish.

F. Catches: Magnetic.

G. Drawer Slides:
1. Type: Full extension.
2. Static Load Capacity: Heavy Duty grade.
3. Mounting: Side mounted.

H. Hinges: European style concealed self-closing type, steel with satin finish.

2.7. FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners.

E. Provide cutouts for plumbing fixtures. Verify locations of cutouts from on-site dimensions. Seal cut edges.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify location and sizes of utility rough-in associated with work of this section.

3.2. INSTALLATION

A. Install work in accordance with AWI/AWMAC/WI (AWS) requirements for grade indicated.

B. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

C. Use fixture attachments in concealed locations for wall mounted components.

D. Use concealed joint fasteners to align and secure adjoining cabinet units.

E. Carefully scribe casework abutting other components, with maximum gaps of 1/32 inch. Do not use additional overlay trim for this purpose.

F. Secure cabinets to floor using appropriate angles and anchorages.

3.3. ADJUSTING

A. Test installed work for rigidity and ability to support loads.

B. Adjust moving or operating parts to function smoothly and correctly.

3.4. CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 06 8316 - FIBERGLASS REINFORCED PANELING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Fiberglass reinforced plastic panels.

B. Trim.

1.2. REFERENCE STANDARDS

A. 9 CFR 416.2 - Regulatory Requirements Under the Federal Meat Inspection Act and the Poultry Products Inspection Act, Part 416-Sanitation; current edition.

B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).

C. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor; 2013a.

D. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

E. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2017.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

G. ISO 2812-1 - Paints and varnishes -- Determination of resistance to liquids -- Part 1: Immersion in liquids other than water; 2017.

1.3. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Samples: Submit two samples 4 by 4 inch in size illustrating material and surface design of panels.

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 Panels: Quantity equal to 5 percent of total installed.

1.4. DELIVERY, STORAGE, AND HANDLING

A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Fiberglass Reinforced Plastic Panels:

1. Nudo Products, Inc; FiberLite FRP, Class A: www.nudo.com/#sle.

2. Substitutions: See Section 01 6000 - Product Requirements.

2.2. PANEL SYSTEMS

A. Wall Panels FRP-1:

1. Panel Size: 4 by 8 feet.

2. Panel Thickness: 0.10 inch.

3. Surface Design: Pebbled.

4. Color: As indicated on drawings..

5. Attachment Method: Adhesive only, with trim and sealant in joints.

2.3. MATERIALS

A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.

1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
3. Scratch Resistance: Barcol hardness score greater than 35, when tested in accordance with ASTM D2583.
4. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.
5. Sanitation and Cleanability: Comply with 9 CFR 416.2.
6. Chemical Cleanability: Excellent chemical resistance to common cleaners and detergents when tested in accordance with ISO 2812-1.

B. Trim: Vinyl; color coordinating with panel.

C. Adhesive: Type recommended by panel manufacturer.

D. Sealant: Type recommended by panel manufacturer; color matching panel.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify existing conditions and substrate flatness before starting work.

B. Verify that substrate conditions are ready to receive the work of this section.

3.2. INSTALLATION - WALLS

A. Install panels in accordance with manufacturer's instructions.

B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.

C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.

D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.

E. Install panels with manufacturer's recommended gap for panel field and corner joints.

F. Place trim on panel before fastening edges, as required.

G. Fill channels in trim with sealant before attaching to panel.

H. Install trim with adhesive and screws or nails, as required.

I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.

J. Remove excess sealant after paneling is installed and prior to curing.

END OF SECTION

SECTION 07 0553 - FIRE AND SMOKE ASSEMBLY IDENTIFICATION

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Identification markings for fire and smoke rated partitions, and fire rated walls.

1.2. RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Paint finish.

1.3. REFERENCE STANDARDS

A. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.

C. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.

1.5. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

1.6. FIELD CONDITIONS

A. Do not install adhered markings when ambient temperature is lower than recommended by label or sign manufacturer.

B. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Partition Identification Labels:

1. Fire Wall Signs, Inc: www.firewallsigns.com/#sle.
2. Safety Supply Warehouse, Inc: www.safetysupplywarehouse.com/#sle.
3. Substitutions: See Section 01 6000 - Product Requirements.

2.2. FIRE AND SMOKE ASSEMBLY IDENTIFICATION

A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC).

B. Adhered Fire and Smoke Assembly Identification Signs: Printed vinyl or paper sign with factory applied adhesive backing.

C. Applied Fire and Smoke Assembly Identification: Identification markings applied to partition with paint and a code compliant stencil. See Section 09 9123 for products.

D. Languages: Provide sign markings in English.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that substrate surfaces are ready to receive work.

3.2. PREPARATION

A. See Section 09 9123 for substrate preparation for painted markings.

3.3. INSTALLATION

A. Locate markings as required by ICC (IBC).

B. Install adhered markings in accordance with manufacturer's instructions.

C. Install applied markings in accordance with Section 09 9123.

D. Install neatly, with horizontal edges level.

E. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

END OF SECTION

SECTION 07 2100 - THERMAL INSULATION

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Board insulation at cavity wall construction, perimeter foundation wall, and exterior wall behind EIFS wall finish.

B. Batt insulation for filling perimeter window and door shim spaces and gaps and joints in exterior walls and existing building attic.

1.2. RELATED REQUIREMENTS

A. Section 03 1119 - Insulating Concrete Forming: Polystyrene insulation used for forms.

B. Section 07 2119 - Foamed-In-Place Insulation: Plastic foam insulation other than boards.

C. Section 07 2500 - Weather Barriers: Separate air barrier and vapor retarder materials.

D. Section 07 5400 - Thermoplastic Membrane Roofing: Installation requirements for board insulation over low slope roof deck specified in this section.

E. Section 09 2116 - Gypsum Board Assemblies: Acoustic insulation inside walls and partitions.

1.3. REFERENCE STANDARDS

A. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2017, with Editorial Revision (2018).

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

C. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2018.

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

F. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.

C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

1.5. FIELD CONDITIONS

A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Protect insulation materials from physical damage and from deterioration due to moisture, soiling, and other sources. Store inside and in a dry location. Comply with manufacturer's written instructions for handling, storing, and protecting during installation.

B. Protect foam-plastic board insulation as follows:

1. Do not expose to sunlight except to necessary extent for period of installation and concealment.

2. Protect against ignition at all times. Do not deliver foam-plastic board materials to Project site until just before installation time.

3. Quickly complete installation and concealment of foam-plastic board insulation in each area of construction.

PART 2 PRODUCTS

2.1. APPLICATIONS

A. Insulation at Perimeter of Foundation: Extruded polystyrene (XPS) board.

B. Insulation Inside Masonry Cavity Walls: Extruded polystyrene (XPS) carbon black board.

C. Insulation Over Metal Stud Framed Walls, Continuous: Extruded polystyrene (XPS) board.

D. Insulation in Metal Framed Roof Structure: Batt insulation with separate vapor retarder.

2.2. FOAM BOARD INSULATION MATERIALS

A. Extruded Polystyrene (XPS) Board Insulation: Complies with ASTM C578 with either natural skin or cut cell surfaces.

1. Type and Compressive Resistance: Type IV, 25 psi (173 kPa), minimum.

2. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.

3. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

4. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88) per 1 inch thickness at 75 degrees F mean temperature.

B. Extruded Polystyrene (XPS) Cavity Wall Insulation Board: Complies with ASTM C578, and manufactured using carbon black technology.

1. Flame Spread Index (FSI): Class A - 0 to 25, when tested in accordance with ASTM E84.

2. Smoke Developed Index (SDI): 450 or less, when tested in accordance with ASTM E84.

3. Type and Thermal Resistance, R-value: Type IV, 5.0 (0.88), minimum, per 1 inch thickness at 75 degrees F mean temperature.

4. Board Size: 15-3/4 inch by 96 inch.

5. Board Thickness: 1-3/4 inch.

6. Board Edges: Square.

2.3. ACCESSORIES

A. Tape: Reinforced polyethylene film with acrylic pressure sensitive adhesive.

1. Application: Sealing of interior circular penetrations, such as pipes or cables.

2. Width: Are required for application.

B. Z-Furring: Non-thermally bridging Z-furring for use on exterior face.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.

B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

3.2. BOARD INSTALLATION AT FOUNDATION PERIMETER

A. Adhere a 6 inch wide strip of polyethylene sheet over construction, control, and expansion joints with double beads of adhesive each side of joint.

B. Install boards horizontally on foundation perimeter.

1. Butt edges and ends tightly to adjacent boards and to protrusions.

C. Extend boards over expansion joints, unbonded to foundation on one side of joint.

D. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.3. BOARD INSTALLATION AT EXTERIOR WALLS

A. Adhere a 6 inch wide strip of polyethylene sheet over expansion joints with double beads of adhesive each side of joint.

B. Install boards vertically on walls, with thermally broken z-furring running vertically @ 16” o.c. to simultaneously support both the rigid insulation and the fiber cement siding.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

3.4. BOARD INSTALLATION AT CAVITY WALLS

A. Install boards to fit snugly between wall ties.

B. Install boards horizontally on walls.

1. Butt edges and ends tightly to adjacent boards and to protrusions.

C. Cut and fit insulation tightly to protrusions or interruptions to the insulation plane.

D. Insulation should lay flat against backup wall to avoid ledges to catch mortar. If adesive strips are used to maintain insulation position, apply adhesive in vertical stips to allow any water behind insulation to drain.

3.5. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

3.6. PROTECTION

A. Do not permit installed insulation to be damaged prior to its concealment.

END OF SECTION

SECTION 07 2119 - FOAMED-IN-PLACE INSULATION

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Foamed-in-place insulation.

1. In exterior wall crevices.
2. At junctions of dissimilar wall and roof materials.
3. At roof expansion joints.

B. Protective intumescent coating.

1.2. REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

E. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

F. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

1.3. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, insulation properties, and preparation requirements.

C. Certificates: Certify that products of this section meet or exceed specified requirements.

D. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

E. Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

1.4. 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.

B. Applicator Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience.

1.5. FIELD CONDITIONS

A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.

PART 2 PRODUCTS

2.1. MATERIALS

A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, open or closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.

1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and overcoat limitations.
2. Thermal Resistance: R-value of 5.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.

3. Water Vapor Permeance: Vapor retarder; 2 perms, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
4. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
5. Air Permeance: 0.04 cfm/sq ft, maximum, when tested at intended thickness in accordance with ASTM E2178 or ASTM E283 at 1.57 psf.
6. Closed Cell Content: At least 90 percent.
7. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.

2.2. ACCESSORIES

A. Primer: As required by insulation manufacturer.

B. Protective Coating: Intumescent coating of type recommended by insulation manufacturer and as required to comply with applicable codes.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify work within construction spaces or crevices is complete prior to insulation application.

B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

3.2. PREPARATION

A. Mask and protect adjacent surfaces from over spray or dusting.

B. Apply primer in accordance with manufacturer's instructions.

3.3. APPLICATION

A. Apply insulation in accordance with manufacturer's instructions.

B. Apply insulation by spray method, to a uniform monolithic density without voids.

C. Patch damaged areas.

D. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.

E. Trim excess away for applied trim or remove as required for continuous sealant bead.

3.4. PROTECTION

A. Do not permit subsequent construction work to disturb applied insulation.

END OF SECTION

SECTION 07 2400 - EXTERIOR INSULATION AND FINISH SYSTEMS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Composite wall and cornice cladding of rigid insulation and reinforced finish coating (Class PB).

B. Drainage and water-resistive barriers behind insulation board.

1.2. RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Sheathing on metal studs.

B. Section 07 6200 - Sheet Metal Flashing and Trim: Perimeter flashings.

C. Section 07 9200 - Joint Sealants: Sealing joints between EIFS and adjacent construction and penetrations through EIFS.

1.3. REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

C. ASTM C150/C150M - Standard Specification for Portland Cement; 2015.

D. ASTM C297/C297M - Standard Test Method for Flatwise Tensile Strength of Sandwich Constructions; 2016.

E. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2018.

F. ASTM C1397 - Standard Practice for Application of Class PB Exterior Insulation and Finish Systems (EIFS) and EIFS with Drainage; 2013 (Reapproved 2019).

G. ASTM D968 - Standard Test Methods for Abrasion Resistance of Organic Coatings by Falling Abrasive; 2017.

H. ASTM D2247 - Standard Practice for Testing Water Resistance of Coatings in 100% Relative Humidity; 2015.

I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

J. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

K. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

L. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

M. ASTM E2273 - Standard Test Method for Determining the Drainage Efficiency of Exterior Insulation and Finish Systems (EIFS) Clad Wall Assemblies; 2018.

N. ASTM E2485/E2485M - Standard Test Method for Freeze/Thaw Resistance of Exterior Insulation and Finish Systems (EIFS) and Water Resistive Barrier Coatings; 2013 (Reapproved 2018).

O. ASTM E2486/E2486M - Standard Test Method for Impact Resistance of Class PB and PI Exterior Insulation and Finish Systems (EIFS); 2013 (Reapproved 2018).

P. ASTM G153 - Standard Practice for Operating Enclosed Carbon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013.

Q. ASTM G155 - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Nonmetallic Materials; 2013.

R. ICC-ES AC219 - Acceptance Criteria for Exterior Insulation and Finish Systems; 2009, with Editorial Revision (2014).

S. ICC-ES AC235 - Acceptance Criteria for EIFS Clad Drainage Wall Assemblies; 2009, with Editorial Revision (2012).

T. ISO 9001 - Quality management systems -- Requirements; 2015.

U. NFPA 259 - Standard Test Method for Potential Heat of Building Materials; 2018.

V. NFPA 268 - Standard Test Method for Determining Ignitibility of Exterior Wall Assemblies Using a Radiant Heat Energy Source; 2017.

W. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on system materials, product characteristics, performance criteria, and system limitations.

C. Shop Drawings: Indicate wall and soffit joint patterns, joint details, and molding profiles.

D. Selection Samples: Submit manufacturer's standard range of samples illustrating available coating colors and textures.

E. Verification Samples: Submit actual samples of selected coating on specified substrate, minimum 12 inches square, illustrating project colors and textures.

F. Manufacturer's Installation Instructions: Indicate preparation required, installation techniques, and jointing requirements.

1.5. QUALITY ASSURANCE

A. EIFS Manufacturer Qualifications: Provide EIFS products other than insulation from the same manufacturer with qualifications as follows:

1. Member in good standing of EIMA (EIFS Industry Members Association).
2. Manufacturer of EIFS products for not less than 5 years.
3. Manufacturing facilities ISO 9001 certified.

B. Insulation Manufacturer Qualifications: Approved by manufacturer of EIFS and approved and labeled under third party quality program as required by applicable building code.

C. Installer Qualifications: Company specializing in the type of work specified and with at least three years of documented experience.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Delivery: Deliver materials to project site in manufacturer's original, unopened containers with labels intact. Inspect materials and notify manufacturer of any discrepancies.

B. Storage: Store materials as directed by manufacturer's written instructions.

1. Protect adhesives and finish materials from freezing, temperatures below 40 degrees F and temperatures in excess of 90 degrees F.
2. Protect Portland cement based materials from moisture and humidity. Store under cover off the ground in a dry location.
3. Protect insulation materials from exposure to sunlight.

1.7. FIELD CONDITIONS

A. Do not prepare materials or apply EIFS under conditions other than those described in the manufacturer's written instructions.

B. Do not prepare materials or apply EIFS during inclement weather unless areas of installation are protected. Protect installed EIFS areas from inclement weather until dry.

C. Do not install coatings or sealants when ambient temperature is below 40 degrees F.

D. Do not leave installed insulation board exposed to sunlight for extended periods of time.

1.8. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's standard material warranty, covering a period of not less than 5 years.

C. Provide separate warranty from installer covering labor for repairs or replacement for a period of not less than 5 years.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Basis of Design:

1. BASF Wall Systems; Senergy; Senerflex Channeled Insulation Design, Class PB: www.senergy.basf.com/#sle.

B. Other Acceptable Exterior Insulation and Finish Systems Manufacturers:

1. Dryvit Systems, Inc; Dryvit Outsulation EIFS, Class PB: www.dryvit.com/#sle.

2. Master Wall, Inc; Aggre-flex Drainage System - Class PB Drainage EIFS: www.masterwall.com/#sle.

3. Substitutions: See Section 01 6000 - Product Requirements.

2.2. EXTERIOR INSULATION AND FINISH SYSTEM

A. Exterior Insulation and Finish System: DRAINAGE type; reinforced finish coating on mechanically-fastened grooved insulation board over water-resistive coating over substrate; provide a complete system that has been tested to show compliance with the following characteristics; include all components of specified system and substrate(s) in tested samples.

B. Fire Characteristics:

1. Flammability: Pass, when tested in accordance with NFPA 285.

2. Ignitibility: No sustained flaming when tested in accordance with NFPA 268.

3. Potential Heat of Foam Plastic Insulation Tested Independently of Assembly: No portion of the assembly having potential heat that exceeds that of the insulation sample tested for flammability (above), when tested in accordance with NFPA 259 with results expressed in Btu per square foot.

C. Adhesion of Water-Resistive Coating to Substrate: For each combination of coating and substrate, minimum flatwise tensile bond strength of 15 psi, when tested in accordance with ASTM C297/C297M.

D. Adhesion to Water-Resistive Coating: For each combination of insulation board and substrate, when tested in accordance with ASTM C297/C297M, maximum adhesive failure of 25 percent unless flatwise tensile bond strength exceeds 15 psi in all samples.

E. Water Penetration Resistance: No water penetration beyond the plane of the base coat/insulation board interface after 15 minutes, when tested in accordance with ASTM E331 at 6.24 psf differential pressure with tracer dye in the water spray; include in tested sample at least two vertical joints and one horizontal joint of same type to be used in construction; disassemble sample if necessary to determine extent of water penetration.

F. Drainage Efficiency: Average minimum efficiency of 90 percent, when tested in accordance with ASTM E2273 for 75 minutes.

G. Freeze-Thaw Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 10 cycles, when tested in accordance with ICC-ES AC219 or ICC-ES AC235.

H. Weathering Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating when viewed under 5x magnification after 2000 hours of accelerated weathering conducted in accordance with ASTM G153 Cycle 1 or ASTM G155 Cycles 1, 5, or 9.

I. Water Degradation Resistance: No cracking, checking, crazing, erosion, blistering, peeling, delamination, or corrosion of finish coating after 14 days exposure, when tested in accordance with ASTM D2247.

J. Mildew Resistance: No growth supported on finish coating during 28 day exposure period, when tested in accordance with ASTM D3273.

K. Abrasion Resistance Of Finish: No cracking, checking or loss of film integrity when tested in accordance with ASTM D968 with 113.5 gallons of sand.

L. Impact Resistance: Construct system to provide the following impact resistance without exposure of broken reinforcing mesh, when tested in accordance with ASTM E2486/E2486M:

1. Standard: 25 to 49 in-lb, for areas not indicated as requiring higher impact resistance.

2.3. MATERIALS

A. Finish Coating Top Coat: Water-based, air curing, acrylic or polymer-based finish with integral color and texture.

1. EIFS Type A (Buff) Texture/color: BASF Wall Systems; Senergy Classic; 3103 Sandstorm.
2. EIFS Type B (Red) Texture/color: BASF Wall Systems; Senergy Classic; 3026 Clay Pot.

B. Base Coat: Fiber-reinforced, acrylic or polymer-based product compatible with insulation board and reinforcing mesh, Class PB.

C. Reinforcing Mesh: Balanced, open weave glass fiber fabric, treated for compatibility and improved bond with coating, weight, strength, and number of layers as required to meet required system impact rating.

D. Expanded Polystyrene (EPS) Board Insulation: Complies with ASTM C578.

1. Grooved Board: Back side of board adjacent to sheathing grooved with vertical channels designed to allow moisture to drain; at drainage points provide board configuration that permits drainage to the exterior.
2. Board Size: 24 by 48 inches.
3. Board Size Tolerance: Plus/minus 1/16 inch from square and dimension.
4. Board Thickness: As indicated on drawings.
5. Board Edges: Square.
6. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, when tested in accordance with ASTM E84.

E. Water-Resistive Barrier Coating: Fluid-applied air and water barrier membrane; applied to sheathing; furnished or approved by EIFS manufacturer.

F. Fluid-Applied Flashing: Flexible water based polymer material suitable for use with reinforcing mesh and, if used with water-resistive barrier sheet, certified compatible with sheet material.

G. Flashing Tape: Self-adhering rubberized asphalt tape with polyethylene backing or other material and surface conditioner furnished or approved by EIFS manufacturer.

2.4. ACCESSORY MATERIALS

A. Insulation Adhesive: Type required by EIFS manufacturer for project substrate.

B. Insulation Fasteners: Fastener and plate system appropriate for substrate and as recommended by EIFS manufacturer.

C. Trim: EIFS manufacturer's standard PVC or galvanized steel trim accessories, as required for a complete project and including starter track and drainage accessories.

D. Sealant Materials: Compatible with EIFS materials and as recommended by EIFS manufacturer.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that substrate is sound and free of oil, dirt, other surface contaminants, efflorescence, loose materials, or protrusions that could interfere with EIFS installation and is of a type and construction that is acceptable to EIFS manufacturer. Do not begin work until substrate and adjacent materials are complete and thoroughly dry.

B. Verify that substrate surface is flat, with no deviation greater than 1/4 in when tested with a 10 ft straightedge.

3.2. PREPARATION

A. Apply primer to substrate as recommended by EIFS manufacturer for project conditions.

3.3. INSTALLATION - GENERAL

A. Install in accordance with EIFS manufacturer's instructions and ASTM C1397.

1. Where different requirements appear in either document, comply with the most stringent.

2. Neither of these documents supercedes provisions of Contract Documents that defines contractual relationships between parties or scope of this work.

3.4. INSTALLATION - WATER-RESISTIVE BARRIER

A. Apply barrier coating as recommended by coating manufacturer; prime substrate as required before application.

B. Seal substrate transitions and intersections with other materials to form continuous water-resistive barrier on exterior of sheathing, using method recommended by manufacturer.

C. At door and window rough openings and other wall penetrations, seal water-resistive barrier and flexible flashings to rough opening before installation of metal flashings, sills, or frames, using method recommended by manufacturer.

D. At moving expansion joints, apply flexible flashing or flashing tape across and recessed into joint with U-loop forming continuous barrier but allowing movement.

E. Lap flexible flashing or flashing tape at least 2 inches on each side of joint or transition.

F. Install drainage layer or spacers after flashing tape has been completed.

3.5. INSTALLATION - INSULATION

A. Install in accordance with manufacturer's instructions.

B. Install back wrap reinforcing mesh at all openings and terminations that are not to be protected with trim.

C. On wall surfaces, install boards horizontally. On horizontal surfaces, install boards _____.

D. Place boards in a method to maximize tight joints. Stagger vertical joints and interlock at corners. Butt edges and ends tight to adjacent board and to protrusions. Achieve a continuous flush insulation surface, with no gaps in excess of 1/16 inch.

E. Fill gaps greater than 1/16 inch with strips or shims cut from the same insulation material.

F. Rasp irregularities off surface of installed insulation board.

G. Mechanical Fastening: Space fasteners as recommended by EIFS manufacturer.

H. Adhesive Attachment: Use method required by manufacturer to achieve drainage efficiency specified; do not close up drainage channels when placing insulation board.

3.6. INSTALLATION - CLASS PB FINISH

A. Base Coat: Apply in thickness as necessary to fully embed reinforcing mesh, wrinkle free, including back-wrap at terminations of EIFS. Install reinforcing fabric as recommended by EIFS manufacturer.

1. Lap reinforcing mesh edges and ends a minimum of 2-1/2 inches.

2. Allow base coat to dry a minimum of 24 hours before next coating application.

B. Apply finish coat after base coat has dried not less than 24 hours, embed finish aggregate, and finish to a uniform texture and color.

C. Finish Coat Thickness: As recommended by manufacturer.

D. Seal control and expansion joints within the field of exterior finish and insulation system, using procedures recommended by sealant and finish system manufacturers.

3.7. CLEANING

A. Clean EIFS surfaces and work areas of foreign materials resulting from EIFS operations.

3.8. PROTECTION

A. Protect completed work from damage and soiling by subsequent work.

END OF SECTION

SECTION 07 2500 - WEATHER BARRIERS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Vapor Retarders: Materials to make exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls water vapor resistant and air tight.

B. Air Barriers: Materials that form a system to stop passage of air through exterior walls, joints between exterior walls and roof, and joints around frames of openings in exterior walls.

1.2. RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Water-resistive barrier under exterior cladding.

B. Section 07 2100 - Thermal Insulation: Vapor retarder installed in conjunction with batt insulation.

C. Section 07 2400 - Exterior Insulation and Finish Systems: Water-resistive barrier under exterior insulation.

D. Section 07 9200 - Joint Sealants: Sealing building expansion joints.

E. Section 09 2116 - Gypsum Board Assemblies: Water-resistive barrier under exterior cladding.

1.3. DEFINITIONS

A. Weather Barrier: Assemblies that form either water-resistive barriers, air barriers, or vapor retarders.

B. Air Barrier: Air tight barrier made of material that is relatively air impermeable but water vapor permeable, both to the degree specified, with sealed seams and with sealed joints to adjacent surfaces. Note: For the purposes of this specification, vapor impermeable air barriers are classified as vapor retarders.

C. Vapor Retarder: Air tight barrier made of material that is relatively water vapor impermeable, to the degree specified, with sealed seams and with sealed joints to adjacent surfaces.

1. Water Vapor Permeance: For purposes of conversion, 57.2 ng/(Pa s sq m) = 1 perm.

1.4. REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

C. ICC-ES AC212 - Acceptance Criteria for Water-Resistive Coatings Used as Water-Resistive Barriers over Exterior Sheathing; ICC Evaluation Service, Inc; 2015.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on material characteristics.

C. Shop Drawings: Provide drawings of special joint conditions.

D. ABAA Field Quality Control Submittals: Submit third-party reports of testing and inspection required by ABAA QAP.

E. Manufacturer's Installation Instructions: Indicate preparation, installation methods, and storage and handling criteria.

F. ABAA Manufacturer Qualification: Submit documentation of current evaluation of proposed manufacturer and materials.

G. ABAA Installer Qualification: Submit documentation of current contractor accreditation and current installer certification; keep copies of each contractor accreditation and installer certification on site during and after installation, and present on-site documentation upon request.

H. Testing Agency Qualification Statement.

1.6. QUALITY ASSURANCE

A. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); www.airbarrier.org/#sle:

1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.

2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture, and use secondary materials approved in writing by primary material manufacturer.

B. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.7. MOCK-UP

A. Install air barrier/vapor barrier materials in a representative exterior wall mock up in coordination with other work.

1. Build mockup for each typical waterproofing installation including accessories to demonstrate surface preparation, crack and joint treatments, inside and outside corner treatments, and protection.

1.8. FIELD CONDITIONS

A. Maintain temperature and humidity recommended by the materials manufacturers before, during and after installation.

1.9. WARRANTY

A. Manufacturer's Special Warranty: Weather barrier and accessories are free of defects at time of delivery and are manufactured to meet manufacturer's published physical properties and material specifications.

B. Warranty Period: Five years from date of substantial completion.

PART 2 PRODUCTS

2.1. WEATHER BARRIER ASSEMBLIES

A. Exterior Vapor Retarder / Air Barrier:

1. On outside surface of sheathing use vapor retarder coating.

2.2. [AVB] VAPOR RETARDER MATERIALS (AIR BARRIER AND WATER-RESISTIVE)

A. Vapor Retarder Coating: Liquid applied, resilient, UV-resistant coating and associated joint treatment.

1. LowTemperature Crack Bridging: ASTM C1305, no cracking after 10 cycles at -15°F (-26°C)

2. Elongation: ASTM D412, primary air barrier and vapor barrier material, > 500%.

3. Tensile Strength: ASTM D412, > 200 psi (1378 kPa).

4. Dry Film Thickness: 40 mils (0.040 inch), minimum.

5. Water Vapor Permeance: 0.1 perm, maximum, when tested in accordance with ASTM E96/E96M.

6. Air Leakage: Less than 0.2 L/m2s @ 75 Pa

7. VOC Content: Less than 100 g per L when tested in accordance with 40 CFR 59, Subpart D (EPA Method 24).

8. Resistance to Fungal Growth: No growth when tested according to ASTM D5590.

9. Code Acceptance: Comply with applicable requirements of ICC-ES AC212.

10. Suitable for use on concrete, masonry, plywood and glass mat gypsum sheathing.

11. Joint Preparation Treatment: Coating manufacturer's recommended method, either tape or reinforcing mesh saturated with coating material.
12. Manufacturers:
    a. Basis of Design: Sto Corp; Sto VaporSeal (40 mil application): www.stocorp.com/#sle
        1) Rough Opening Treatments: StoGuard VaporSeal with StoGuard Fabric and StoGuard RedicornerTM: flexible waterproof air barrier membrane material with non-woven integrally reinforced cloth reinforcements
        2) Transition Membrane:
            (a) StoGuard Transition Membrane: flexible air barrier membrane for continuity at transitions: sheathing to foundation, dissimilar materials (CMU to frame wall), flashing shingle lap transitions, floor line deflection joints, masonry control joints, and through wall joints in masonry or frame construction.
            (b) StoGuard RapidFill: one component gun-applied air and moisture barrier membrane material for continuity at static transitions such as through wall penetrations such as pipes, electrical boxes, and scupper penetrations.
    b. Other approved manufacturers (dependant on meeting basis of design and specification criteria):
        1) BASF Corporation
        2) Grace Construction & Packaging
        3) Henry Company
    c. Substitutions: See Section 01 6000 - Product Requirements.
13. Joint Filler: As recommended by coating manufacturer and suitable to the substrate.

2.3. ACCESSORIES

A. Sealants, Tapes, and Accessories for Sealing Weather Barrier and Sealing Weather Barrier to Adjacent Substrates: As specified or as recommended by weather barrier manufacturer.

B. Primer, joint reinforcing strip, substrate-patching membrane, adhesive, and tape as recommended by material manufacturer.

C. Thinners and Cleaners: As recommended by material manufacturer.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that surfaces and conditions are ready to accept the work of this section.

3.2. PREPARATION

A. Remove projections, protruding fasteners, and loose or foreign matter that might interfere with proper installation.

B. Clean and prime substrate surfaces to receive air/vapor barrier material in accordance with manufacturer's instructions.

3.3. INSTALLATION

A. Install materials in accordance with manufacturer's instructions.

B. Vapor Retarders: Install continuous air tight barrier over surfaces indicated, with sealed seams and with sealed joints to adjacent surfaces.

C. Apply sealants and adhesives within recommended application temperature ranges. Consult manufacturer if temperature is out of this range.

D. Coatings:

1. Prepare substrate in manner recommended by coating manufacturer; treat joints in substrate and between dissimilar materials as recommended by manufacturer.
2. Where exterior masonry veneer is to be installed, install masonry anchors before installing weather barrier over masonry; seal around anchors air tight.
3. Mastic Coating: Install by trowel or roller to minimum thickness of 1/4 inch; use sheet seal to join to adjacent construction, seal air tight with sealant.
4. Use flashing to seal to adjacent construction and to bridge joints.

E. Openings and Penetrations in Exterior Weather Barriers:

1. Install flashing over sills, covering entire sill frame member, extending at least 5 inches onto weather barrier and at least 6 inches up jambs; mechanically fasten stretched edges.
2. At openings to be filled with frames having nailing flanges, seal head and jamb flanges using a continuous bead of sealant compressed by flange and cover flanges with sealing tape at least 4 inches wide; do not seal sill flange.
3. At openings to be filled with non-flanged frames, seal weather barrier to each side of opening framing, using flashing at least 9 inches wide, covering entire depth of framing.
4. At head of openings, install flashing under weather barrier extending at least 2 inches beyond face of jambs; seal weather barrier to flashing.
5. At interior face of openings, seal gap between window/door frame and rough framing, using joint sealant over backer rod.
6. Service and Other Penetrations: Form flashing around penetrating item and seal to weather barrier surface.

3.4. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Coordination of ABAA Tests and Inspections:

1. Provide testing and inspection required by ABAA QAP.
2. Notify ABAA in writing of schedule for air barrier work, and allow adequate time for testing and inspection.
3. Cooperate with ABAA testing agency.
4. Allow access to air barrier work areas and staging.
5. Do not cover air barrier work until tested, inspected, and accepted.

C. Do not cover installed weather barriers until required inspections have been completed.

D. Take digital photographs of each portion of the installation prior to covering up.

3.5. PROTECTION

A. Do not leave materials exposed to weather longer than recommended by manufacturer.

B. Protect air barrier from contact with incompatible materials and sealants not approved by air-barrier manufacturer.

C. Do not leave paper- or felt-based barriers exposed to weather for longer than one week.

END OF SECTION

SECTION 07 4213.23 - METAL COMPOSITE MATERIAL WALL PANELS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Exterior cladding consisting of formed metal composite material (MCM) sheet, secondary supports, and anchors to structure, attached to solid backup.

B. Matching flashing and trim.

1.2. RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Weather barrier behind wall panel system.

B. Section 07 6200 - Sheet Metal Flashing and Trim: Metal flashing components integrated with this wall system.

C. Section 07 9200 - Joint Sealants: Sealing joints between siding and adjacent construction and fixtures.

1.3. REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

C. ASTM D1781 - Standard Test Method for Climbing Drum Peel for Adhesives; 1998 (Reapproved 2012).

D. ASTM D1929 - Standard Test Method for Determining Ignition Temperature of Plastics; 2020.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

F. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

G. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

H. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

I. NFPA 285 - Standard Fire Test Method for Evaluation of Fire Propagation Characteristics of Exterior Non-Load-Bearing Wall Assemblies Containing Combustible Components; 2012.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Meeting: Convene one week before starting work of this section to verify project requirements, coordinate with installers of other work, establish condition and completeness of building substrate, and review manufacturers' installation instructions and warranty requirements.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data - MCM Sheets: Manufacturer's data sheets on each product to be used, including thickness, physical characteristics, and finish, and:

1. Finish manufacturer's data sheet showing physical and performance characteristics.
2. Storage and handling requirements and recommendations.
3. Fabrication instructions and recommendations.
4. Specimen warranty for finish, as specified herein.

C. Shop Drawings: Show layout and elevations, dimensions and thickness of panels, connections, details and location of joints, sealants and gaskets, method of anchorage, support clips, number of anchors, supports, reinforcement, trim, flashings, and accessories.

1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

D. Design Data: Submit structural calculations stamped by design engineer, for Architect's information and project record.

E. Test Report: Submit report of full-size mock-up tests for air infiltration, water penetration, and wind performance.

F. Test Report: Submit test report verifying compliance with NFPA 285 for previously-tested exterior wall assembly.

G. Manufacturer's Field Reports: Provide within 48 hours of field review. State what was observed and what changes, if any, were requested or required.

H. Installer's Qualification Statement.

I. Testing Agency's Qualification Statement.

J. Maintenance Data: Care of finishes and warranty requirements.

K. Executed Warranty: Submit warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.6. QUALITY ASSURANCE

A. Field Measurements: Verify actual dimensions by field measurement before fabrication; show recorded measurements on shop drawings.

B. Design Engineer's Qualifications: Design structural supports and anchorages under direct supervision of a Structural Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Installer Qualifications: Company specializing in performing work of the type specified in this section.

1. With minimum three years of documented experience.

D. Testing Agency Qualifications: Independent agency experienced in testing assemblies of the type required for this project and having the necessary facilities for full-size mock-up testing of the type specified.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Deliver products in manufacturer's original, unopened, undamaged containers with identification labels intact.

1. Protect finishes by applying heavy-duty removable plastic film during production.
2. Package for protection against transportation damage.
3. Provide markings to identify components consistently with drawings.
4. Exercise care in unloading, storing, and installing panels to prevent bending, warping, twisting, and surface damage.

B. Store products protected from exposure to harmful weather conditions and at temperature conditions recommended by manufacturer.

1. Store in well-ventilated space out of direct sunlight.
2. Protect from moisture and condensation with tarpaulins or other suitable weathertight covering installed to provide ventilation.
3. Store at a slope to ensure positive drainage of accumulated water.
4. Do not store in enclosed space where ambient temperature can exceed 120 degrees F.
5. Avoid contact with other materials that might cause staining, denting, or other surface damage.

1.8. 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, including defects in water tightness and integrity of seals for insulated metal wall panel systems.

C. Correct defective work within a five year period after Date of Substantial Completion for degradation of panel finish, including color fading caused by exposure to weather.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Metal Composite Material Wall Panels:

1. Basis of Design: Castel Metal Products, RS-200 4mm System.

2. System Description: Drained and back-ventilated rainscreen design consisting of dry seal joinery designed to minimize water penetration and induce air circulation in the space behind the panel system. Moisture weeping trim at panel base details allows water to drain out of the system.

3. Substitutions: See Section 01 6000 - Product Requirements.

2.2. WALL PANEL SYSTEM

A. Wall Panel System: Metal panels, fasteners, and anchors designed to be supported by framing or other substrate provided by others; provide installed panel system capable of maintaining specified performance without defects, damage, or failure.

1. Provide structural design by or under direct supervision of a Structural Engineer licensed in the State in which the Project is located.

2. Provide panel jointing and weatherseal using a dry seal joinery system.

3. Anchor panels to supporting framing without exposed fasteners.

2.3. PERFORMANCE REQUIREMENTS

A. Thermal Movement: Provide for free and noiseless vertical and horizontal thermal movement due to expansion and contraction under material temperature range of minus 20 degrees F to 180 degrees F without buckling, opening of joints, undue stress on fasteners, or other detrimental effects; allow for ambient temperature at time of fabrication, assembly, and erection procedures.

1. Wind Performance: Provide system tested in accordance with ASTM E330/E330M without permanent deformation or failures of structural members under the following conditions:

2. Maximum deflection of perimeter framing member of L/175 normal to plane of the wall; maximum deflection of individual panels of L/60.

3. Maximum anchor deflection in any direction of 1/16 inch at connection points of framing members to anchors.

B. Air Infiltration: 0.06 cfm/sq ft of wall area, maximum, when tested at 1.57 psf in accordance with ASTM E283/E283M.

C. Water Penetration: No water penetration under static pressure when tested in accordance with ASTM E331 at a differential of 10 percent of inward acting design load, 6.24 psf minimum, after 15 minutes.

1. Water penetration is defined as the appearance of uncontrolled water on the interior face of the wall.

2. Design to drain leakage and condensation to the exterior face of the wall.

D. Fire Performance: Tested in accordance with, and complying with acceptance criteria of NFPA 285.

E. General: Provide composite wall panel system meeting performance requirements as determined by application of specified tests by a qualified testing agency on manufacturer's standard assemblies.

F. Structural Performance: Design composite wall panel system fabricated to withstand effects of indicated loads and stresses within limits and under conditions indicated below.

1. Wind Loads: Determine loads based on uniform pressure, building category, exposure category, and basic wind speed indicated on drawings.
2. Limits of Deflection: Composite wall panel system shall withstand design wind pressure with the following allowable deflection:
3. Maximum allowable deflection limited to L/175 deflection of panel head and sill normal to plane of wall.
4. Maximum allowable deflection of panel stiffeners and aluminum panel material combined limited to L/60.
5. Seismic Performance: Comply with ASCE 7 Section 9, "Earthquake Loads."

G. System Performance: A third party test report utilizing the standard ASTM E 283, E 331 and AAMA 501 procedures following the test protocol described in AAMA 508-07 must be submitted prior to bid. Test panel must include a horizontal joint, with an imperfect air barrier.

H. Drained and Back Ventilated Rain Screen Performance: Per AAMA 509-09:
1. Water penetration through panel system: W1 classification.
2. Ventilation: V4 classification.

I. Air/Moisture Barrier: Refer to Division 07 Section "Weather Barriers."

J. Thermal Movements: Allow for thermal movements from variations in both ambient and internal temperatures. Accommodate movement of support structure caused by thermal expansion and contraction.

K. Fire Performance Characteristics: Provide metal composite wall systems with the following fire-test characteristics determined by indicated test standard as applied by UL or other testing and inspection agency acceptable to authorities having jurisdiction.
1. Surface-Burning Characteristics: Provide metal composite wall system panels with the following characteristics when tested per ASTM E 84.
a. Flame spread index: 25 or less.
b. Smoke developed index: 450 or less.

2.4. WALL PANEL SYSTEM

A. Metal Composite Material Wall Panel Systems: Provide factory-formed and -assembled, metal composite material wall panels fabricated from two metal facings that are bonded to a solid, extruded thermoplastic core; formed into profile for installation method indicated. Include attachment assembly components, panel stiffeners, and accessories required for weathertight system.

B. Basis-of-Design: Castel Metal Products, RS-200 4mm Rainscreen System.
1. Core: Fire retardant.
2. Factory Finish: Two coat fluoropolymer resin coating, approved by coating manufacturer for length of warranty specified for project, and applied by coil manufacturing facility that specializes in coil applied finishes.
a. Design intent for panels and trim systems is buff color to match buff color of EIFS Type A system.
3. Substitutions: See Section 01 6000 - Product Requirements.

C. Composite Wall Panel Accessories
1. Provide manufacturer's factory-formed clips, shims, flashings, sealants, and tapes for a complete installation.

2. Extruded Trim: Aluminum, minimum thickness 0.060 inch (1.59 mm) for trim and 0.90 inch (2.38 mm) for structural units. Include manufacturer-provided extruded trim for the following locations and as indicated on Drawings:
    a. Base trim.
    b. Coping.
    c. Panel installation perimeter.
    d. Opening perimeters.
3. Sealants: Type recommended by composite wall panel system manufacturer for application, meeting requirements of Division 07 Section "Joint Sealants."
4. Flashing Tape: 4 inch (102 mm) wide self-adhering butyl flashing tape.

D. Secondary Metal Framing

1. Miscellaneous Framing Components, General: Cold-formed metallic-coated steel sheet, ASTM C 645, Grade 50, with ASTM A 653/A 653M, G90 (Z180) hot-dip galvanized zinc coating.
    a. Hat Channels: 0.053"minimum/16 ga. (1.35 mm) minimum.
    b. Sill Channels: 0.053" minimum/16 ga. (1.35 mm) minimum.

2.5. FABRICATION

A. General: Fabricate composite wall panels and accessories at factory identical to tested units using manufacturer's standard procedures and processes necessary to meet performance requirements.

1. Provide components of composite wall panel system that are products of one manufacturer, including composite panels, gaskets, head and sill trim, bottom weep, base extrusion, and metal copings.

B. Composite Panels: Fabricate composite wall panels with extruded aluminum stiffeners requiring no further fabrication or modification in field.

1. Horizontal Joints: Dry seal, drained and back ventilated.
2. Vertical Joints: Pre-formed returns with metal spline or gasket and aluminum extrusion receptors and extruded drain channels.

PART 3 EXECUTION

3.1. EXAMINATION

A. Examine dimensions, tolerances, and interfaces with other work.

1. Verify that weather barrier system is properly installed; refer to Section 07 2500 for requirements.

B. Examine substrate on-site to determine that conditions are acceptable for product installation in accordance with manufacturer's written instructions.

C. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

D. Notify Architect in writing of conditions detrimental to proper and timely completion of work, and do not proceed with erection until unsatisfactory conditions have been corrected.

3.2. INSTALLATION

A. Do not install products that are defective, including warped, bowed, dented, and broken members, and members with damaged finishes.

B. Comply with instructions and recommendations of MCM sheet manufacturer and wall system manufacturer, as well as with approved shop drawings.

C. Install wall system securely allowing for necessary thermal and structural movement; comply with wall system manufacturer's instructions for installation of concealed fasteners.

D. Do not handle or tool products during erection in manner that damages finish, decreases strength, or results in visual imperfection or failure in performance. Return component parts that require alteration to shop for refabrication, if possible, or for replacement with new parts.

E. Do not form panels in field unless required by wall system manufacturer and approved by the Architect; comply with MCM sheet manufacturer's instructions and recommendations for field forming.

F. Separate dissimilar metals; use gasket fasteners, isolation shims, or isolation tape where needed to eliminate possibility of electrolytic action between metals.

G. Install square, plumb, straight, and true, accurately fitted, with tight joints and intersections maintaining the following installation tolerances:

1. Variation From Plane or Location: 1/2 inch in 30 feet of length and up to 3/4 inch in 300 feet, maximum.
2. Deviation of Vertical Member From True Line: 0.1 inch in 25 feet run, maximum.
3. Deviation of Horizontal Member From True Line: 0.1 inch in 25 feet run, maximum.
4. Offset From True Alignment Between Two Adjacent Members Abutting End To End, In Line: 0.03 inch, maximum.

H. Replace damaged products.

3.3. FIELD QUALITY CONTROL

A. Wall System Manufacturer's Field Services: Provide field services consisting of product use recommendations and periodic site visits for inspection of product installation in accordance with instructions.

3.4. CLEANING

A. Ensure weep holes and drainage channels are unobstructed and free of dirt and sealants.

B. Remove protective film after installation of joint sealers, after cleaning of adjacent materials, and immediately prior to completion of work.

C. Remove temporary coverings and protection of adjacent work areas.

D. Clean installed products in accordance with manufacturer's instructions.

3.5. PROTECTION

A. Protect installed panel system from damage until Date of Substantial Completion.

END OF SECTION

SECTION 07 4213.53 - METAL SOFFIT PANELS

PART 1 GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section includes metal soffit panels.

1.3. PREINSTALLATION MEETINGS

A. Preinstallation Conference: Conduct conference at Project site.

1.4. ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for each type of panel and accessory.

B. Shop Drawings:

1. Include fabrication and installation layouts of metal panels; details of edge conditions, joints, panel profiles, corners, anchorages, attachment system, trim, flashings, closures, and accessories; and special details.

2. Accessories: Include details of flashing, trim, and anchorage systems, at a scale of not less than 1-1/2 inches per 12 inches (1:10).

C. Samples for Verification: For each type of exposed finish required, prepared on Samples of size indicated below:

1. Metal Panels: 12 inches (305 mm) long by actual panel width. Include fasteners, closures, and other metal panel accessories.

1.5. INFORMATIONAL SUBMITTALS

A. Qualification Data: For Installer.

B. Product Test Reports: For each product, tests performed by a qualified testing agency.

C. Sample Warranties: For special warranties.

1.6. CLOSEOUT SUBMITTALS

A. Maintenance Data: For metal panels to include in maintenance manuals.

1.7. QUALITY ASSURANCE

A. Installer Qualifications: An entity that employs installers and supervisors who are trained and approved by manufacturer.

B. Mockups: Build mockups to verify selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for fabrication and installation.

1. Build mockup of typical roof eave, including fascia, and soffit; approximately 24 inches wide by full eave width, including attachments and accessories.

2. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.

3. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

1.8. DELIVERY, STORAGE, AND HANDLING

A. Deliver components, metal panels, and other manufactured items so as not to be damaged or deformed. Package metal panels for protection during transportation and handling.

B. Unload, store, and erect metal panels in a manner to prevent bending, warping, twisting, and surface damage.

C. Stack metal panels horizontally on platforms or pallets, covered with suitable weathertight and ventilated covering. Store metal panels to ensure dryness, with positive slope for drainage of water. Do not store metal panels in contact with other materials that might cause staining, denting, or other surface damage.

D. Retain strippable protective covering on metal panels during installation.

1.9. FIELD CONDITIONS

A. Weather Limitations: Proceed with installation only when existing and forecasted weather conditions permit assembly of metal panels to be performed according to manufacturers' written instructions and warranty requirements.

1.10. COORDINATION

A. Coordinate metal panel installation with rain drainage work, flashing, trim, construction of walls, and other adjoining work to provide a leakproof, secure, and noncorrosive installation.

1.11. WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of metal panel systems that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including rupturing, cracking, or puncturing.

b. Deterioration of metals and other materials beyond normal weathering.

2. Warranty Period: One year from date of Substantial Completion.

B. Special Warranty on Panel Finishes: Manufacturer's standard form in which manufacturer agrees to repair finish or replace metal panels that show evidence of deterioration of factory-applied finishes within specified warranty period.

1. Exposed Panel Finish: Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Finish Warranty Period: 20 years from date of Substantial Completion.

PART 2 PRODUCTS

2.1. PERFORMANCE REQUIREMENTS

A. Structural Performance: Provide metal panel systems capable of withstanding the effects of the following loads, based on testing according to ASTM E 1592:

1. Wind Loads: As indicated on Drawings.

2. Other Design Loads: As indicated on Drawings.

3. Deflection Limits: For wind loads, no greater than 1/180 of the span.

B. Air Infiltration: Air leakage of not more than 0.06 cfm/sq. ft. when tested according to ASTM E 283 at the following test-pressure difference:

1. Test-Pressure Difference: 1.57 lbf/sq. ft. (75 Pa).

C. Water Penetration under Static Pressure: No water penetration when tested according to ASTM E 331 at the following test-pressure difference:

1. Test-Pressure Difference: 2.86 lbf/sq. ft.

D. Thermal Movements: Allow for thermal movements from ambient and surface temperature changes by preventing buckling, opening of joints, overstressing of components, failure of joint sealants, failure of connections, and other detrimental effects. Base calculations on surface temperatures of materials due to both solar heat gain and nighttime-sky heat loss.

1. Temperature Change (Range): 120 deg F (67 deg C), ambient, material surfaces.

2.2. METAL SOFFIT PANELS

A. General: Provide metal soffit panels designed to be installed by lapping and interconnecting side edges of adjacent panels and mechanically attaching through panel to supports using concealed fasteners in side laps. Include accessories required for weathertight installation.

B. Metal Soffit Panels: match finish of composite metal wall panels.

C. Flush-Profile Metal Soffit Panels: Solid panels formed with vertical panel edges and a flat pan between panel edges; with flush joint between panels.

1. Basis-of-Design Product: Series UC-500 Panel as manufactured by Firestone Metal Products.

2. Panel width: 12 inches.

3. Panel height: 1 inch.

4. Substitutions: See Section 01 6000 - Product Requirements.

2.3. MISCELLANEOUS MATERIALS

A. Miscellaneous Metal Subframing and Furring: ASTM C 645, cold-formed, metallic-coated steel sheet, ASTM A 653/A 653M, G90 (Z275 hot-dip galvanized) coating designation or ASTM A 792/A 792M, Class AZ50 (Class AZM150) aluminum-zinc-alloy coating designation unless otherwise indicated. Provide manufacturer's standard sections as required for support and alignment of metal panel system.

B. Panel Accessories: Provide components required for a complete, weathertight panel system including trim, clips, flashings, sealants, gaskets, fillers, closure strips, and similar items. Match material and finish of metal panels unless otherwise indicated.

1. Closure Strips: Closed-cell, expanded, cellular, rubber or crosslinked, polyolefin-foam or closed-cell laminated polyethylene; minimum 1-inch- (25-mm-) thick, flexible closure strips; cut or premolded to match metal panel profile. Provide closure strips where indicated or necessary to ensure weathertight construction.

C. Flashing and Trim: Provide flashing and trim formed from same material as metal panels as required to seal against weather and to provide finished appearance. Finish flashing and trim with same finish system as adjacent metal panels.

D. Panel Fasteners: Self-tapping screws designed to withstand design loads. Provide exposed fasteners with heads matching color of metal panels by means of plastic caps or factory-applied coating. Provide EPDM or PVC sealing washers for exposed fasteners.

E. Panel Sealants: Provide sealant types recommended by manufacturer that are compatible with panel materials, are nonstaining, and do not damage panel finish.

1. Sealant Tape: Pressure-sensitive, 100 percent solids, gray polyisobutylene compound sealant tape with release-paper backing. Provide permanently elastic, nonsag, nontoxic, nonstaining tape 1/2 inch (13 mm) wide and 1/8 inch (3 mm) thick.

2. Joint Sealant: ASTM C 920; elastomeric polyurethane or silicone sealant; of type, grade, class, and use classifications required to seal joints in metal panels and remain weathertight; and as recommended in writing by metal panel manufacturer.
3. Butyl-Rubber-Based, Solvent-Release Sealant: ASTM C 1311.

2.4. FABRICATION

A. General: Fabricate and finish metal panels and accessories at the factory, by manufacturer's standard procedures and processes, as necessary to fulfill indicated performance requirements demonstrated by laboratory testing. Comply with indicated profiles and with dimensional and structural requirements.

B. Provide panel profile, including major ribs and intermediate stiffening ribs, if any, for full length of panel.

C. Fabricate metal panel joints with factory-installed captive gaskets or separator strips that provide a weathertight seal and prevent metal-to-metal contact, and that minimize noise from movements.

D. Sheet Metal Flashing and Trim: Fabricate flashing and trim to comply with manufacturer's recommendations and recommendations in SMACNA's "Architectural Sheet Metal Manual" that apply to design, dimensions, metal, and other characteristics of item indicated.

1. Form exposed sheet metal accessories that are without excessive oil canning, buckling, and tool marks and that are true to line and levels indicated, with exposed edges folded back to form hems.
2. Seams for Aluminum: Fabricate nonmoving seams with flat-lock seams. Form seams and seal with epoxy seam sealer. Rivet joints for additional strength.
3. Seams for Other Than Aluminum: Fabricate nonmoving seams in accessories with flat-lock seams. Tin edges to be seamed, form seams, and solder.
4. Sealed Joints: Form nonexpansion, but movable, joints in metal to accommodate sealant and to comply with SMACNA standards.
5. Conceal fasteners and expansion provisions where possible. Exposed fasteners are not allowed on faces of accessories exposed to view.
6. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal recommended in writing by metal panel manufacturer.
    a. Size: As recommended by SMACNA's "Architectural Sheet Metal Manual" or metal soffit panel manufacturer for application but not less than thickness of metal being secured.

2.5. FINISHES

A. Protect mechanical and painted finishes on exposed surfaces from damage by applying a strippable, temporary protective covering before shipping.

B. Appearance of Finished Work: Variations in appearance of abutting or adjacent pieces are acceptable if they are within one-half of the range of approved Samples. Noticeable variations in same piece are not acceptable. Variations in appearance of other components are acceptable if they are within the range of approved Samples and are assembled or installed to minimize contrast.

C. Steel Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 621. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

D. Aluminum Panels and Accessories:

1. Two-Coat Fluoropolymer: AAMA 2605. Fluoropolymer finish containing not less than 70 percent PVDF resin by weight in color coat. Prepare, pretreat, and apply coating to exposed metal surfaces to comply with coating and resin manufacturers' written instructions.

PART 3 EXECUTION

3.1. EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances, metal panel supports, and other conditions affecting performance of the Work.

1. Examine framing to verify that girts, angles, channels, studs, and other structural panel support members and anchorage have been installed within alignment tolerances required by metal panel manufacturer.

2. Examine sheathing to verify that sheathing joints are supported by framing or blocking and that installation is within flatness tolerances required by metal panel manufacturer.

a. Verify that air- or water-resistive barriers been installed over sheathing or backing substrate to prevent air infiltration or water penetration.

B. Examine roughing-in for components and systems penetrating metal panels to verify actual locations of penetrations relative to seam locations of metal panels before installation.

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. PREPARATION

A. Miscellaneous Supports: Install subframing, furring, and other miscellaneous panel support members and anchorages according to ASTM C 754 and metal panel manufacturer's written recommendations.

1. Soffit Framing: Wire tie or clip furring channels to supports.

3.3. METAL PANEL INSTALLATION

A. General: Install metal panels according to manufacturer's written instructions in orientation, sizes, and locations indicated. Install panels perpendicular to supports unless otherwise indicated. Anchor metal panels and other components of the Work securely in place, with provisions for thermal and structural movement.

1. Shim or otherwise plumb substrates receiving metal panels.

2. Flash and seal metal panels at perimeter of all openings. Fasten with self-tapping screws. Do not begin installation until air- or water-resistive barriers and flashings that will be concealed by metal panels are installed.

3. Install screw fasteners in predrilled holes.

4. Locate and space fastenings in uniform vertical and horizontal alignment.

5. Install flashing and trim as metal panel work proceeds.

6. Locate panel splices over, but not attached to, structural supports. Stagger panel splices and end laps to avoid a four-panel lap splice condition.

7. Provide weathertight escutcheons for pipe- and conduit-penetrating panels.

B. Fasteners:

1. Steel Panels: Use stainless-steel fasteners for surfaces exposed to the exterior; use galvanized-steel fasteners for surfaces exposed to the interior.

2. Aluminum Panels: Use aluminum or stainless-steel fasteners for surfaces exposed to the exterior; use aluminum or galvanized-steel fasteners for surfaces exposed to the interior.

3. Stainless-Steel Panels: Use stainless-steel fasteners.

C. Metal Protection: Where dissimilar metals contact each other or corrosive substrates, protect against galvanic action as recommended in writing by metal panel manufacturer.

D. Lap-Seam Metal Panels: Fasten metal panels to supports with fasteners at each lapped joint at location and spacing recommended by manufacturer.

1. Apply panels and associated items true to line for neat and weathertight enclosure.
2. Provide metal-backed washers under heads of exposed fasteners bearing on weather side of metal panels.
3. Locate and space exposed fasteners in uniform vertical and horizontal alignment. Use proper tools to obtain controlled uniform compression for positive seal without rupture of washer.
4. Install screw fasteners with power tools having controlled torque adjusted to compress washer tightly without damage to washer, screw threads, or panels. Install screws in predrilled holes.

E. Watertight Installation:

1. Apply a continuous ribbon of sealant or tape to seal lapped joints of metal panels, using sealant or tape as recommend by manufacturer on side laps of nesting-type panels and elsewhere as needed to make panels watertight.
2. Provide sealant or tape between panels and protruding equipment, vents, and accessories.
3. At panel splices, nest panels with minimum 6-inch (152-mm) end lap, sealed with sealant and fastened together by interlocking clamping plates.

F. Accessory Installation: Install accessories with positive anchorage to building and weathertight mounting, and provide for thermal expansion. Coordinate installation with flashings and other components.

1. Install components required for a complete metal panel system including trim, corners, seam covers, flashings, sealants, gaskets, fillers, closure strips, and similar items. Provide types indicated by metal panel manufacturer; or, if not indicated, provide types recommended by metal panel manufacturer.

G. Flashing and Trim: Comply with performance requirements, manufacturer's written installation instructions, and SMACNA's "Architectural Sheet Metal Manual." Provide concealed fasteners where possible, and set units true to line and level as indicated. Install work with laps, joints, and seams that are permanently watertight.

1. Install exposed flashing and trim that is without buckling, and tool marks, and that is true to line and levels indicated, with exposed edges folded back to form hems. Install sheet metal flashing and trim to fit substrates and to achieve waterproof performance.
2. Expansion Provisions: Provide for thermal expansion of exposed flashing and trim. Space movement joints at a maximum of 10 feet (3 m) with no joints allowed within 24 inches (610 mm) of corner or intersection. Where lapped expansion provisions cannot be used or would not be waterproof, form expansion joints of intermeshing hooked flanges, not less than 1 inch (25 mm) deep, filled with mastic sealant (concealed within joints).

3.4. CLEANING AND PROTECTION

A. Remove temporary protective coverings and strippable films, if any, as metal panels are installed unless otherwise indicated in manufacturer's written installation instructions. On completion of metal panel installation, clean finished surfaces as recommended by metal panel manufacturer. Maintain in a clean condition during construction.

B. Replace metal panels that have been damaged or have deteriorated beyond successful repair by finish touchup or similar minor repair procedures.

END OF SECTION

SECTION 07 5423 - THERMOPLASTIC-POLYOLEFIN ROOFING (TPO) - FIRESTONE

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Thermoplastic membrane roofing system, including all components specified.

1.2. RELATED REQUIREMENTS

A. Section 05 3100 - Metal Decking: Metal roof deck.

B. Section 06 1000 - Rough Carpentry: Wood nailers associated with roofing and roof insulation.

C. Section 07 6200 - Sheet Metal Flashing and Trim: Formed metal flashing and trim items associated with roofing.

D. Section 07 7100 - Roof Specialties: Manufactured copings, fascias, gravel stops, and other flashing-related items.

E. Section 07 7123 - Manufactured Gutters and Downspouts: Gutters and downspouts at entry canopy.

F. Section 07 7200 - Roof Accessories: Roof equipment mounting and roof penetration curbs.

G. Section 09 2116 - Gypsum Board Assemblies: Gypsum-based exterior sheathing.

1.3. DEFINITIONS

A. Roofing Terminology: Refer to ASTM D1079 for definition of terms related to roofing work not otherwise defined in the section.

B. LTTR: Long Term Thermal Resistance, as defined by CAN-ULC-S770.

1.4. REFERENCE STANDARDS

A. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2017.

B. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.

C. ASTM C473 - Standard Test Methods for Physical Testing of Gypsum Panel Products; 2019.

D. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

E. ASTM C1177/C1177M - Standard Specification for Glass Mat Gypsum Substrate for Use as Sheathing; 2013.

F. ASTM C1289 - Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board; 2014.

G. ASTM C1549 - Standard Test Method for Determination of Solar Reflectance Near Ambient Temperature Using a Portable Solar Reflectometer; 2016.

H. ASTM D638 - Standard Test Method for Tensile Properties of Plastics; 2014.

I. ASTM D1004 - Standard Test Method for Tear Resistance (Graves Tear) of Plastic Film and Sheeting; 2013.

J. ASTM D1079 - Standard Terminology Relating to Roofing and Waterproofing; 2020.

K. ASTM D1621 - Standard Test Method for Compressive Properties Of Rigid Cellular Plastics; 2016.

L. ASTM D1622/D1622M - Standard Test Method for Apparent Density of Rigid Cellular Plastics; 2014.

M. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

N. ASTM D4601/D4601M - Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing; 2004 (Reapproved 2020).

O. ASTM D6163/D6163M - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements; 2016.

P. ASTM D6164/D6164M - Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements; 2016.

Q. ASTM D6878/D6878M - Standard Specification for Thermoplastic Polyolefin Based Sheet Roofing; 2019.

R. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

S. ASTM E136 - Standard Test Method for Behavior of Materials in a Vertical Tube Furnace At 750 Degrees C; 2012.

T. CAN-ULC-S770 - Standard Test Method Determination of L-Term Thermal Resistance Of Closed-Cell Thermal Insulating Foams; 2015.

U. FM (AG) - FM Approval Guide; current edition.

V. FM 4470 - Approval Standard for Single-Ply, Polymer-Modified Bitumen Sheet, Built-Up Roof (BUR) and Liquid Applied Roof Assemblies for use in Class 1 and Noncombustible Roof Deck Construction; 2016.

W. FM DS 1-29 - Roof Deck Securement and Above-Deck Roof Components; 2016, with Editorial Revision (2020).

X. ISO 9000 - Quality management systems -- Fundamentals and vocabulary; 2015.

1.5. ADMINISTRATIVE REQUIREMENTS

A. Pre-Installation Conference: Before start of roofing work, Contractor 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.

1.6. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. 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.

C. Shop Drawings: Provide:

1. The roof membrane manufacturer's standard details customized for this project for all relevant conditions, including flashings, base tie-ins, roof edges, terminations, expansion joints, penetrations, and drains.

2. For tapered insulation, provide project-specific layout and dimensions for each board.

D. Specimen Warranty: Submit prior to starting work.

E. Pre-Installation Notice: Copy to show that manufacturer's required Pre Installation Notice (PIN) has been accepted and approved by the manufacturer.

F. Executed Warranty.

1.7. INSTALLER

A. Acceptable Installer: B&L Sheet Metal and Roofing, Inc.

1.8. 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.

1.9. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Comply with all warranty procedures required by manufacturer, including notifications, scheduling, and inspections.

C. Warranty: Firestone Red Shield Roofing System Limited Warranty covering membrane, roof insulation, and other indicated components of the system, for the term indicated.

1. Warranty Term: 20 years.

2. Limit of Liability: No dollar limitation.

3. Scope of Coverage: Repair leaks in the roofing system caused by:

a. Ordinary wear and tear of the elements.

b. Unintentional damage due to normal rooftop inspections, maintenance, or service at areas protected by protective walkway surface.

c. Manufacturing defect in Firestone brand materials.

d. Defective workmanship used to install these materials.

e. Damage due to winds up to 55 mph.

4. Not Covered:

a. Damage due to winds in excess of 55 mph.

b. Damage due to hurricanes or tornadoes.

c. Damage due to hail.

d. Intentional damage.

e. Unintentional damage due to normal rooftop inspections, maintenance, or service at areas not protected by protective walkway surface.

D. Insulation Warranty: Separate Firestone ISO 95+ Insulation Warranty with warranty term coinciding with Red Shield Warranty.

1. Limit of Liability: No dollar limitation

2. Scope of Coverage: Provide replacement for insulation that warps, bows, or is on the point of causing a roof leak as a result of manufacturing defect.

E. Metal Roof Edging: Firestone full-system warranty for roof edge system, covering blow-off from winds up to 150 mph.

F. Metal Roof Edging with Exposed Decorative Fascia: Provide 20 year warranty for painted finish covering color fade, chalk, and film integrity.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Acceptable Manufacturer - Roofing System: Firestone Building Products LLC, Carmel, IN: www.firestonebpco.com/#sle.

B. Acceptable Installer: B&L Sheet Metal and Roofing, Inc.

C. Basis of Design: The Owner has confirmed that the existing roofing system on the existing hospital building affected by this project is Firestone Ultraply TPO Platinum Membrane, 0.080 inch membrane adhered to tapered polyisocyanurate insulation; which will serve as basis of design for this project.

D. Manufacturer of Insulation and Cover Boards: Same manufacturer as roof membrane.

E. Manufacturer of Metal Roof Edging: Same manufacturer as roof membrane.

1. Metal roof edging products by other manufacturers are not acceptable.
2. Field- or shop-fabricated metal roof edgings are not acceptable.

F. No sustitutions are permitted.

2.2. ROOFING SYSTEM DESCRIPTION

A. Roofing System: Thermoplastic polyolefin (TPO) single-ply membrane.

1. Membrane Attachment: Fully adhered.
2. Warranty: Full system warranty; Firestone 20 year Red Shield Limited Warranty covering membrane, roof insulation, and membrane accessories.
3. Slope: Deck is flat, provide slope of 1/4 inch per foot by means of tapered insulation.
4. Comply with applicable local building code requirements.
5. Provide assembly having Underwriters Laboratories, Inc. (UL) Class A Fire Hazard Classification.

B. Roofing System Components: Listed in order from the top of the roof down:

1. Membrane: Thickness as indicated.
2. Base Sheet Over Insulation: Cold adhesive attached.
3. Insulation Cover Board: High density polyisocyanurate; cold adhesive attached.
4. Insulation:
    a. Maximum Board Thickness: 3 inches; use as many layers as necessary; stagger joints in adjacent layers.
    b. Tapered: Slope as indicated; provide minimum R-value at thinnest point; place tapered layer on bottom.
    c. Total R-value of 30, minimum.
    d. Crickets: Tapered insulation of same type as specified for top layer; slope as indicated.
5. Vapor Retarder: One layer SBS modified bitumen base sheet; heat fused.
6. Roof Sheathing: Refer to Section 09 2116 for exterior sheathing.
7. Metal Roof Deck: Refer to Section 05 3100 for meal roock deck.
8. Applied Fire Proofing: Refer to Section 07 8100 for applied fire proofing.

2.3. MEMBRANE MATERIALS

A. Membrane: Flexible, heat weldable sheet composed of thermoplastic polyolefin polymer and ethylene propylene rubber; complying with ASTM D6878/D6878M, with polyester weft inserted reinforcement and the following additional characteristics:

1. Solar Reflectance: 0.79, minimum, when tested in accordance with ASTM C1549.
2. Color: White.
3. Acceptable Product: UltraPly Platinum TPO by Firestone.

B. Slip Sheet: Coated glass fiber mat; qualified as part of Class A assembly over combustible and non-combustible decks, complying with ASTM D828 tensile testing.

1. Adhesive: Token application may be necessary under windy conditions.

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 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, minimum, when tested in accordance with ASTM D638 after heat aging.
3. Elongation at Break: 650 percent, minimum, when tested in accordance with ASTM D638 after heat aging.
4. Tearing Strength: 12 lbf, minimum, when tested in accordance with ASTM D1004 after heat aging.
5. Color: White.
6. Acceptable Product: UltraPly TPO Flashing by Firestone.

E. Tape Flashing: 5-1/2 inch nominal wide TPO membrane laminated to cured rubber polymer seaming tape, overall thickness 0.065 inch nominal; TPO QuickSeam Flashing by Firestone.

F. Bonding Adhesive: Neoprene and SBR rubber blend, formulated for compatibility with the membrane other substrate materials, including masonry, wood, and insulation facings; UltraPly Bonding Adhesive by Firestone.

G. Pourable Sealer: Two-part polyurethane, two-color for reliable mixing; Pourable Sealer by Firestone.

H. Seam Plates: Steel with barbs and Galvalume coating; corrosion-resistance complying with FM 4470.

I. Termination Bars: Aluminum bars with integral caulk ledge; 1.3 inches wide by 0.10 inch thick; Firestone Termination Bar by Firestone.

J. Cut Edge Sealant: Synthetic rubber-based, for use where membrane reinforcement is exposed; UltraPly TPO Cut Edge Sealant by Firestone.

K. General Purpose Sealant: EPDM-based, one part, white general purpose sealant; UltraPly TPO General Purpose Sealant by Firestone.

L. 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.

M. Water Block Seal: Butyl rubber sealant for use between two surfaces, not exposed; Water Block Seal by Firestone.

N. Roof Walkway Pads: Non-reinforced TPO walkway pads, 0.130 inch by 30 inches by 40 feet long with patterned traffic bearing surface; UltraPly TPO Walkway Pads by Firestone.

2.4. VAPOR RETARDER MATERIALS

A. Base Sheet: Firestone MB Base Sheet; high-performance, asphalt coated, fiberglass reinforced, roofing base sheet complying with ASTM D4601/D4601M Type II.

B. Base Sheet: Torch grade SBS polymer-modified bitumen sheet, reinforced with non-woven fabric, complying with ASTM D6163/D6163M, Type I, Grade S, or ASTM D6164/D6164M, Type I, Grade S, formulated for torch application to substrate and cap sheet; Firestone SBS Poly Torch Base or SBS Glass Torch Base.

C. Adhesive: As recommended by roofing membrane manufacturer.

2.5. ROOF INSULATION AND COVER BOARDS

A. Polyisocyanurate Board Insulation: Closed cell polyisocyanurate foam with black glass reinforced mat laminated to faces, complying with ASTM C1289 Type II Class 1, with the following additional characteristics:

1. Thickness: As indicated elsewhere.
2. Size: 48 inches by 48 inches, nominal.
3. R-value (LTTR):
    a. 4.0 inch Thickness: 25.0, minimum.
4. Compressive Strength: 20 psi when tested in accordance with ASTM C1289.
5. UL-Classified and FM-approved for direct to steel deck applications.
6. Ozone Depletion Potential: Zero; made without CFC or HCFC blowing agents.
7. Recycled Content: 19 percent post-consumer and 15 percent pre-consumer (post-industrial), average.
8. Acceptable Product: ISO 95+ GL Polyisocyanurate Insulation by Firestone.

B. High Density Polyisocyanurate Cover Board: Non-combustible, water resistant, high density closed cell polyisocyanurate core with coated glass mat facers, with the following characteristics:

1. Size: 48 inches by 48 inches, nominal.
2. Thickness: 1/2 inch.
3. Thermal Value: R-value of 2.5, when tested in accordance with ASTM C518 and ASTM C177.
4. Surface Water Absorption: 3 percent, maximum, when tested in accordance with ASTM C209.
5. Compressive Strength: 120 psi, when tested in accordance with ASTM D1621.
6. Density: 5 pcf, when tested in accordance with ASTM D1622/D1622M.
7. Factory Mutual approved for use with FM 1-60 and 1-90 rated roofing assemblies.
8. Mold Growth Resistance: Passing ASTM D3273.
9. Acceptable Product: ISOGARD HD Cover Board by Firestone.

2.6. METAL ACCESSORIES

A. Metal Roof Edging and Fascia: Continuous metal edge member serving as termination of roof membrane and retainer for metal fascia; watertight with no exposed fasteners; mounted to roof edge nailer.

1. Wind Performance:
    a. Membrane Pull-Off Resistance: 100 lbs/ft, minimum, when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-1.
    b. Fascia Pull-Off Resistance: At least minimum required when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-2.
    c. Provide product listed in FM (AG) with at least FM 1-270 rating.
2. Fascia Face Height: 5 inches.
3. Edge Member Height Above Nailer: 1-1/4 inches.
4. Length: 144 inches.
5. Functional Characteristics: Fascia retainer supports while allowing for free thermal cycling of fascia.
6. Aluminum Bar: Continuous 6063-T6 alloy aluminum extrusion with pre-punched slotted holes; miters welded; injection molded EPDM splices to allow thermal expansion.
7. Anchor Bar Cleat: 20 gauge, 0.036 inch G90 coated commercial type galvanized steel with pre-punched holes.
8. Fasteners: Factory-provided corrosion resistant fasteners, with drivers; no exposed fasteners permitted.

9. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, scuppers, and end caps; minimum 14 inch long legs on corner pieces.

B. Parapet Copings: Formed metal coping with galvanized steel anchor/support cleats for capping any parapet wall; watertight, maintenance free, without exposed fasteners; butt type joints with concealed splice plates; mechanically fastened as indicated; Firestone PTCF.

1. Wind Performance:

a. At least minimum required when tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3.

b. Provide product listed in FM (AG) with at least FM 1-90 rating.

2. Description: Coping sections allowed to expand and contract freely while locked in place on anchor cleats by mechanical pressure from hardened stainless steel springs factory attached to anchor cleats; 8 inch wide splice plates with factory applied dual non-curing sealant strips capable of providing watertight seal.

3. Dimensions:

a. Wall Width: As indicated on the drawings.

b. Piece Length: Minimum 144 inches.

4. Anchor/Support Cleats: 20 gauge, 0.036 inch thick prepunched galvanized cleat with 12 inch wide stainless steel spring mechanically locked to cleat at 72 inches on center.

5. Special Shaped Components: Provide factory-fabricated pieces necessary for complete installation, including miters, corners, intersections, curves, pier caps, and end caps; minimum 14 inch long legs on corner, intersection, and end pieces.

6. Fasteners: Factory-furnished; electrolytically compatible; minimum pull out resistance of 240 pounds for actual substrate used; no exposed fasteners.

PART 3 INSTALLATION

3.1. 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.

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.

3.2. 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.

3.3. 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 wide with fill material acceptable insulation to membrane manufacturer.

D. Wood Nailers: Provide wood nailers at all perimeters and other locations where indicated on the drawings, of total height matching the total thickness of insulation being used.

1. Install with 1/8 inch gap between each length and at each change of direction.
2. Mechanically fasten to deck to resist force of 200 lbf per linear foot.

3.4. VAPOR RETARDER

A. Before installing insulation install vapor retarder directly over the deck.

B. Ensure that all penetrations and edge conditions are sealed to prevent moisture and air drive into the roofing system.

3.5. INSULATION AND COVER BOARD INSTALLATION

A. Install insulation in configuration and with attachment method(s) specified in PART 2, under Roofing System.

B. Install insulation in a manner that will not compromise the vapor retarder integrity.

C. 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.

D. Lay roof insulation in courses parallel to roof edges.

E. Neatly and tightly fit insulation to all penetrations, projections, and nailers, with gaps not greater than 1/4 inch. Fill gaps greater than 1/4 inch with acceptable insulation. Do not leave the roofing membrane unsupported over a space greater than 1/4 inch.

3.6. SINGLE-PLY 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. Install membrane adhered to the substrate, with edge securement as specified.

E. Adhered Membrane: Bond membrane sheet to substrate using membrane manufacturer's recommended bonding material, application rate, and procedures.

F. Edge Securement: Secure membrane at all locations where membrane terminates or goes through an angle change greater than 2 in 12 inches 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 in diameter and square penetrations less than 4 inches square.

2. Metal edging is not merely decorative; ensure anchorage of membrane as intended by roofing manufacturer.

3.7. 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. Metal Accessories: Install metal edgings, gravel stops, and copings in locations indicated on the drawings, with horizontal leg of edge member over membrane and flashing over metal onto membrane.

1. Follow roofing manufacturer's instructions.

2. Remove protective plastic surface film immediately before installation.

3. Install water block sealant under the membrane anchorage leg.

4. Flash with manufacturer's recommended flashing sheet unless otherwise indicated.

5. Where single application of flashing will not completely cover the metal flange, install additional piece of flashing to cover the metal edge.

6. If the roof edge includes a gravel stop and sealant is not applied between the laps in the metal edging, install an additional piece of self-adhesive flashing membrane over the metal lap to the top of the gravel stop; apply seam edge treatment at the intersections of the two flashing sections.

7. When the roof slope is greater than 1:12, apply seam edge treatment along the back edge of the flashing.

C. Scuppers: Set in sealant and secure to structure; flash as recommended by manufacturer.

D. Roofing Expansion Joints: Install as shown on drawings and as recommended by roofing manufacturer.

E. 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 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.

F. 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 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.

G. 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 deep, with at least 1 inch clearance from penetration, sloped to shed water.
3. Structural Steel Tubing: If corner radii are greater than 1/4 inch and longest side of tube does not exceed 12 inches, 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, protect the elastomeric components from direct contact with the hot surfaces using an intermediate insulated sleeve as flashing substrate as recommended by membrane manufacturer.

3.8. FINISHING AND WALKWAY INSTALLATION

A. Install walkways at access points to the roof, around rooftop equipment and ductwork that may require maintenance, and where indicated on the drawings.

B. Walkway Pads: Adhere to the roofing membrane, spacing each pad at minimum of 1.0 inch and maximum of 3.0 inches from each other to allow for drainage.

1. If installation of walkway pads over field fabricated splices or within 6 inches of a splice edge cannot be avoided, adhere another layer of flashing over the splice and extending beyond the walkway pad a minimum of 6 inches on either side.
2. Prime the membrane, remove the release paper on the pad, press in place, and walk on pad to ensure proper adhesion.

3.9. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. 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).

C. Perform all corrections necessary for issuance of warranty.

3.10. 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.

3.11. 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

SECTION 07 6200 - SHEET METAL FLASHING AND TRIM

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Fabricated sheet metal items, including flashings and counterflashings.

B. Sealants for joints within sheet metal fabrications.

1.2. RELATED REQUIREMENTS

A. Section 07 5423 - Thermoplastic Polyolefin Roofing (TPO): Manufactured roof edges and copings associated with membrane roof system.

B. Section 07 7100 - Roof Specialties: roof edge drainage systems.

C. Section 07 7123 - Manufactured Gutters and Downspouts: gutters and downspouts for entry canopy.

D. Section 07 7200 - Roof Accessories: Roof equipment mounting and penetration curbs.

E. Section 07 9200 - Joint Sealants: Sealing non-lap joints between sheet metal fabrications and adjacent construction.

1.3. REFERENCE STANDARDS

A. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

G. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

H. ASTM D226/D226M - Standard Specification for Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing; 2017.

I. ASTM D4479/D4479M - Standard Specification for Asphalt Roof Coatings - Asbestos-Free; 2007 (Reapproved 2012).

J. ASTM D4586/D4586M - Standard Specification for Asphalt Roof Cement, Asbestos-Free; 2007 (Reapproved 2012).

K. CDA A4050 - Copper in Architecture - Handbook; current edition.

L. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate material profile, jointing pattern, jointing details, fastening methods, flashings, terminations, and installation details.

C. Samples: Submit two samples 2 by 3 inch minimum in size illustrating metal finish colors for final selection.

1.5. QUALITY ASSURANCE

A. Perform work in accordance with SMACNA (ASMM) and CDA A4050 requirements and standard details, except as otherwise indicated.

B. Fabricator and Installer Qualifications: Company specializing in sheet metal work with five years of documented experience.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, and abrasion, and to provide ventilation. Slope metal sheets to ensure drainage.

B. Prevent contact with materials that could cause discoloration or staining.

PART 2 PRODUCTS

2.1. SHEET MATERIALS

A. Pre-Finished Galvanized Steel: ASTM A653/A653M, with G90/Z275 zinc coating; minimum 24 gage, (0.0239) inch thick base metal, shop pre-coated with PVDF coating.

1. Modified Silicone Polyester Coating: Pigmented Organic Coating System, AAMA 2603; baked enamel finish system.

2. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system.

3. Color: As indicated on drawings.

B. Aluminum: ASTM B209 (ASTM B209M); 20 gauge, 0.032 inch thick; anodized finish of color as selected.

C. Stainless Steel: ASTM A666, Type 304 alloy, soft temper, 28 gage, (0.0156 inch) thick; smooth No. 4 - Brushed finish.

2.2. FABRICATION

A. Form sections true to shape, accurate in size, square, and free from distortion or defects.

B. Form pieces in longest possible lengths.

C. Hem exposed edges on underside 1/2 inch; miter and seam corners.

D. Form material with flat lock seams, except where otherwise indicated; at moving joints, use sealed lapped, bayonet-type or interlocking hooked seams.

E. Fabricate corners from one piece with minimum 18 inch long legs; seam for rigidity, seal with sealant.

F. Fabricate flashings to allow toe to extend 2 inches over roofing gravel. Return and brake edges.

2.3. ACCESSORIES

A. Fasteners: Galvanized steel, with soft neoprene washers.

B. Underlayment: ASTM D226/D226M, organic roofing felt, Type II (No. 30).

C. Primer: Zinc chromate type.

D. Protective Backing Paint: Asphaltic mastic, ASTM D4479 Type I.

E. Concealed Sealants: Non-curing butyl sealant.

F. Exposed Sealants: ASTM C920; elastomeric sealant, with minimum movement capability as recommended by manufacturer for substrates to be sealed; color to match adjacent material.

G. Plastic Cement: ASTM D4586/D4586M, Type I.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify roof openings, curbs, pipes, sleeves, ducts, and vents through roof are solidly set, reglets in place, and nailing strips located.

B. Verify roofing termination and base flashings are in place, sealed, and secure.

3.2. PREPARATION

A. Install starter and edge strips, and cleats before starting installation.

B. Back paint concealed metal surfaces with protective backing paint to a minimum dry film thickness of 15 mil.

3.3. INSTALLATION

A. Secure flashings in place using concealed fasteners, and use exposed fasteners only where permitted..

B. Apply plastic cement compound between metal flashings and felt flashings.

C. Fit flashings tight in place; make corners square, surfaces true and straight in planes, and lines accurate to profiles.

D. Seal metal joints watertight.

3.4. SCHEDULE

A. Through-Wall Flashing in Masonry: Stainless Steel

B. Coping, Cap, Parapet, Sill and Ledge Flashings: Pre-Finished Galvanized Steel

END OF SECTION

SECTION 07 7100 - ROOF SPECIALTIES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Manufactured roof specialties not included in other Sections.

B. Roof-edge drainage systems.

C. Reglets and counter flashings.

1.2. RELATED REQUIREMENTS

A. Section 07 5423 - Thermoplastic Polyolefin Roofing (TPO): Manufactured roof edges and copings associated with membrane roof system.

B. Section 07 7123 - Manufactured Gutters and Downspouts: Gutters and downspouts for entry canopy.

C. Section 07 7200 - Roof Accessories: Roof equipment mounting and penetration curbs.

D. Section 07 9000 - Expansion Joint Cover Assemblies: Roof expansion joint covers.

1.3. REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. AAMA 2603 - Voluntary Specification, Performance Requirements and Test Procedures for Pigmented Organic Coatings on Aluminum Extrusions and Panels (with Coil Coating Appendix); 2015.

C. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

D. ANSI/SPRI/FM 4435/ES-1 - Test Standard for Edge Systems Used with Low Slope Roofing Systems; 2017.

E. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

G. NRCA (RM) - The NRCA Roofing Manual; 2017.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on shape of components, materials and finishes, anchor types and locations.

C. Shop Drawings: Indicate configuration and dimension of components, adjacent construction, required clearances and tolerances, and other affected work.

D. Samples: Submit two appropriately sized samples of coping, illustrating component shape, finish, and color.

E. Manufacturer's Installation Instructions: Indicate special procedures, fasteners, supporting members, and perimeter conditions requiring special attention.

1.5. CLOSEOUT SUBMITTALS

A. Maintenance Data.

B. Executed Manfucturer's Warranties.

1.6. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer’s Standard Warranty: Warranted materials shall be free of defects in material and workmanship for five years after shipment. If, after inspection, the manufacturer agrees that materials are defective, the manufacturer shall at their option repair or replace them.

C. Manufacturer's Special Warranty: Warranty shall guarantee that a standard size roof edge system, when installed per manufacturer's instructions, will not blow off, leak, or cause membrane failure, even in wind conditions up to 110 mph, or the manufacturer shall at their option repair or replace their materials.

1. Warranty Period: Twenty (20) years from date of Substantial Completion.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Roof Edge Flashings and Copings:

1. Architectural Products Co: www.archprod.com/#sle.
2. ATAS International, Inc; Rapid-Lok Fascia: www.atas.com/#sle.
3. Drexel Metals Inc; Fascia: www.drexmet.com/#sle.
4. Metal-Era Inc: www.metalera.com/#sle.
5. Metal Roofing Systems, Inc; Rapid Lock Coping: www.metalroofingsystems.biz/#sle.
6. OMG Roofing Products; Formed Coping Plus: www.omgroofing.com/#sle.
7. Substitutions: See Section 01 6000 - Product Requirements.

2.2. COMPONENTS

A. Copings: Factory fabricated to sizes required; mitered, welded corners; concealed fasteners.

1. Configuration: Concealed continuous hold down cleat at both legs; internal splice piece at joints of same material, thickness and finish as cap; concealed stainless steel fasteners.
2. Pull-Off Resistance: Tested in accordance with ANSI/SPRI/FM 4435/ES-1 using test method RE-3 to positive and negative design wind pressure as defined by applicable local building code.
3. Material: Formed steel sheet, galvanized, 0.050 inch thick, minimum.
4. Clips: Galvanized steel, 20 gage thich, minimum.
5. Finish: 70 percent polyvinylidene fluoride.
6. Color: As indicated on drawings.

2.3. ROOF-EDGE DRAINAGE SYSTEMS

A. Downspouts: Plain rectangular complete with elbows, manufactured from the following exposed metal. Furnish with metal hangers, from same material as downspouts, and anchors.

1. Zinc-Coated Steel: Nominal 0.034-inch thickness.

B. Parapet Scuppers: Manufactured with closure flange trim to exterior, 4-inch- wide wall flanges to interior, and base extending 4 inches beyond cant or tapered strip into field of roof.

1. Zinc-Coated Steel: Nominal 0.028-inch thickness.

C. Conductor Heads: Manufactured conductor heads, each with flanged back and stiffened top edge, and of dimensions and shape indicated, complete with outlet tube that nests into upper end of downspout, exterior flange trim,.

1. Basis of Design Product: GutterSupply.com; Standard 6" Conductor Head.
2. Zinc-Coated Steel: Nominal 0.028-inch thickness.
3. Substitutions: See Section 01 6000 - Product Requirements.

D. Zinc-Coated Steel Finish: Two-coat fluoropolymer / Two-coat mica fluoropolymer.

1. Color: Match dark bronze anodized aluminum.

2.4. REGLETS AND COUNTER FLASHINGS

A. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Castle Metal Products.
2. Cheney Flashing Company.
3. Fry Reglet Corporation.
4. Heckmann Building Products Inc.
5. Hickman Company, W. P.
6. Keystone Flashing Company, Inc.
7. Metal-Era, Inc.
8. Metal-Fab Manufacturing, LLC.

B. Reglets: Manufactured units formed to provide secure interlocking of separate reglet and counterflashing pieces, from the following exposed metal:

1. Formed Aluminum: 0.050 inch thick.
2. Surface-Mounted Type: Provide reglets with slotted holes for fastening to substrate, with neoprene or other suitable weatherproofing washers, and with channel for sealant at top edge.
3. Masonry Type, Embedded: Provide reglets with offset top flange for embedment in masonry mortar joint.

C. Counterflashings: Manufactured units of heights to overlap top edges of base flashings by 4 inches and in lengths not exceeding 12 feet designed to snap into reglets or through-wall-flashing receiver and compress against base flashings with joints lapped, from the following exposed metal:

1. Formed Aluminum: 0.032 inch thick.

D. Accessories:

1. Flexible-Flashing Retainer: Provide resilient plastic or rubber accessory to secure flexible flashing in reglet where clearance does not permit use of standard metal counterflashing or where reglet is provided separate from metal counterflashing.
2. Counterflashing Wind-Restraint Clips: Provide clips to be installed before counterflashing to prevent wind uplift of counterflashing lower edge.

2.5. FINISHES

A. Color Anodized Finish: AAMA 611 AA-M12C22A42/44 Class I integrally or electrolytically colored anodic coating not less than 0.7 mils thick; color as indicated.

B. PVDF (Polyvinylidene Fluoride) Coating: Superior Performance Organic Finish, AAMA 2605; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

2.6. ACCESSORIES

A. Sealant for Joints in Linear Components: As recommended by component manufacturer.

B. Adhesive for Anchoring to Roof Membrane: Compatible with roof membrane and approved by roof membrane manufacturer.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that deck, curbs, roof membrane, base flashing, and other items affecting work of this Section are in place and positioned correctly.

3.2. INSTALLATION

A. Install components in accordance with manufacturer's instructions and NRCA (RM) applicable requirements.

B. Seal joints within components when required by component manufacturer.

C. Anchor components securely.

D. Coordinate installation of components of this section with installation of roofing membrane and base flashings.

E. Coordinate installation of sealants and roofing cement with work of this section to ensure water tightness.

F. Coordinate installation of flashing flanges into reglets.

END OF SECTION

SECTION 07 7123 - MANUFACTURED GUTTERS AND DOWNSPOUTS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Aluminum gutters and downspouts.

B. Precast concrete splash pads.

1.2. RELATED REQUIREMENTS

A. Section 07 7100 - Roof Specialties: Roof-edge drainage parapet scuppers and conductor heads.

1.3. REFERENCE STANDARDS

A. AAMA 2604 - Voluntary Specification, Performance Requirements and Test Procedures for High Performance Organic Coatings on Aluminum Extrusions and Panels; 2013.

B. AAMA 2605 - Voluntary Specification, Performance Requirements and Test Procedures for Superior Performing Organic Coatings on Aluminum Extrusions and Panels; 2013.

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. SMACNA (ASMM) - Architectural Sheet Metal Manual; 2012.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on prefabricated components.

C. Shop Drawings: Indicate locations, configurations, jointing methods, fastening methods, locations, and installation details.

D. Samples: Submit two samples, 4 inch long illustrating component design, finish, color, and configuration.

1.5. DELIVERY, STORAGE, AND HANDLING

A. Stack material to prevent twisting, bending, or abrasion, and to provide ventilation. Slope to drain.

B. Prevent contact with materials that could cause discoloration, staining, or damage.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Gutters and Downspouts:

1. ATAS International, Inc; Water Control System: www.atas.com/#sle.

2. Cheney Flashing Company: www.cheneyflashing.com/#sle.

3. OMG Roofing Products: www.omgroofing.com/#sle.

4. SAF Perimeter Systems, a division of Southern Aluminum Finishing Company, Inc: www.saf.com/persys/#sle.

5. Substitutions: See Section 01 6000 - Product Requirements.

2.2. MATERIALS

A. Pre-Finished Aluminum Sheet: ASTM B209 (ASTM B209M); 0.032 inch thick.

1. Finish: Plain, shop pre-coated with PVDF (polyvinylidene fluoride) coating.

2. Color: As indicated.

2.3. COMPONENTS

A. Gutters: Profile as indicated.

B. Downspouts: SMACNA Rectangular profile.

C. Anchors and Supports: Profiled to suit gutters and downspouts.

D. Fasteners: Galvanized steel, with soft neoprene washers.

2.4. ACCESSORIES

A. Leaf Guards:

1. Basis of design is SAF Commercial Gutter Leaf Guard.

a. Manufactured from 0.040” aluminum with 3/16” holes @ ¼” staggered centers to provide a 50% open area for drainage while keeping debris out of the gutter system.

b. System is to be attached with clips at 30” on center to allow for the end user the ability to remove debris if needed.

c. Finish: same color as gutter system.

2. Substitutions: See Section 01 6000 - Product Requirements.

B. Splash Pads: Precast concrete type, size and profiles indicated; minimum 3000 psi at 28 days, with minimum 5 percent air entrainment.

2.5. FABRICATION

A. Form gutters and downspouts of profiles and size indicated.

B. Fabricate with required connection pieces.

C. Form sections square, true, and accurate in size, in maximum possible lengths, free of distortion or defects detrimental to appearance or performance. Allow for expansion at joints.

D. Hem exposed edges of metal.

E. Fabricate gutter and downspout accessories; seal watertight.

2.6. FINISHES

A. Fluoropolymer Coating: High Performance Organic Finish, AAMA 2604; multiple coat, thermally cured fluoropolymer finish system; color as indicated.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that surfaces are ready to receive work.

3.2. PREPARATION

A. Paint concealed metal surfaces and surfaces in contact with dissimilar metals with protective backing paint to a minimum dry film thickness of 15 mil.

3.3. INSTALLATION

A. Install gutters, downspouts, and accessories in accordance with manufacturer's instructions.

B. Slope gutters 0.025 inch per foot, 2.5 percent minimum.

C. Solder metal joints for full metal surface contact. After soldering, wash metal clean with neutralizing solution and rinse with water.

D. Connect downspouts to storm sewer system. Grout connection watertight.

END OF SECTION

SECTION 07 7200 - ROOF ACCESSORIES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Curbs.

B. Roof penetration mounting curbs.

1.2. RELATED REQUIREMENTS

A. Section 07 5423 Thermoplastic Polyolefin Roofing (TPO): gravel stops and copings associated with membrane roofing system.

B. Section 07 7100 - Roof Specialties: Other manufactured roof items, roof edge drainage systems.

C. Section 07 7123 - Manufactured Gutters and Downspouts: Gutters and downspouts at entry canopy.

1.3. REFERENCE STANDARDS

A. 29 CFR 1910.23 - Ladders; current edition.

B. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM A792/A792M - Standard Specification for Steel Sheet, 55% Aluminum-Zinc Alloy-Coated by the Hot-Dip Process; 2010 (Reapproved 2015).

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

H. FM (AG) - FM Approval Guide; current edition.

I. UL (DIR) - Online Certifications Directory; Current Edition.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used.

1. Preparation instructions and recommendations.
2. Storage and handling requirements and recommendations.
3. Installation methods.
4. Maintenance requirements.

C. Shop Drawings: Submit detailed layout developed for this project and provide dimensioned location and number for each type of roof accessory.

1. Non-penetrating Rooftop Supports: Submit design calculations for loadings and spacings.
2. Submit shop drawings sealed and signed by a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

D. Warranty Documentation:

1. Submit manufacturer warranty.
2. Ensure that forms have been completed in Owner's name and registered with manufacturer.

3. Submit documentation that roof accessories are acceptable to roofing manufacturer, and do not limit the roofing warranty.

1.5. DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store products under cover and elevated above grade.

1.6. 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

2.1. ROOF CURBS

A. Manufacturers:

1. AES Industries Inc: www.aescurb.com/#sle.
2. The Pate Company: www.patecurbs.com/#sle.
3. LMCurbs; Roof Curbs: www.lmcurbs.com/#sle.
4. Roof Products & Systems (RPS): www.rpscurbs.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Roof Curbs Mounting Assemblies: Factory fabricated hollow sheet metal construction, internally reinforced, and capable of supporting superimposed live and dead loads and designated equipment load with fully mitered and sealed corner joints welded or mechanically fastened, and integral counterflashing with top and edges formed to shed water.

1. Applications: Roof curbs used for roof penetrations/openings as indicated on drawings, HVAC units, exhaust fans, duct openings, and equipment supports.
2. Provide layouts and configurations indicated on drawings.

C. Curbs Adjacent to Roof Openings: Provide curb on each side of opening, with top of curb horizontal for equipment mounting.

1. Provide preservative treated wood nailers along top of curb.
2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.
3. Height Above Finished Roof Surface: 8 inches, minimum.

D. Equipment Rail Curbs: Straight curbs on each side of equipment, with top of curbs horizontal and level with each other for equipment mounting.

1. Provide preservative treated wood nailers along top of rails.
2. Height Above Finished Roof Surface: 8 inches, minimum.
3. Manufacturers:
   a. MKT Metal Manufacturing; Equipment Rails: www.mktduct.com/#sle.
   b. Substitutions: See Section 01 6000 - Product Requirements.

E. Equipment Support: Straight curbs on each side of equipment, with top of curbs parallel with metal roofing system and each other for equipment mounting.

1. Height Above Metal Roofing System: 8 inches, minimum.

F. Pipe, Duct, or Conduit Mounting Curbs: Vertical posts, minimum 8 inches square unless otherwise indicated.

1. Provide sliding channel welded along top edge with adjustable height steel bracket, fabricated to fit item supported.

2. Height Above Finished Roof Surface: 8 inches, minimum.

PART 3 EXECUTION

3.1. EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2. PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving acceptable results for applicable substrate under project conditions.

3.3. INSTALLATION

A. Install in accordance with manufacturer's instructions, in manner that maintains roofing system weather-tight integrity.

3.4. CLEANING

A. Clean installed work to like-new condition.

3.5. PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 07 8400 - FIRESTOPPING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Firestopping systems.

B. Firestopping of joints and penetrations in fire resistance rated and smoke resistant assemblies, whether indicated on drawings or not, and other openings indicated.

1.2. RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Cutting and patching.

1.3. REFERENCE STANDARDS

A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).

D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.

E. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013 (Reapproved 2017).

F. ITS (DIR) - Directory of Listed Products; current edition.

G. FM (AG) - FM Approval Guide; current edition.

H. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

I. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.

J. UL (DIR) - Online Certifications Directory; Current Edition.

K. UL (FRD) - Fire Resistance Directory; current edition.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.

C. Product Data: Provide data on product characteristics, performance ratings, and limitations.

1.5. QUALITY ASSURANCE

A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.

1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and:

1. Trained by manufacturer.

1.6. FIELD CONDITIONS

A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Firestopping Manufacturers:

1. 3M Fire Protection Products: www.3m.com/firestop/#sle.
2. A/D Fire Protection Systems Inc: www.adfire.com/#sle.
3. Hilti, Inc: www.us.hilti.com/#sle.
4. Nelson FireStop Products: www.nelsonfirestop.com/#sle.
5. Specified Technologies Inc: www.stifirestop.com/#sle.
6. Tremco Commercial Sealants & Waterproofing; TREMstop Acrylic: www.tremcosealants.com/#sle.
7. Substitutions: See Section 01 6000 - Product Requirements.

2.2. MATERIALS

A. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.

B. Fire Ratings: Refer to drawings for required systems and ratings.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify openings are ready to receive the work of this section.

3.2. PREPARATION

A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.

B. Remove incompatible materials that could adversely affect bond.

C. Install backing materials to prevent liquid material from leakage.

3.3. INSTALLATION

A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.

B. Do not cover installed firestopping until inspected by authorities having jurisdiction.

C. Install labeling required by code and identification of the specific fire rating of firestopping installations.

3.4. CLEANING

A. Clean adjacent surfaces of firestopping materials.

3.5. PROTECTION

A. Protect adjacent surfaces from damage by material installation.

END OF SECTION

SECTION 07 9200 - JOINT SEALANTS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Self-leveling pourable joint sealants.

C. Joint backings and accessories.

1.2. RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping: Firestopping sealants.

B. Section 07 9513 - Expansion Joint Cover Assemblies: Sealants forming part of expansion joint cover assemblies.

C. Section 08 7100 - Door Hardware: Setting exterior door thresholds in sealant.

D. Section 08 8000 - Glazing: Glazing sealants and accessories.

E. Section 09 2116 - Gypsum Board Assemblies: Sealing acoustical and sound-rated walls and ceilings.

1.3. REFERENCE STANDARDS

A. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2018.

B. ASTM C834 - Standard Specification for Latex Sealants; 2017.

C. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2018.

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

E. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2016.

F. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2018.

G. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.

H. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.

I. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).

J. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2015.

K. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

L. UL 263 - Standard for Fire Tests of Building Construction and Materials; Current Edition, Including All Revisions.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes the following.

1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.

2. List of backing materials approved for use with the specific product.

3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.

4. Substrates the product should not be used on.

5. Substrates for which use of primer is required.

6. Substrates for which laboratory adhesion and/or compatibility testing is required.

7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
8. Sample product warranty.
9. Certification by manufacturer indicating that product complies with specification requirements.

C. Product Data for Accessory Products: Submit manufacturer's technical data sheet for each product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

1.5. QUALITY ASSURANCE

A. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.

1. Adhesion Testing: In accordance with ASTM C794.
2. Compatibility Testing: In accordance with ASTM C1087.
3. Allow sufficient time for testing to avoid delaying the work.
4. Deliver to manufacturer sufficient samples for testing.
5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
6. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.

B. Source Limitations: Obtain each kind of joint sealant from single source from single manufacturer.

1.6. 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.

C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal , exhibit loss of adhesion or cohesion, or do not cure.

D. Special Manufacturer's Warranty: Manufacturer's standard form in which joint-sealant manufacturer agrees to furnish joint sealants to repair or replace those that do not comply with performance and other requirements specified in this Section within specified warranty period.

1. Verify available warranties and warranty periods with manufacturers listed in Part 2 articles.
2. Warranty Period: Two years from date of Substantial Completion.

E. Special warranties specified in this article exclude deterioration or failure of joint sealants from the following:

1. Movement of the structure caused by structural settlement or errors attributable to design or construction resulting in stresses on the sealant exceeding sealant manufacturer's written specifications for sealant elongation and compression.
2. Disintegration of joint substrates from natural causes exceeding design specifications.
3. Mechanical damage caused by individuals, tools, or other outside agents.
4. Changes in sealant appearance caused by accumulation of dirt or other atmospheric contaminants.

PART 2 PRODUCTS

2.1. MATERIALS, GENERAL

A. Compatibility: Provide joint sealants, backings, and other related materials that are compatible with one another and with joint substrates under conditions of service and application, as demonstrated by joint-sealant manufacturer, based on testing and field experience.

B. Liquid-Applied Joint Sealants: Comply with ASTM C 920 and other requirements indicated for each liquid-applied joint sealant specified, including those referencing ASTM C 920 classifications for type, grade, class, and uses related to exposure and joint substrates.

1. Suitability for Immersion in Liquids. Where sealants are indicated for Use I for joints that will be continuously immersed in liquids, provide products that have undergone testing according to ASTM C 1247. Liquid used for testing sealants is deionized water, unless otherwise indicated.

C. Suitability for Contact with Food: Where sealants are indicated for joints that will come in repeated contact with food, provide products that comply with 21 CFR 177.2600.

D. Colors of Exposed Joint Sealants: As selected by Architect from manufacturer's full range.

2.2. MANUFACTURERS

A. Non-Sag Sealants: Permits application in joints on vertical surfaces without sagging or slumping.

1. Bostik Inc: www.bostik-us.com/#sle.
2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
3. Pecora Corporation: www.pecora.com/#sle.
4. Sika Corporation: www.usa-sika.com/#sle.
5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Self-Leveling Sealants: Pourable or self-leveling sealant that has sufficient flow to form a smooth, level surface when applied in a horizontal joint.

1. Bostik Inc: www.bostik-us.com/#sle.
2. Dow Chemical Company: consumer.dow.com/en-us/industry/ind-building-construction.html/#sle.
3. Pecora Corporation: www.pecora.com/#sle.
4. Sika Corporation: www.usa-sika.com/#sle.
5. Tremco Commercial Sealants & Waterproofing; ____: www.tremcosealants.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

2.3. JOINT SEALANT APPLICATIONS

A. Scope:

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
    a. Wall expansion and control joints.
    b. Joints between door, window, and other frames and adjacent construction.
    c. Joints between different exposed materials.
    d. Openings below ledge angles in masonry.
    e. Other joints indicated below.

2. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items.
    a. Joints between door, window, and other frames and adjacent construction.
    b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
        1) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated assemblies.
    c. Other joints indicated below.
3. Do not seal the following types of joints.
    a. Intentional weepholes in masonry.
    b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
    c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
    d. Joints where installation of sealant is specified in another section.
    e. Joints between suspended panel ceilings/grid and walls.

B. Exterior Joints: Use non-sag non-staining silicone sealant, unless otherwise indicated.
1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
2. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.

C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.
1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
2. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.
3. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
4. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.

D. Interior Wet Areas: restrooms and staff break room kitchenettes; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.

E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

2.4. NONSAG JOINT SEALANTS

A. Non-Staining Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 50 percent, minimum.
2. Non-Staining To Porous Stone: Non-staining to light-colored natural stone when tested in accordance with ASTM C1248.
3. Dirt Pick-Up: Reduced dirt pick-up compared to other silicone sealants.
4. Color: Match adjacent finished surfaces.
5. Cure Type: Single-component, neutral moisture curing.
6. Service Temperature Range: Minus 65 to 180 degrees F.

B. Silicone Sealant: ASTM C920, Grade NS, Uses M and A; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.
2. Color: Match adjacent finished surfaces.
3. Cure Type: Single-component, neutral moisture curing
4. Service Temperature Range: Minus 65 to 180 degrees F.

C. Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.

1. Color: Clear.

D. Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.

1. Movement Capability: Plus and minus 50 percent, minimum.
2. Color: Match adjacent finished surfaces.
3. Service Temperature Range: Minus 40 to 180 degrees F.

E. Polyurethane Sealant for Continuous Water Immersion: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion; suitable for traffic exposure when recessed below traffic surface.

1. Movement Capability: Plus and minus 50 percent, minimum.
2. Color: Match adjacent finished surfaces.
3. Service Temperature Range: Minus 40 to 180 degrees F.

F. Non-Sag "Traffic-Grade" Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; explicitly approved by manufacturer for continuous water immersion and traffic without the necessity to recess sealant below traffic surface.

1. Movement Capability: Plus and minus 25 percent, minimum.
2. Color: Match adjacent finished surfaces.
3. Service Temperature Range: Minus 40 to 180 degrees F.

G. Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.

1. Color: To be selected by Architect from manufacturer's standard range.
2. Grade: ASTM C834; Grade Minus 18 Degrees C (0 Degrees F).

H. Non-Curing Butyl Sealant: Solvent-based, single component, non-sag, non-skinning, non-hardening, non-bleeding; non-vapor-permeable; intended for fully concealed applications.

1. Manufacturers:
   a. Basis of Design: Tremco; JS-773.
   b. Substitutions: See Section 01 6000 - Product Requirements.

2.5. SELF-LEVELING SEALANTS

A. Self-Leveling Polyurethane Sealant: ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure; not expected to withstand continuous water immersion .

1. Movement Capability: Plus and minus 25 percent, minimum.
2. Color: To be selected by Architect from manufacturer's standard range.
3. Service Temperature Range: Minus 40 to 180 degrees F.

2.6. ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
3. Open Cell: 40 to 50 percent larger in diameter than joint width.
4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.

B. Preformed Extruded Silicone Joint Seal: Pre-cured low-modulus silicone extrusion, in sizes to fit applications indicated on drawings, combined with a neutral-curing liquid silicone sealant for bonding joint seal to substrates.

1. Size: 1 inch wide, in rolls 100 feet long.
2. Thickness: 0.78 inch, with ridges along outside bottom edges for bonding area.
3. Color: As selected by Architect..

C. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.

D. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.

E. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

F. Primers: Type recommended by sealant manufacturer to suit application; non-staining.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.2. PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints, and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

3.3. INSTALLATION

A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Perform installation in accordance with ASTM C1193.

C. Perform acoustical sealant application work in accordance with ASTM C919.

D. Measure joint dimensions and size joint backers to achieve width-to-depth ratio, neck dimension, and surface bond area as recommended by manufacturer, except where specific dimensions are indicated.

E. Install bond breaker backing tape where backer rod cannot be used.

F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

G. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

I. Concrete Floor Joint Filler: After full cure, shave joint filler flush with top of concrete slab.

3.4. FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Non-Destructive Adhesion Testing: If there are any failures in first 100 linear feet, notify Architect immediately.

C. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect immediately.

D. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

E. Repair destructive test location damage immediately after evaluation and recording of results.

3.5. POST-OCCUPANCY

A. Post-Occupancy Inspection: Perform visual inspection of entire length of project sealant joints at a time that joints have opened to their greatest width; i.e. at low temperature in thermal cycle. Report failures immediately and repair.

END OF SECTION

SECTION 07 9513 - EXPANSION JOINT COVER ASSEMBLIES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Expansion joint cover assemblies for wall, ceiling, soffit, and roof surfaces.

1.2. RELATED REQUIREMENTS

A. Section 04 2000 - Unit Masonry: Placement of joint cover assembly frames in masonry.

B. Section 09 2116 - Gypsum Board Assemblies: Gypsum board control joint trim.

C. Section 09 5100 - Acoustical Ceilings: Expansion joint assemblies in suspended ceiling grids.

1.3. REFERENCE STANDARDS

A. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

B. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

C. ASTM B308/B308M - Standard Specification for Aluminum-Alloy 6061-T6 Standard Structural Profiles; 2020.

D. ASTM B455/B455M - Standard Specification for Copper-Zinc-Lead Alloy (Leaded-Brass) Extruded Shapes; 2020.

E. ITS (DIR) - Directory of Listed Products; current edition.

F. UL (DIR) - Online Certifications Directory; Current Edition.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Installation Templates: For frames and anchors to be embedded in concrete or masonry, furnish templates to relevant installers; include installation instructions and tolerances.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide joint assembly profiles, profile dimensions, anchorage devices and available colors and finish.

C. Shop Drawings: Indicate joint and splice locations, miters, layout of the work, affected adjacent construction and anchorage locations.

D. Samples: Submit two samples 6 inch long, illustrating profile, dimension, color, and finish selected.

E. Manufacturer's Installation Instructions: Indicate rough-in sizes and required tolerances for item placement.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Expansion Joint Cover Assemblies: Basis of Design: Inpro JointMaster, www.inprocorp.com.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.2. EXPANSION JOINT COVER ASSEMBLY APPLICATIONS

A. EJC1 (Exterior Wall Joint and Exterior Roof Joint) Basis of Design: Inpro JointMaster 615 model, #615-A09-050.

1. System Description: Wall to corner (wall), roof to roof, exterior: 2 inches, silicone seal, custom color, fill with compressible mineral wool insulation.

2. Provide manufacturer's standard EPDM vapor barrier system.

B. EJC2 (Interior Wall Joint) Basis of Design: Inpro JointMaster 101 Series, #101-A07-050, #101-A09-050LP.

1. System Description: Wall to wall, ceiling to ceiling interior, 2 inches, low profile system, continuous seal in continuous aluminum frame.

2. Provide manufacturer's standard fire blanket system at fire rated locations.

C. EJC3 (Acoustical Ceiling to Wall Joint) Basis of Design: Inpro JointMaster 116 Series, #116-A18-050.

1. System Description: Acoustical ceiling to wall, 2 inches, continuous seal in continuoius aluminum frame. Attached to ceiling grid on one side with pop rivits and wall on other side.

D. EJC4 (Acoustical Ceiling to Acoustical Ceiling Joint) Basis of Design: Inpro JointMaster 116 Series, #116-A24-050.

1. System Description: Acoustical ceiling to acoustical ceiling, 2 inches, continuous seal in continuous aluminum frame attached to ceiling grid on both sides with pop rivits.

E. All fire-rated joints to use Fire Blanket Joint System: JointMaster “Fireline” F520; 1-hour typical.

F. Substitutions: See Section 01 6000 - Product Requirements.

2.3. EXPANSION JOINT COVER ASSEMBLIES

A. Expansion Joint Cover Assemblies - General: Factory-fabricated and assembled; designed to completely fill joint openings, sealed to prevent passage of air, dust, water, smoke; suitable for traffic expected.

1. Joint Dimensions and Configurations: As indicated on drawings.

2. Joint Cover Sizes: Selected to suit joint width and configuration, based on manufacturer's published recommendations and limitations.

3. Joint Cover Styles: As indicated on drawings.

4. Joint Movement Capability: If not indicated, provide minimum plus/minus 25 percent joint movement capability.

5. Lengths: Provide covers in full lengths required; avoid splicing wherever possible.

6. Anchors, Fasteners, and Fittings: Provided by cover manufacturer.

2.4. MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper; or ASTM B308/B308M, 6061 alloy, T6 temper.

1. Exposed Finish Outdoors: Natural anodized.

2. Exposed Finish at Walls and Ceilings: Natural anodized.

B. Resilient Seals:

1. For Ceilings: Manufacturer's standard resilient material, flush, pleated, or hollow gasket.

C. Anchors and Fasteners: As recommended by cover manufacturer.

D. Backing Paint for Aluminum Components in Contact with Cementitious Materials: Asphaltic type.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that joint preparation and dimensions are acceptable and in accordance with manufacturer's requirements.

B. Verify that frames and anchors installed by others are in correct locations and suitable for installation of remainder of assembly.

3.2. INSTALLATION

A. Install components and accessories in accordance with manufacturer's instructions.

B. Align work plumb and level, flush with adjacent surfaces.

C. Rigidly anchor to substrate to prevent misalignment.

D. Transition to Roof Expansion Joint Covers: Coordinate installation of exterior wall expansion joint covers with roof expansion joint covers.

1. Install factory-fabricated units at transition between exterior walls and roof expansion joint cover assemblies.

E. Fire-Resistance-Rated Assemblies: Coordinate installation of expansion joint cover assembly materials and associated work so complete assemblies comply with performance requirements.

1. Fire Barriers: Install fire barriers to provide continuous, uninterrupted fire resistance throughout length of joint, including transitions and field splices.

3.3. PROTECTION

A. Provide strippable coating to protect finish surface.

END OF SECTION

SECTION 08 1113 - HOLLOW METAL DOORS AND FRAMES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Non-fire-rated hollow metal doors and frames.

B. Hollow metal frames for wood doors.

C. Fire-rated hollow metal doors and frames.

D. Thermally insulated hollow metal doors with frames.

E. Hollow metal borrowed lites glazing frames.

F. Accessories, including frames for glass lites within doors, astragals, silencers.

1.2. RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware: Hardware and accessories not included in this section.

B. Section 08 8000 - Glazing: Glass for doors and borrowed lites.

C. Section 09 9113 - Exterior Painting: Field painting.

D. Section 09 9123 - Interior Painting: Field painting.

1.3. ABBREVIATIONS AND ACRONYMS

A. ANSI: American National Standards Institute.

B. ASCE: American Society of Civil Engineers.

C. HMMA: Hollow Metal Manufacturers Association.

D. NAAMM: National Association of Architectural Metal Manufacturers.

E. NFPA: National Fire Protection Association.

F. SDI: Steel Door Institute.

G. UL: Underwriters Laboratories.

1.4. REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.

C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).

D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2014.

E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.

F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable; 2018.

H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.

I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2015a.

J. ASTM C476 - Standard Specification for Grout for Masonry; 2010.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

L. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

M. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

N. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

O. ITS (DIR) - Directory of Listed Products; current edition.

P. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.

Q. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.

R. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2007.

S. NAAMM HMMA 850 - Fire-Protection and Smoke Control Rated Hollow Metal Door and Frame Products; 2014.

T. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.

U. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

V. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.

W. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

X. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

Y. UL (DIR) - Online Certifications Directory; Current Edition.

Z. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

AA. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

AB. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.

C. Shop Drawings: Details of each opening, showing elevations, glazing, frame profiles, and any indicated finish requirements.

D. Schedule: Provide a schedule of hollow metal work prepared by or under the supervision of supplier, using same reference numbers for details and openings as those on Drawings. Coordinate with door hardware schedule.

E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.

F. Manufacturer's Qualification Statement.

G. Installer's Qualification Statement.

1.6. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years documented experience.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.

B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

1.8. COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to the Project site in time for installation.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Hollow Metal Doors and Frames:

1. Ceco Door, an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Curries, an Assa Abloy Group company: www.assaabloydss.com/#sle.
3. Republic Doors, an Allegion brand: www.republicdoor.com/#sle.
4. Steelcraft, an Allegion brand: www.allegion.com/#sle.
5. Substitutions: See Section 01 6000 - Product Requirements.

2.2. PERFORMANCE REQUIREMENTS

A. Requirements for Hollow Metal Doors and Frames:

1. Steel Sheet: Comply with one or more of the following requirements; galvannealed steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
2. Accessibility: Comply with ICC A117.1 and ADA Standards.
3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
4. Door Edge Profile: Manufacturers standard for application indicated.
5. Typical Door Face Sheets: Flush.
6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvannealed) by the hot-dip process in accordance with ASTM A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.
    a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.

B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

2.3. HOLLOW METAL DOORS

A. Exterior Doors: Thermally insulated.

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).

a. Level 2 - Heavy-duty.
b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.

2. Door Thickness: 1-3/4 inches, nominal.

B. Interior Doors, Non-Fire-Rated:

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 2 - Heavy-duty.
b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
2. Door Thickness: 1-3/4 inches, nominal.

C. Fire-Rated Doors:

1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
a. Level 2 - Heavy-duty.
b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
c. Model 1 - Full Flush.
d. Door Face Metal Thickness: 18 gauge, 0.042 inch, minimum.
2. Fire Rating: As indicated on drawings, tested in accordance with UL 10C and NFPA 252 ("positive pressure fire tests").
3. Provide units listed and labeled by UL (DIR) or ITS (DIR).
a. Attach fire rating label to each fire rated unit.
4. Smoke and Draft Control Doors (Indicated with letter "S" on Drawings and/or Door Schedule): Self-closing or automatic closing doors in accordance with NFPA 80 and NFPA 105, with fire-resistance-rated wall construction rated the same or greater than the fire-rated doors, and the following;
a. Maximum Air Leakage: 3.0 cfm/sq ft of door opening at 0.10 inch w.g. pressure, when tested in accordance with UL 1784 at both ambient and elevated temperatures.
b. Gasketing: Provide gasketing or edge sealing as necessary to achieve leakage limit.
c. Label: Include the "S" label on fire-rating label of door.
5. Door Core Material: Manufacturers standard core material/construction in compliance with requirements.
6. Door Thickness: 1-3/4 inches, nominal.

2.4. HOLLOW METAL FRAMES

A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.

B. Frame Finish: Factory primed and field finished.

C. Exterior Door Frames: Full profile/continuously welded type.

1. Galvanizing: Components hot-dipped zinc-iron alloy-coated (galvannealed) in accordance with ASTM A653/A653M, with A40/ZF120 coating.

2. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.
3. Weatherstripping: Separate, see Section 08 7100.

D. Interior Door Frames, Non-Fire Rated: Full profile/continuously welded type.
1. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.

E. Door Frames, Fire-Rated: Full profile/continuously welded type.
1. Fire Rating: Same as door, labeled.
2. Frame Metal Thickness: 14 gauge, 0.067 inch, minimum.

F. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.

G. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.

H. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.

I. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

2.5. FINISHES

A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, door manufacturer's standard.

B. Bituminous Coating: Cold-applied asphalt mastic, compounded for 15 mil, 0.015 inch dry film thickness (DFT) per coat; provide inert-type noncorrosive compound free of asbestos fibers, sulfur components, and other deleterious impurities.
1. Fire-Rated Frames: Comply with fire rating requirements indicated.

2.6. ACCESSORIES

A. Door Window Frames: Door window frames with glazing securely fastened within door opening.
1. Size: As indicated on drawings.
2. Frame Material: 18 gauge, 0.0478 inch, galvanized steel.
3. Metal Finish: Dark Bronze polyester powder coating.

B. Glazing: As specified in Section 08 8000, factory installed.

C. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.

D. Astragals and Edges for Double Doors: Pairs of door astragals, and door edge sealing and protection devices.
1. UL listed products in compliance with requirements of authorities having jurisdiction.
2. Provide surface mounted astragal to cover or fill space for full door height between pair of doors or door and adjacent jamb.
3. Astragal Type: Split, two parts, and with automatic locking, cutouts for other door hardware, and sealing gasket.
4. Edge Type: Beveled edge
5. Material: Aluminum.
6. Metal Finish: Dark Bronze powder coating.
7. Provide non-corroding fasteners at exterior locations.
8. Manufacturers:
a. All Metal Stamping: www.allmetalstamping.com/#sle.

b. Substitutions: See Section 01 6000 - Product Requirements.

E. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.

F. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.

G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Verify that finished walls are in plane to ensure proper door alignment.

3.2. PREPARATION

A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

3.3. INSTALLATION

A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.

B. Install fire rated units in accordance with NFPA 80.

C. Coordinate frame anchor placement with wall construction.

D. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.

E. Install door hardware as specified in Section 08 7100.

1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.

F. Comply with glazing installation requirements of Section 08 8000.

G. Coordinate installation of electrical connections to electrical hardware items.

3.4. TOLERANCES

A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.

B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

3.5. ADJUSTING

A. Adjust for smooth and balanced door movement.

END OF SECTION

SECTION 08 1416 - FLUSH WOOD DOORS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Flush wood doors; flush and flush glazed configuration; fire-rated and non-rated.

1.2. RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.

B. Section 08 7100 - Door Hardware.

C. Section 08 8000 - Glazing.

1.3. REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

B. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

D. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.

E. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

F. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.

C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.

D. Samples: Submit two samples of door veneer, 8 by 10 inch in size illustrating wood grain, stain color, and sheen for each species of veneer and solid lumber specified.

E. Warranty, executed in Owner's name.

1.5. 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. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Package, deliver and store doors in accordance with specified quality standard.

B. Comply with requirements of referenced standard and manufacturer's written instructions.

C. Accept doors on site in manufacturer's packaging. Inspect for damage.

D. Protect doors with resilient packaging. Do not store in damp or wet areas; or in areas where sunlight might bleach veneer. Seal top and bottom edges with tinted sealer if stored more than one week. Break seal on site to permit ventilation.

1.7. FIELD CONDITIONS

A. Environmental Limitations: Do not deliver or install doors until spaces are enclosed and weathertight, wet work in spaces is complete and dry, and HVAC system is operating and maintaining temperature between 60 and 90 deg F and relative humidity between 25 and 55 percent during remainder of construction period.

1.8. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Interior Doors: Provide manufacturer's warranty for the life of the installation.

C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

D. Warranty shall also include installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Wood Veneer Faced Doors:

1. Basis of Design: VT Industries, Heritage Series: www.vtindustries.com.

a. Finish Profile: Red Oak, Alpine AL18.

2. Other Acceptable Manufacturers (dependent on compliance with Basis of Design requirements and specification):

a. Eggers Industries: www.eggersindustries.com/#sle.

b. Graham Wood Doors: www.grahamdoors.com/#sle.

c. Masonite Architectural; Aspiro Select Wood Veneer Doors: www.architectural.masonite.com/#sle.

3. Substitutions: See Section 01 6000 - Product Requirements.

B. Source Limitations: Obtain flush wood doors from single manufacturer.

2.2. DOORS

A. Doors: Refer to drawings for locations and additional requirements.

1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with WDMA I.S. 1A.

2. Wood Veneer Faced Doors: 5-ply or 7-ply unless otherwise indicated.

B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.

1. Provide solid core doors at each location.

2. Fire Rated Doors: Tested to ratings indicated on drawings in accordance with UL 10C - Positive Pressure; Underwriters Laboratories Inc (UL) or Intertek/Warnock Hersey (WHI) labeled without any visible seals when door is open.

3. Smoke and Draft Control Doors: In addition to required fire rating, provide flush wood door assemblies in compliance with WDMA I.S. 1A requirements for "S" label; no additional gasketing or edge sealing allowed.

4. Wood veneer facing with factory transparent finish.

2.3. DOOR AND PANEL CORES

A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.

B. Fire-Rated Doors: Mineral core type, with fire resistant composite core (FD), plies and faces as indicated above; with core blocking as required to provide adequate anchorage of hardware without through-bolting.

2.4. DOOR FACINGS

A. Veneer Facing for Standard Finish: Red Oak, veneer grade in accordance with quality standard indicated, plain sliced (flat cut), with book match between leaves of veneer, running match of spliced veneer leaves assembled on door or panel face.

1. Vertical Edges: Same species as face veneer.

a. Provide finish at exposed top edge where door is visible from above.

2. "Pair Match" each pair of doors; "Set Match" pairs of doors within 10 feet of each other when doors are closed.

3. Finish: VT Industries, Heritage, Alpine AL18 stain.

2.5. DOOR CONSTRUCTION

A. Fabricate doors in accordance with door quality standard specified.

B. Cores Constructed with stiles and rails:

1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.

2. Provide solid blocking for other throughbolted hardware.

C. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

D. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.

E. Provide edge clearances in accordance with the quality standard specified.

F. Coordinate door construction with semi-motising requirements for automatic door bottoms where specified.

2.6. FACTORY FINISHING - WOOD VENEER DOORS

A. Finish work in accordance with WDMA I.S. 1A for grade specified and as follows:

1. Transparent:

a. System - TR-2, Catalyzed Lacquer.

b. Grade: Premium

c. Stain: as specified in Door Facings section above.

d. Sheen: Satin.

B. Seal door top edge with color sealer to match door facing.

2.7. ACCESSORIES

A. Glazing: As specified in Section 08 8000.

B. Glazing Stops: Wood, of same species as door facing, metal clips for rated doors, mitered corners; prepared for countersink style tamper proof screws.

C. Door Hardware: As specified in Section 08 7100.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that opening sizes and tolerances are acceptable.

C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

3.2. INSTALLATION

A. Install doors in accordance with manufacturer's instructions and specified quality standard.

1. Install fire-rated doors in accordance with NFPA 80 requirements.
2. Install smoke and draft control doors in accordance with NFPA 105 requirements.

B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.

C. Use machine tools to cut or drill for hardware.

D. Coordinate installation of doors with installation of frames and hardware.

E. Coordinate installation of glazing.

3.3. TOLERANCES

A. Comply with specified quality standard for fit and clearance tolerances.

B. Comply with specified quality standard for telegraphing, warp, and squareness.

3.4. ADJUSTING

A. Adjust doors for smooth and balanced door movement.

B. Adjust closers for full closure.

END OF SECTION

SECTION 08 3100 - ACCESS DOORS AND PANELS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Wall mounted access units.

1.2. RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Field paint finish.

1.3. REFERENCE STANDARDS

A. UL (FRD) - Fire Resistance Directory; current edition.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.

C. Shop Drawings: Indicate exact position of each access door and/or panel unit.

D. Project Record Documents: Record actual locations of each access unit.

PART 2 PRODUCTS

2.1. ACCESS DOORS AND PANELS ASSEMBLIES

A. Wall-Mounted Units with Return Air Grille:

1. Location: As indicated on drawings and specifications.
2. Panel Material: Aluminum extrusions with gypsum board inlay.
3. Size: 18 by 18 inches unless otherwise indicated.
4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
5. Gypsum Board Mounting Criteria: Provide drywall bead frame with door surface flush with wall surface.

B. Wall-Mounted Units in Wet Areas:

1. Location: As indicated on drawings and specifications.
2. Panel Material: Steel, hot-dipped zinc, or zinc-aluminum-alloy coated.
3. Size: 12 by 12 inches.
4. Door/Panel: Hinged, standard duty, with tool-operated spring or cam lock and no handle.
5. Wall Mounting Criteria: Provide surface-mounted face frame and door surface flush with frame surface.

C. Fire-Rated Wall-Mounted Units:

1. Location: As indicated on drawings and specifications.
2. Wall Fire-Rating: As indicated on drawings.
3. Panel Material: Steel.
4. Size: 18 by 18 inches unless otherwise indicated.
5. Door/Panel: Insulated double-surface panel, with tool-operated spring or cam lock and no handle.

D. Ceiling-Mounted Units with Return Air Grille:

1. Size - Lay-In Grid Ceilings: To match module of ceiling grid.
2. Size - Other Ceilings: 12 by 12 inches.

2.2. WALL MOUNTED ACCESS UNITS

A. Manufacturers:

1. ACUDOR Products Inc: www.acudor.com/#sle.
2. Babcock-Davis: www.babcockdavis.com/#sle.
3. Cendrex, Inc: www.cendrex.com/#sle.
4. Milcor, Inc: www.milcorinc.com/#sle.
5. Nystrom, Inc: www.nystrom.com/#sle.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.

1. Door Style: Single thickness with rolled or turned in edges.
2. Frames: 16 gauge, 0.0598 inch, minimum thickness.
3. Units in Fire-Rated Assemblies: Fire rating as required by applicable code for fire-rated assembly that access doors are being installed.
4. Steel Finish: Primed.
5. Hardware:
    a. Hardware for Fire-Rated Units: As required for listing.
    b. Hinges for Non-Fire-Rated Units: Concealed, constant force closure spring type.
    c. Latch/Lock: Cylinder lock-operated cam latch, two keys for each unit.

2.3. WALL AND CEILING MOUNTED ACCESS UNITS WITH RETURN AIR GRILLES

A. Gypsum Board Inlay Access Panels: Provide rectangular and square access panel with recessed and gasketed aluminum perimeter frame that acts as finishing edge and having concealed mechanical touch-latch with safety cable and free-pivoting hinge.

1. Rectangular Panel Frame Size: 24 by 36 inches set within 1/2 inch thick gypsum board.
2. Square Panel Frame Size: 24 by 24 inches set within 1/2 inch thick gypsum board.
3. Panel Frame: 1 inch margin with concealed countersunk screw mounting.

B. Air Return Grille: Linear bar grille fitted with flush and concealed perimeter frame.

1. Grille: Fixed grilles with 1/4 inch thick by 5/8 inch deep bars at 1/2 inch on center providing 48 percent free space opening.
2. Grille Size: 12 by 12 inches set within 1/2 inch thick gypsum board.
3. Fabrication: Aluminum with factory powder coated finish.
4. Grille Frame: 1 inch margin with concealed countersunk screw mounting.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that rough openings are correctly sized and located.

B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2. PREPARATION

A. Clean surfaces thoroughly prior to proceeding with this work.

B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

3.3. INSTALLATION

A. Install units in accordance with manufacturer's instructions.

B. Install frames plumb and level in openings, and secure units rigidly in place.

C. Position units to provide convenient access to concealed equipment when necessary.

END OF SECTION

SECTION 08 4229 - AUTOMATIC ENTRANCES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Packaged power-operated door assemblies of following types:

1. Sliding type.

B. Controllers, actuators and safety devices.

C. Maintenance.

1.2. DEFINITIONS

A. AAADM: American Association of Automatic Door Manufacturers.

1.3. REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

C. BHMA A156.19 - American National Standard for Power Assist and Low Energy Power Operated Doors; 2013.

D. IAC - Illinois Accessibility Code

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.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate layout and dimensions; head, jamb, and sill conditions; elevations; components, anchorage, recesses, materials, and finishes, electrical characteristics and connection requirements.

2. Identify installation tolerances required, assembly conditions, routing of service lines and conduit, and locations of operating components and boxes.

C. Product Data: Provide data on system components, sizes, features, and finishes.

D. Manufacturer's Installation Instructions: Indicate special procedures, perimeter conditions requiring special attention, and manufacturer's hardware and component templates.

E. Manufacturer's Qualification Statement.

F. Installer's Qualification Statement.

G. Maintenance Contract.

H. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

I. Maintenance Data: Include manufacturer's parts list and maintenance instructions for each type of hardware and operating component.

J. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience, and a member of AAADM.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.6. 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.

C. Special Warranty: Manufacturer agrees to repair or replace components of automatic entrances that fail in materials or workmanship within specified warranty period.

1. Failures include, but are not limited to, the following:

a. Structural failures including, but not limited to, excessive deflection.

b. Faulty operation of operators, controls, and hardware.

c. Deterioration of metals, metal finishes, and other materials beyond normal weathering and use.

2. Warranty Period: Five years from date of Substantial Completion.

D. Special Finish Warranty: Manufacturer agrees to repair or replace components on which finishes fail in materials or workmanship within specified warranty period.

1. Deterioration includes, but is not limited to, the following:

a. Color fading more than 5 Hunter units when tested according to ASTM D 2244.

b. Chalking in excess of a No. 8 rating when tested according to ASTM D 4214.

c. Cracking, checking, peeling, or failure of paint to adhere to bare metal.

2. Warranty Period: Five years from date of Substantial Completion.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Sliding Automatic Entrance Door Assemblies:

1. Sliding Automatic Door, Vestibule, V101-1 (Exterior).

a. Basis of design is Horton Profiler Series 2000B Belt Drive, Type 110 Bi-parting Slide, O-SX, SX-O, 9’ unit width, transom.

b. Operational description: 3’-6” slider opening, fixed sidelights, breakaway operation, activated by standard header mounted sensor operation to allow access to either the RHC or adjacent Pharmacy.

2. Sliding Automatic Door, Vestibule, V101-2 (Interior).

a. Basis of design is Horton Profiler Series 2000B Belt Drive, Type 110 Bi-parting Slide, O-SX, SX-O, 9’ unit width, transom.

b. Operational description: 3'-6" slider opening, fixed sidelights. breakaway operation, door to have fail safe auto lock to be activated by card reader from vestibule side after hours and by header mounted sensor on building interior side..

2.2. AUTOMATIC ENTRANCE DOOR ASSEMBLIES

A. Comply with ADA Standards for egress requirements.

B. Framing Members: Provide manufacturer's standard extruded aluminum framing, reinforced as required to support imposed loads.

1. Nominal Sizes:
    a. Single Slide and Bi-Parting Sliding Doors: 1-3/4 inch wide by 4-1/2 inch deep.
2. Transoms: Provide flush glazed transom with framing that is integral with automatic entrance framing system.

C. Door and Sidelight Construction: Heavy duty interlocked extruded aluminum tubular stile and rail sections, through-rod bolted construction with steel corner support at hinge stile of carrier-suspended swinging panels or mechanically fastened corners with welded reinforcing brackets to reduce sag in sliding or breakout mode.
1. Door Thickness: 1-3/4 inch, nominal.
2. Stile Design:
    a. Wide stile, 4 inch, nominal width.
3. Top Rail Height: 4 inch, nominal.
4. Center Rail (Muntin Bar) Height: 2 inch, nominal.
5. Bottom Rail Height: 10 inch, nominal.
6. Glazing Stops: Manufacturer's standard snap-on extruded aluminum square stops with preformed resilient glazing gaskets.
7. Glazing Stop Width: Manufacturers standard.
8. Glazing Thickness: 1 inch at exterior systems and 1/4 inch at interior systems.

D. Door and Frame Finish: dark bronze anodized aluminum.

2.3. CONTROLLERS, ACTUATORS, AND SAFETIES

A. Controller: Provide microprocessor operated controller for each door.

B. Comply with BHMA A156.10 for actuator and safety types and zones.

C. Proximity Detector Actuator/Safety: Microwave; distance of control sensitivity adjustable.

2.4. ELECTRICAL CHARACTERISTICS AND COMPONENTS

A. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

B. Disconnect Switch: Factory mount disconnect switch in control panel.

C. Electrical Interlocks: Provide electrical interlocks to prevent activation of operator when door is locked, latched, or bolted

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that surfaces are ready to receive work and dimensions are as indicated on shop drawings.

B. Verify that electric power is available and is of the correct characteristics.

3.2. INSTALLATION

A. Install equipment in accordance with manufacturer's instructions.

B. Provide for thermal expansion and contraction of door and frame units and live and dead loads that may be transmitted to operating equipment.

C. Provide for dimensional distortion of components during operation.

D. Coordinate installation of components with related and adjacent work; level and plumb.

3.3. ADJUSTING

A. Adjust door equipment for correct function and smooth operation.

B. Readjust door operators and controls after repeated operation of completed installation equivalent to three days' use by normal traffic (100 to 300 cycles).

3.4. CLEANING

A. Remove temporary protection, clean exposed surfaces.

3.5. CLOSEOUT ACTIVITIES

A. Demonstrate operation, operating components, adjustment features, and lubrication requirements.

3.6. MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide a separate maintenance contract for specified maintenance service.

C. Provide service and maintenance of operating equipment for one year from Date of Substantial Completion, at no extra charge to Owner.

END OF SECTION

SECTION 08 4313 - ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass; for both exterior and interior conditions.

B. Aluminum doors.

C. Weatherstripping.

1.2. RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Sealing framing to weather barrier installed on adjacent construction.

B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 08 4229 - Automatic Entrances.

D. Section 08 7100 - Door Hardware: Hardware items other than specified in this section.

E. Section 08 8000 - Glazing: Glass and glazing accessories.

1.3. REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum From Shop to Site; 2015.

B. AAMA 501.2 - Field Check of Metal Storefronts, Curtain Walls, and Sloped Glazing Systems for Water Leakage; 2009.

C. AAMA 503 - Voluntary Specification for Field Testing of Newly Installed Storefronts, Curtain Walls and Sloped Glazing Systems; 2014.

D. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

E. AAMA 1503 - Voluntary Test Method for Thermal Transmittance and Condensation Resistance of Windows, Doors and Glazed Wall Sections; 2009.

F. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

G. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes [Metric]; 2013.

H. ASTM E283 - Standard Test Method for Determining the Rate of Air Leakage Through Exterior Windows, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2004 (Reapproved 2012).

I. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014.

J. ASTM E331 - Standard Test Method for Water Penetration of Exterior Windows, Skylights, Doors, and Curtain Walls by Uniform Static Air Pressure Difference; 2000 (Reapproved 2009).

K. ASTM E1105 - Standard Test Method for Field Determination of Water Penetration of Installed Exterior Windows, Skylights, Doors, and Curtain Walls, by Uniform or Cyclic Static Air Pressure Difference; 2015.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordinate with installation of other components that comprise the exterior enclosure.

B. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

D. Design Data: Provide framing member structural and physical characteristics, engineering calculations, and dimensional limitations.

E. Hardware Schedule: Complete itemization of each item of hardware to be provided for each door, cross-referenced to door identification numbers in Contract Documents.

F. Field Quality Control Submittals: Report of field testing for water penetration and air leakage.

G. Designer's Qualification Statement.

H. Manufacturer's Qualification Statement.

I. Installer's Qualification Statement.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.6. QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.8. FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F. Maintain this minimum temperature during and 48 hours after installation.

1.9. 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.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

D. Provide 20 year manufacturer warranty against excessive degradation of exterior finish. Include provision for replacement of units with excessive fading, chalking, or flaking.

1.10. MAINTENANCE SERVICE

A. Entrance Door Hardware:

1. 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 entrance door hardware.

2. Initial Maintenance Service: Beginning at Substantial Completion, provide six months' full maintenance by skilled employees of entrance door hardware Installer. Include quarterly

preventive maintenance, repair or replacement of worn or defective components, lubrication, cleaning, and adjusting as required for proper entrance door hardware operation at rated speed and capacity. Provide parts and supplies the same as those used in the manufacture and installation of original equipment.

PART 2 PRODUCTS

2.1. BASIS OF DESIGN -- FRAMING

A. Exterior Storefront: Center-Set Style, Thermally-Broken:

1. Basis of Design: Kawneer TriFab 451UT.
2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.

B. Interior Storefront: Center-Set Style, non Thermally-Broken Framing System:

1. Basis of Design: Kawneer TriFab 451.
2. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep.

C. Substitutions: See Section 01 6000 - Product Requirements.

1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.2. BASIS OF DESIGN -- SWINGING DOORS

A. Interior Doors: Wide Stile, Single Glazing:

1. Basis of Design: Kawneer, 500 Tuffline Entrance.

B. Substitutions: See Section 01 6000 - Product Requirements.

1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.3. STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.

1. Finish: Class I color anodized.
   a. Factory finish all surfaces that will be exposed in completed assemblies.
   b. Coat concealed metal surfaces that will be in contact with cementitious materials or dissimilar metals with bituminous paint.
2. Finish Color: Dark bronze.
3. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
4. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
5. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
6. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
7. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.

8. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.
9. Air and Vapor Seal: Maintain continuous air barrier and vapor retarder throughout assembly, primarily in line with inside pane of glazing and inner sheet of infill panel and heel bead of glazing compound.

B. Performance Requirements:

1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
    a. Member Deflection: Limit member deflection to 1/175 in any direction, with full recovery of glazing materials.
2. Water Penetration Resistance on Manufactured Assembly: No uncontrolled water on interior face, when tested in accordance with ASTM E331 at pressure differential of 8 psf.
3. Air Leakage Laboratory Test: Maximum of 0.06 cu ft/min sq ft of wall area, when tested in accordance with ASTM E283 at 6.27 psf pressure differential across assembly.
4. Condensation Resistance Factor of Framing: 50, minimum, measured in accordance with AAMA 1503.
5. Overall U-value Including Glazing: 0.38 Btu/(hr sq ft deg F), maximum.

2.4. COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.

1. Framing members for interior applications need not be thermally broken.
2. Glazing Stops: Flush.

B. Glazing: As specified in Section 08 8000.

1. For Exterior Framing: Tempered, insulated glass as scheduled.
2. For Interior Framing: Tempered glass as scheduled.

C. Swing Doors: Glazed aluminum.

1. Thickness: 1-3/4 inches.
2. Top Rail: 5 inches wide.
3. Vertical Stiles: 5 inches wide.
4. Bottom Rail: 10 inches wide.
5. Glazing Stops: Square.
6. Finish: Same as storefront.

2.5. MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Exposed Flashings: Aluminum sheet, 20 gage, 0.032 inch minimum thickness; finish to match framing members.

D. Concealed Flashings: Sheet aluminum, 26 gage, 0.017 inch minimum thickness.

E. Sill Flashing Sealant: Elastomeric, silicone or polyurethane, compatible with flashing material.

F. Sealant for Setting Thresholds: Non-curing butyl type.

G. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

H. Glazing Accessories: As specified in Section 08 8000.

I. Shop and Touch-Up Primer for Steel Components: Zinc oxide, alkyd, linseed oil primer appropriate for use over hand cleaned steel.

2.6. FINISHES

A. Class I Color Anodized Finish: AAMA 611 AA-M12C22A42 Integrally colored anodic coating not less than 0.7 mils thick.

B. Color: Dark bronze.

2.7. HARDWARE

A. For each door, include weatherstripping and sill sweep strip.

B. Other Door Hardware: As specified in Section 08 7100.

C. Weatherstripping at exterior doors: Wool pile, continuous and replaceable; provide on all doors.

D. Silencers at interior doors: Provide silencers at stops to prevent metal-to-metal contact. Install three silencers on strike jamb of single-door frames and two silencers on head of frames for pairs of doors.

E. Sill Sweep Strips at exterior doors: Resilient seal type, retracting, of neoprene; provide on all doors.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that wall openings and adjoining air and vapor seal materials are ready to receive work of this section.

3.2. INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.3. TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet non-cumulative or 0.06 inch per 10 feet, whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch.

3.4. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for independent field testing and inspection requirements, and requirements for monitoring quality of specified product installations.

B. Water-Spray Test: Provide water spray quality test of installed storefront components in accordance with AAMA 501.2 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.

2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

C. Provide field testing of installed storefront system by independent laboratory in accordance with AAMA 503 during construction process and before installation of interior finishes.

1. Perform a minimum of two tests in each designated area as indicated on drawings.

2. Conduct tests in each area prior to 10 percent and 50 percent completion of this work.

3. Field test for water penetration in accordance with ASTM E1105 with uniform static air pressure difference (Procedure A) not less than 4.18 psf.

a. Maximum allowable rate of water penetration in 15-minute test is 0.5 ounce that is not contained in an area with provisions to drain to exterior, or collected on surface of interior horizontal framing member.

D. Repair or replace storefront components that have failed designated field testing, and retest to verify performance conforms to specified requirements.

3.5. ADJUSTING

A. Adjust operating hardware for smooth operation.

3.6. CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

3.7. PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 5659 - SERVICE AND TELLER WINDOW UNITS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Service and teller window units; referred to as rolling door assembly.

B. Pharmacy transaction window with pass-through device.

1.2. RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Sealing frames to weather barrier installed on adjacent construction.

B. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

C. Section 08 8000 - Glazing: Interior and exterior glazing.

1.3. REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordinate work with adjacent materials specified in other sections and as indicated on drawings and approved shop drawings.

B. Coordinate electrical service and rough-in requirements.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit manufacturer's product data for specified products indicating materials, operation, glazing, finishes, and installation instructions.

C. Shop Drawings: Indicate configuration, sizes, rough-in, mounting, anchors and fasteners, and installation clearances.

D. Manufacturer Qualification Statement.

E. Warranty: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.6. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with at least ten years documented experience, and with ability to provide test reports showing that their standard manufactured products meet the specified requirements.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Store units in area protected from exposure to weather and vandalism.

1.8. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide manufacturer's warranty agreeing to repair or replace units and their components that fail in materials or workmanship within five years from Date of Substantial Completion.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Service and Teller Window Rolling Door Assembly:

1. Basis of Design: Stylmark, Inc.; www.stylmark.com; rolling door assembly.

a. Substitutions: See Section 01 6000 - Product Requirements.

B. Pharmacy Transaction Window with Pass-through Device:

1. Basis of Design: Quikserv; www.quikserv.com; pharmacy packages.

a. Substitutions: See Section 01 6000 - Product Requirements.

2.2. SERVICE AND TELLER WINDOW ROLLING DOOR ASSEMBLY

A. Location: Built within interior wall, as indicated on drawings.

B. Location: Built as a portion of the transaction station at the main reception counter.

1. See Section 08 8000 - Glazing for rolling doors and surrounding glass.

C. Basis of Design: Stylmark rolling door 610185.

D. Window Type: rolling door, 2 panels.

1. Mounting: Floating header, top and bottom track, routed into countertop at sill.

2. Window Size: As indicated on drawings.

3. Material: Aluminum.

a. Finish: Natural anodized.

4. Components:

a. Floating Header: Stylmark FH4SACS, 1 3/4" x 4", aluminum mullion.

b. Rolling Door Tracks: Stylmark #110007.

c. Rolling Door Bottom Roller Assemblies: Stylmark #110009, #510001 and #110012.

d. Rolling Door Top Trim: Stylmark #419007.

e. Manufacturer's standard sick on finger pulls.

f. Manufacturer's standard ratchet-type keyed lock.

E. Glazing: Single (monolithic), 1/4 inch thick, clear.

1. Tempered safety glazing, refer to section 08 8000.

2.3. PHARMACY TRANSACTION WINDOW WITH PASS-THROUGH DEVICE

A. Location: Built within exterior wall, as indicated on drawings.

B. Window Type: Fixed.

1. Overall Window Frame Size: nominally 60 inch wide by 54 inch high.

2. Frame Material: Aluminum.

a. Finish: Dark Bronze anodized.

C. Glazing: Laminated Insulating glass, 1 inch overall depth, tinted, refer to section 08 8000.

D. Pass-Through Device: Drawer mounted below window.

1. Operation: Manual.

2. Material: Aluminum and stainless steel.

3. Finish Color: As selected from manufacturer's standard colors.

E. Communication: Integrated microphone, speaker, and call button.

F. Products:

1. Quikserv Corp; PCJ-130 Pharmacy Combo with QSP-713S (Manual with Speaker) Drive-Through Large Package Transaction Drawer: www.quikserv.com/#sle.

2. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1. COORDINATION

A. Coordinate rolling door assembly installation with glazing and reception counter construction.

3.2. EXAMINATION

A. Verify that window openings are ready for installation of windows.

B. Verify that correct embedded anchors are in place and in proper location; repair or replace anchors as required to achieve satisfactory installation.

C. Notify Architect if conditions are not suitable for installation of units; do not proceed until conditions are satisfactory.

3.3. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install units in correct orientation (inside/outside or secure/non-secure).

C. Anchor units securely in manner so as to achieve performance specified.

3.4. ADJUSTING

A. Adjust operating components for smooth operation while also maintaining a secure, weather-tight enclosure and a tight fit at the contact points; lubricate operating hardware.

3.5. CLEANING

A. Remove protective material from factory finished surfaces.

B. Clean exposed surfaces promptly after installation without damaging finishes.

3.6. PROTECTION

A. Provide temporary protection to ensure that service and teller windows are without damage upon Date of Substantial Completion.

END OF SECTION

SECTION 08 7100 - DOOR HARDWARE

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Hardware for wood and aluminum doors.

B. Hardware for fire-rated doors.

C. Electrically operated and controlled hardware.

D. Thresholds.

E. Weatherstripping and gasketing.

1.2. RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames.

B. Section 08 4313 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.

C. Section 28 4600 - Fire Detection and Alarm: Electrical connection to activate door closers, release magnetic holders, and coordinate with access control system.

1.3. REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. BHMA A156.1 - American National Standard for Butts and Hinges; 2013.

C. BHMA A156.2 - American National Standard for Bored and Preassembled Locks & Latches; 2011.

D. BHMA A156.3 - American National Standard for Exit Devices; 2014.

E. BHMA A156.4 - American National Standard for Door Controls - Closers; 2013.

F. BHMA A156.6 - American National Standard for Architectural Door Trim; 2010.

G. BHMA A156.7 - American National Standard for Template Hinge Dimensions; 2014.

H. BHMA A156.8 - American National Standard for Door Controls - Overhead Stops and Holders; 2010.

I. BHMA A156.13 - American National Standard for Mortise Locks & Latches Series 1000; 2012.

J. BHMA A156.15 - American National Standard for Release Devices - Closer Holder, Electromagnetic and Electromechanical; 2011.

K. BHMA A156.16 - American National Standard for Auxiliary Hardware; 2013.

L. BHMA A156.18 - American National Standard for Materials and Finishes; 2012.

M. BHMA A156.21 - American National Standard for Thresholds; 2014.

N. BHMA A156.22 - American National Standard for Door Gasketing and Edge Seal Systems, Builders Hardware Manufacturers Association; 2012.

O. BHMA A156.23 - American National Standard for Electromagnetic Locks; 2010.

P. BHMA A156.26 - American National Standard for Continuous Hinges; 2012.

Q. BHMA A156.28 - American National Standard for Recommended Practices for Mechanical Keying Systems; 2013.

R. BHMA A156.31 - American National Standard for Electric Strikes and Frame Mounted Actuators; 2013.

S. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2014.

T. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.

U. DHI (H&S) - Sequence and Format for the Hardware Schedule; 1996.

V. DHI (KSN) - Keying Systems and Nomenclature; 1989.

W. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

X. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also in WDHS-1/WDHS-5 Series, 1996.

Y. ITS (DIR) - Directory of Listed Products; current edition.

Z. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

AA. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2016.

AB. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2016.

AC. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

AD. UL (DIR) - Online Certifications Directory; Current Edition.

AE. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

AF. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; attendance is required by affected installers and the following:

1. Installer's Architectural Hardware Consultant (AHC).
2. Hardware Installer.
3. Owner's Information Technology representative.

C. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

D. Keying Requirements Meeting:

1. Attendance Required:
    a. Contractor.
    b. Owner.
    c. Installer's Architectural Hardware Consultant (AHC).
    d. Owner's Information Technology representative.
2. Agenda:
    a. Establish keying requirements.
    b. Verify locksets and locking hardware are functionally correct for project requirements.
    c. Verify that keying and programming complies with project requirements.
    d. Establish keying submittal schedule and update requirements.
3. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
    a. Access control requirements.
    b. Key control system requirements.
    c. Schematic diagram of preliminary key system.

4. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
5. Deliver established keying requirements to manufacturers.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: Submit detailed listing that includes each item of hardware to be installed on each door. Use door numbering scheme as included in Contract Documents.

1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
2. Comply with DHI (H&S) using door numbers and hardware set numbers as indicated in construction documents.
3. List groups and suffixes in proper sequence.
4. Provide complete description for each door listed.
5. Provide manufacturer's and product names, and catalog numbers; include functions, types, styles, sizes and finishes of each item.
6. Include account of abbreviations and symbols used in schedule.

D. Shop Drawings - Electrified Door Hardware: Submit diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:

1. Prepared by or under supervision of Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC).
2. Elevations: Submit front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.
3. Diagrams: Submit point-to-point wiring diagram that shows each device in door opening system with related colored wire connections to each device.
4. Coordinate with access control and security low voltage systems provided by the Owner.

E. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

1. Submit manufacturer's parts lists and templates.

F. Keying Schedule:

1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

1.6. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least three years of documented experience.

C. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) and Electrified Hardware Consultant (EHC) to assist in work of this section.

1. Coordination Responsibility: Coordinate installation of electronic security hardware with Owner, Architect and related subcontractors.
    a. Upon completion of electronic security hardware installation, inspect and verify that all components are working properly.

D. Product Substitutions: Comply with product requirements stated in Division 01 and as specified herein.
1. The Owner has identified certain products as their facility standards and those are included in the hardware sets developed for this project. Substitutions are not permitted for these products.
2. Any requests for substitution items not identified as "substitutions not permitted" must be accompanied by a detailed comparison of significant qualities of proposed substitution with those of the product specified. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the product specified.

E. Special Requirements:
1. Fire-Rated Door Openings: Provide door hardware for fire-rated openings that complies with NFPA 80 and requirements of authorities having jurisdiction. Provide only items of door hardware that are listed and are identical to products tested by Underwriters Laboratories or other testing and inspecting organizations acceptable to authorities having jurisdiction for use on types and sizes of doors indicated, based on testing at positive pressure and according to NFPA 252 or UL 10C and in compliance with requirements of fire-rated door and door frame labels.
    a. Smoke- and Draft-Control Door Assemblies: Where smoke- and draft-control door assemblies are required, provide door hardware that meets requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
        1) Air Leakage Rate: Maximum air leakage of 0.3 cfm/sq. ft. (3 cu. m per minute/sq. m) at tested pressure differential of 0.3-inch wg (75 Pa) of water.
2. Electrified Door Hardware: Listed and labeled as defined in NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction.
    a. Electrified Hardware Coordination Conference: Prior to ordering electrified hardware, schedule and hold meeting to coordinate door hardware with security, electrical, doors and frames, and other related suppliers.
3. Means of Egress Doors: Latches do not require more than 15 lbf (67 N) to release latch. Locks do not require use of key, tool, or special knowledge for operation.
4. Accessibility Requirements: For door hardware on doors in an accessible route, comply with governing accessibility regulations cited in “REFERENCES” article, herein.
    a. Provide operating devices that do not require tight grasping, pinching, or twisting of wrist and that operate with force of not more than 5 lbf (22.2 N).
    b. Maximum opening-force requirements:
        1) Interior, Non-Fire-Rated Hinged Doors: 5 lbf (22.2 N) applied perpendicular to door.
        2) Sliding or Folding Doors: 5 lbf (22.2 N) applied parallel to door at latch.
        3) Fire Doors: Minimum opening force allowable by authorities having jurisdiction.
    c. Bevel raised thresholds with slope of not more than 1:2. Provide thresholds not more than 1/2 inch (13 mm) high.
    d. Adjust door closer sweep periods so that, from open position of 70 degrees, door will take at least 3 seconds to move to 3 inches (75 mm) from latch, measured to leading edge of door.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

B. Promptly replace products damaged during shipping.

C. Handle hardware in manner to avoid damage, marring, or scratching. Correct, replace or repair products damaged during Work.

1.8. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion.

1. Closers: Ten years, minimum.

2. Exit Devices: Three years, minimum.

3. Locksets and Cylinders: Three years, minimum.

4. Other Hardware: Two years, minimum.

PART 2 PRODUCTS

2.1. DESIGN AND PERFORMANCE CRITERIA

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Provide door hardware products that comply with the following requirements:

1. Applicable provisions of federal, state, and local codes.

2. Fire-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.

3. Hardware on Fire-Rated Doors: Listed and classified by UL (DIR), ITS (DIR), or testing firm acceptable to authorities having jurisdiction as suitable for application indicated.

4. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.

5. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.

6. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.

7. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

D. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.

E. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's series. Refer to Drawings for listing of hardware sets.

F. Fasteners:

1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.

a. Aluminum fasteners are not permitted.

b. Provide phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.

2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
    a. Self-drilling (Tek) type screws are not permitted.
3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
4. Provide spacers or sex bolts with sleeves for through bolting of hollow metal doors and frames.
5. Fire-Rated Applications: Comply with NFPA 80.
    a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
    b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.2. HINGES

A. Manufacturers:
1. Basis of Design: Ives.
    a. Basis of Design for Continuous Hinges: Ives, 224HD, 628 finish at interior conditions, 710 finish at exterior conditions.
    b. Basis of Design for Continuous Hinges with electrical cutouts: Ives, 224HD EPT, 628 finish.
    c. Basis of Design for Butt Hinges: Ives, 5BB1 4.5 X 4.5, 652 finish.
    d. Basis of Design for Offset Hinges: Ives, 5BB1SC, 4.5, 652 finish.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Hinges: Comply with BHMA A156.1, Grade 1.
1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.
    a. Provide hinge width required to clear surrounding trim.
2. Continuous Hinges: Aluminum geared hinges complying with BHMA A156.26 on exterior doors and interior doors where scheduled.
3. Provide hinges on every swinging door.
4. Provide five-knuckle full mortise butt hinges unless otherwise indicated.
5. Provide following quantity of butt hinges for each door:
    a. Doors From 60 inches High up to 90 inches High: Three hinges.
    b. Doors 90 inches High up to 120 inches High: Four hinges.
    c. Doors over 120 inches High: One additional hinge per each additional 30 inches in height.
6. Provide hospital tips on hinges where scheduled.

2.3. EXIT DEVICES

A. Manufacturers:
1. Basis of Design: Von Duprin, 9900 Series.
    a. Basis of Design for Panic Device with Electric Latch Retraction: Von Duprin EL9975-NL-17-F-RX, 626 finish.
    b. Basis of Design for Standard Panic Rim Device, Von Duprin, 99-L-17, 626 finish.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Exit Devices: Comply with BHMA A156.3, Grade 1.
1. Lever design to match lockset trim.
2. Provide cylinder with cylinder dogging or locking trim, where scheduled.

a. Rim cylinder to have Schlage keyway.

3. Provide exit devices properly sized for door width and height.
4. Provide strike as recommended by manufacturer for application indicated.
5. Provide UL (DIR) listed exit device assemblies for fire-rated doors and panic device assemblies for non-fire-rated doors.
6. For electrical options, provide a complete system to accomplish scheduled operational description, including but not limited to:
   a. Manufacturer's recommended Electric Power Transfer, sprayed aluminum finish.
   b. Manufacturer's recommended Power Supply.
   c. Manufacturer's recommended wire harness and other accessories needed for a complete system installation.
   d. Provide HID® Proximity ThinLine II® 5395 card reader where scheduled and/or shown. Provide card, keypad or wave activation as scheduled.

2.4. ELECTRIC STRIKES

A. Manufacturers:
   1. Basis of Design: HES, 5000, 630 finish.
   2. Substitutions: See Section 01 6000 - Product Requirements.

B. Electric Strikes: Comply with BHMA A156.31, Grade 1.
   1. Provide UL (DIR) listed burglary-resistant electric strike; style to suit locks.
   2. Provide non-handed 24 VDC electric strike suitable for door frame material and scheduled lock configuration.
   3. Provide field selectable Fail Safe/Fail Secure modes.
   4. Provide transformer and rectifier as necessary for complete installation.
   5. Connect electric strikes into fire alarm where non-rated doors are scheduled to release with fire or sprinkler alarm condition.
   6. Provide HID® Proximity ThinLine II® 5395 card reader where scheduled and/or shown.

2.5. LOCK CYLINDERS

A. Manufacturers:
   1. Basis of Design: Schlage.
   2. Substitutions: Not permitted.

B. Lock Cylinders: Provide key access on outside of each lock, unless otherwise indicated.
   1. Provide Schlage 6-pin core/keyway, 626 finish. Basis of Design is Primus XP Key System.
      a. Provide cylinders from same manufacturer as locking device.
      b. Provide cams and/or tailpieces as required for locking devices.

2.6. CYLINDRICAL LOCKS

A. Manufacturers:
   1. Basis of Design: Schlage ND Series.
      a. Basis of Design for Passage function Latchset: ND10S, Rhodes trim, 626 finish.
      b. Basis of Design for Privacy function Lockset: ND40S, Rhodes trim, 626 finish.
      c. Basis of Design for Classroom function Lockset: ND70PD, Rhodes trim, 626 finish.
      d. Basis of Design for Storeroom function Lockset: ND80PD, Rhodes trim, 626 finish.

2. Substitutions: See Section 01 6000 - Product Requirements.

B. Cylindrical Locks (Bored): Comply with BHMA A156.2, Grade 1, 4000 Series.

1. Bored Hole: 2-1/8 inch diameter.
2. Latchbolt Throw: 1/2 inch, minimum.
3. Backset: 2-3/4 inch unless otherwise indicated.
4. Strikes: Provide manufacturer's standard strike for each latchset or lockset with strike box and curved lip extending to protect frame in compliance with indicated requirements.
    a. Finish: To match lock or latch.
5. Provide an classroom function lockset for swinging door where hardware set is not indicated.
6. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.

2.7. DOOR PULLS AND PUSH PLATES

A. Manufacturers:

1. Basis of Design: Ives.
    a. Basis of Design for Push Plates: Ives, 8200, 4" x 16", 630 finish.
    b. Basis of Design for Pull Plates: Ives, 8303, 10" CTC pull x 16", 630 finish.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.8. COORDINATORS

A. Manufacturers:

1. Basis of Design: Ives.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Coordinators: Provide on doors having closers and self-latching or automatic flush bolts to ensure that inactive door leaf closes before active door leaf.

1. Type: Bar, unless otherwise indicated.
2. Material: Aluminum, unless otherwise indicated.
3. Ensure that coordination of other door hardware affected by placement of coordinators and carry bar is applied properly for completely operable installation.

2.9. CARRY BAR

A. Manufacturers:

1. Basis of Design: Ives.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Carry Bar: Provides a push on active door when inactive door is opened first to allow coordinator to be engaged for proper door leaf closing sequence.

1. Material: Brass with nylon rollers, unless otherwise indicated.

2.10. CLOSERS

A. Manufacturers; Surface Mounted:

1. Basis of Design: LCN 4040XP, 689 finish.
    a. Provide heavy duty hold open arm where noted.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Closers: Comply with BHMA A156.4, Grade 1.

1. Type: Surface mounted to door.

2. Provide door closer on each exterior door.
3. Provide door closer on each fire-rated and smoke-rated door.
4. At corridor entry doors, mount closer on room side of door.
5. At outswinging exterior doors, mount closer on interior side of door.

C. Fire/Life Door Hold Opens:

1. Basis of Design: LCN 4040 SEH.
2. 'SEH' hold open unit is continuously energized allowing the doors to be held open under normal building conditions. When the fire alarm is activated, power to the 'SEH' unit is disconnected allowing the auxiliary door closer to close door automatically.

2.11. PROTECTION PLATES

A. Manufacturers:

1. Basis of Design: Hiawatha.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Protection Plates: Comply with BHMA A156.6.

C. Metal Properties: Stainless steel.

1. Metal, Heavy Duty: Thickness 0.062 inch, minimum.
2. Satin stainless steel finish.

D. Edges: Beveled, on four sides unless otherwise indicated.

E. Fasteners: Countersunk screw fasteners.

2.12. KICK PLATES

A. Manufacturers:

1. Basis of Design: Hiawatha.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Kick Plates: Provide along bottom edge of scheduled doors, unless otherwise indicated.

1. Size: 10 inch high by 2 inch less door width (LDW) on push side of door.

2.13. WALL STOPS

A. Manufacturers:

1. Basis of Design: Ives, WS406/407CCV, 630 finish.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Wall Stops: Comply with BHMA A156.16, Grade 1 and Resilient Material Retention Test as described in this standard.

1. Provide wall stops to prevent damage to wall surface upon opening door.
2. Type: Bumper, concave, wall stop.
3. Material: Stainless steel housing with rubber insert.

2.14. ASTRAGALS

A. Manufacturers:

1. Basis of Design: Reese, M35, 628 finish.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Astragals: Comply with BHMA A156.22.

1. Type: Split, two parts, and with sealing gasket.

2. Material: Aluminum, with neoprene weatherstripping.
3. Provide non-corroding fasteners at exterior locations.

2.15. THRESHOLDS

A. Manufacturers:
1. Basis of Design for typical Thresholds: Reese, S205A, aluminum.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Thresholds: Comply with BHMA A156.21.
1. Provide threshold at each exterior door, unless otherwise indicated.
2. Type: ADA compliant, saddle type at typical thresholds.
3. Material: Aluminum.
4. Threshold Surface: Fluted horizontal grooves across full width.
5. Field cut threshold to profile of frame and width of door sill for tight fit.
6. Provide non-corroding fasteners at exterior locations.

2.16. WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
1. Basis of Design: Reese.
a. Basis of Design for Sweeps: Reese 354C, clear anodized aluminum with nylon brush.
b. Basis of Design for Weatherstripping: Reese 657C, clear anodized aluminum with silicone insert.
c. Basis of Design for Smoke Seals: Reese 797B.
d. Basis of Design for Gasketing: Reese 797B.
e. Basis of Design for Automatic Door Bottoms: Zero 368, aluminum mill finish, neoprene insert, semi-mortised, fire rated.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Weatherstripping and Gasketing: Comply with BHMA A156.22.
1. Head and Jamb Type: Self-adhesive.
2. Door Sweep Type: Encased in retainer.
3. Material: Aluminum, with neoprene weatherstripping.
4. Provide gasketing for smoke and draft control doors (Indicated as "S" on Drawings) that complies with local codes, requirements of assemblies tested in accordance with UL 1784.
5. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated; .
6. Provide door bottom sweep on each exterior door, unless otherwise indicated.

2.17. RAIN DRIPS:

A. Manufacturers:
1. Basis of Design: Reese, R201, dark bronze anodized aluminum finish.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.18. SILENCERS

A. Manufacturers:
1. Basis of Design: Ives.

2. Substitutions: See Section 01 6000 - Product Requirements.

B. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.

1. Single Door: Provide three on strike jamb of frame.
2. Pair of Doors: Provide two on head of frame, one for each door at latch side.
3. Material: Rubber, gray color.

2.19. KEY CONTROL SYSTEMS

A. Key Control Systems: Comply with guidelines of BHMA A156.28.

1. Provide keying information in compliance with DHI (KSN) standards.
2. Keying: Grand master keyed.
3. Include construction keying and control keying with removable core cylinders.
4. Supply keys in following quantities:
   a. 1 each Grand Master keys.
   b. 6 each Sub Master keys.
   c. 6 each Construction Master keys.
   d. 15 each Construction keys.
   e. 2 each Construction Control keys.
   f. 2 each Control keys if new system.
5. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.
6. Permanent Keys and Cores: Stamped with applicable key marking for identification. Do not include actual key cuts within visual key control marks or codes. Stamp permanent keys "Do Not Duplicate."
7. Owner or Owner's agent install permanent cores and return construction cores to hardware supplier. Construction cores and keys to remain property of hardware supplier.

2.20. POWER SUPPLY

A. Manufacturers:

1. Securitron; an Assa Abloy Group company: www.assaabloydss.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. Power Supply: Hard wired, with multiple zones providing eight (8) breakers for each output panel with individual control switches and LED's; UL (DIR) Class 2 listed.

1. Power: 24 VAC, 10 Amp; with 120 VAC power supply.
2. Operating Temperature: 32 to 110 degrees F.
3. Provide with emergency release terminals that release devices upon activation of fire alarm system.

2.21. FINISHES

A. Finishes: Provide door hardware of same finish, unless otherwise indicated.

1. Finish: 652; satin chromium plated over nickel, with steel base material (formar US equivalent US26D); BHMA A156.18.
2. Exceptions:
   a. Where base material metal is specified to be different, provide finish that is an equivalent appearance in accordance with BHMA A156.18.

b. Hinges for Fire-Rated Doors: Steel base material with painted finish, in compliance with NFPA 80.

c. Hardware for Aluminum Storefront Doors: Finished to match door panel finish, except at hand contact surfaces provide stainless steel with satin finish, unless otherwise indicated.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Verify that electric power is available to power operated devices and of correct characteristics.

3.2. INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

C. Install hardware for smoke and draft control doors in accordance with NFPA 105.

D. Use templates provided by hardware item manufacturer.

E. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list; unless noted otherwise in Door Hardware Schedule or on drawings.

1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
2. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
3. Mounting heights in compliance with ADA Standards:

F. Set exterior door thresholds with full-width bead of elastomeric sealant at each point of contact with floor providing a continuous weather seal; anchor thresholds with stainless steel countersunk screws.

3.3. FIELD QUALITY CONTROL

A. Provide an Architectural Hardware Consultant (AHC) to inspect installation and certify that hardware and installation has been furnished and installed in accordance with manufacturer's instructions and as specified.

3.4. ADJUSTING

A. Adjust work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.5. CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

3.6. PROTECTION

A. Protect finished Work under provisions of Section 01 7000 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

END OF SECTION

SECTION 08 8000 - GLAZING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Insulating glass units for exterior use.

B. Spandrel panels.

C. Glazing, for interior use.

D. Glazing compounds and accessories.

1.2. RELATED REQUIREMENTS

A. Section 08 1113 - Hollow Metal Doors and Frames: Glazed lites in doors and borrowed lites.

B. Section 08 1416 - Flush Wood Doors: Information regarding glazed lites in doors to receive glazing.

C. Section 08 4229 - Automatic Entrances: Information regarding door assemblies to receive glazing.

D. Section 08 4313 - Aluminum-Framed Storefronts: Information regarding storefront assemblies to receive glazing.

E. Section 08 5659 - Service and Teller Window Units: Interior reception sliding windows and exterior Pharmacy Transaction Windows.

1.3. REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; current edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings, Safety Performance Specifications and Methods of Test; 2010.

C. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.

D. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2011).

E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

F. ASTM C1036 - Standard Specification for Flat Glass; 2011.

G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

H. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2014.

I. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.

J. ASTM C1376 - Standard Specification for Pyrolytic and Vacuum Deposition Coatings on Flat Glass; 2015.

K. ASTM E1300 - Standard Practice for Determining Load Resistance of Glass in Buildings; 2012a.

L. ASTM E2190 - Standard Specification for Insulating Glass Unit Performance and Evaluation; 2010.

M. GANA (GM) - GANA Glazing Manual; 2009.

N. GANA (SM) - GANA Sealant Manual; 2008.

O. GANA (LGRM) - Laminated Glazing Reference Manual; 2009.

P. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Q. IGMA TM-3000 - North American Glazing Guidelines for Sealed Insulating Glass Units for Commercial & Residential Use; 1990 (2004).

R. ITS (DIR) - Directory of Listed Products; current edition.

S. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2012.

T. NFPA 257 - Standard on Fire Test for Window and Glass Block Assemblies; 2012.

U. NFRC 100 - Procedure for Determining Fenestration Product U-factors; 2014.

V. NFRC 200 - Procedure for Determining Fenestration Product Solar Heat Gain Coefficient and Visible Transmittance at Normal Incidence; 2014.

W. NFRC 300 - Test Method for Determining the Solar Optical Properties of Glazing Materials and Systems; 2014.

X. UL (DIR) - Online Certifications Directory; Current Edition.

Y. UL 10B - Standard for Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

Z. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by each of the affected installers.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data on Insulating Glass Unit and Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Samples: Submit two samples 12 by 12 inch in size of glass units.

E. Samples: Submit 12 inch long bead of glazing sealant, color as selected.

F. Certificate: Certify that products of this section meet or exceed specified requirements.

G. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

H. Glazing Schedule: List glass types and thicknesses for each size opening and location. Use same designations indicated on Drawings.

I. Delegated-Design Submittal: For glass indicated to comply with performance requirements and design criteria, including analysis data signed and sealed by the qualified professional engineer responsible for their preparation

1.6. QUALITY ASSURANCE

A. Perform Work in accordance with GANA (GM), GANA (SM), GANA (LGRM), and IGMA TM-3000 for glazing installation methods.

B. Manufacturer Qualifications: Company specializing in manufacturing the 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 at least three years documented experience.

D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

1.7. MOCK-UPS

A. See Section 01 4000 - Quality Requirements, for additional mock-up requirements.

B. Provide mock-up of one window assembly including glass , air/vapor barrier, and flashing.

C. Locate as indicated by Architect.

D. Mock-ups may remain as part of the Work.

1.8. DELIVERY, STORAGE, AND HANDLING

A. Do not proceed with glazing when ambient and substrate temperature conditions are outside limits permitted by glazing material manufacturers and when glazing channel substrates are wet from rain, frost, condensation, or other causes

B. Protect glazing materials according to manufacturer's written instructions. Prevent damage to glass and glazing materials from condensation, temperature changes, direct exposure to sun, or other causes.

C. Comply with insulating-glass manufacturer's written instructions for venting and sealing units to avoid hermetic seal ruptures due to altitude change.

1.9. FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F.

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.10. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Insulating Glass Units: Provide a ten (10) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

C. Laminated Glass: Provide a ten (10) year manufacturer warranty to include coverage for delamination, including providing products to replace failed units.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Glass Fabricators:

1. GGI - General Glass International: www.generalglass.com/#sle.
2. JE Berkowitz, LP: www.jeberkowitz.com/#sle.
3. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
4. Viracon, Inc: www.viracon.com/#sle.
5. Insulite Glass Company.
6. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Float Glass Manufacturers:

1. AGC Glass North America, Inc: www.agcglass.com/#sle.
2. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
3. Guardian Glass, LLC: www.guardianglass.com/#sle.
4. Pilkington North America Inc: www.pilkington.com/na/#sle.
5. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.
6. Substitutions: Refer to Section 01 6000 - Product Requirements.

C. Laminated Glass Manufacturers:

1. Cardinal Glass Industries: www.cardinalcorp.com/#sle.
2. Viracon, Architectural Glass segment of Apogee Enterprises, Inc: www.viracon.com/#sle.
3. Substitutions: Refer to Section 01 6000 - Product Requirements.

D. Fire-Resistance-Rated Glass: Provide products as required to achieve indicated fire-rating period.

1. Manufacturers:
2. SAFTIFIRST, a division of O'Keeffe's Inc; SuperLite II-XL: www.safti.com/#sle.
3. Technical Glass Products; Pilkington Pyrostop: www.fireglass.com/#sle.
4. Vetrotech North America; Contraflam: www.vetrotechusa.com/#sle.
5. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.2. PERFORMANCE REQUIREMENTS - EXTERIOR GLAZING ASSEMBLIES

A. Provide type and thickness of exterior glazing assemblies to support assembly dead loads, and to withstand live loads caused by positive and negative wind pressure acting normal to plane of glass.

1. Design Pressure: Calculated in accordance with ASCE 7.
2. Comply with ASTM E1300 for design load resistance of glass type, thickness, dimensions, and maximum lateral deflection of supported glass.
3. Provide glass edge support system sufficiently stiff to limit the lateral deflection of supported glass edges to less than 1/175 of their lengths under specified design load.
4. Glass thicknesses listed are minimum.

B. Vapor Retarder and Air Barrier Seals: Provide completed assemblies that maintain continuity of building enclosure vapor retarder and air barrier.

1. In conjunction with vapor retarder and joint sealer materials described in other sections.

C. Thermal and Optical Performance: Provide exterior glazing products with performance properties as indicated. Performance properties are in accordance with manufacturer's published data as determined with the following procedures and/or test methods:

1. Center of Glass U-Value: Comply with NFRC 100 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
2. Center of Glass Solar Heat Gain Coefficient (SHGC): Comply with NFRC 200 using Lawrence Berkeley National Laboratory (LBNL) WINDOW 6.3 computer program.
3. Solar Optical Properties: Comply with NFRC 300 test method.

2.3. GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.

1. Annealed Type: ASTM C1036, Type I - Transparent Flat, Class 1 - Clear, Quality - Q3.
2. Fully Tempered Safety Glass: Complies with ANSI Z97.1 or 16 CFR 1201 criteria for safety glazing used in hazardous locations.
3. Thicknesses: As indicated; provide greater thickness as required for exterior glazing wind load design and for interior butt jointed glass installations.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.

1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.
2. Thickness: Monolithic laminated consisting of two layers of 1/8 inch fully tempered safety glass with interlayer for nominal 1/4 inch thickness. Glass color and coating as defined for insulating glass Type IG-L.
3. Polyvinyl Butyral (PVB) Interlayer: 0.030 inch thick, minimum.

2.4. INSULATING GLASS UNITS

A. Manufacturers:

1. Vitro Architectural Glass (formerly PPG Glass): www.vitroglazings.com/#sle.

2. Basis of Design: Vitro Solarban 70, bronze insulated glass unit. Owner has directed use of basis of design product to match other facilities on hospital campus.
3. Substitutions: Refer to Section 01 6000 - Product Requirements.

B. Insulating Glass Units: Types as indicated.

1. Durability: Certified by an independent testing agency to comply with ASTM E2190.
2. Coated Glass: Comply with requirements of ASTM C1376 for pyrolytic (hard-coat) or magnetic sputter vapor deposition (soft-coat) type coatings on flat glass; coated vision glass, Kind CV; coated overhead glass, Kind CO; or coated spandrel glass, Kind CS.
3. Metal Edge Spacers: Aluminum, bent and soldered corners.
4. Spacer Color: Black.
5. Edge Seal:
    a. Dual-Sealed System: Provide polyisobutylene sealant as primary seal applied between spacer and glass panes, and silicone, polysulfide, or polyurethane sealant as secondary seal applied around perimeter.
6. Color: Black.
7. Purge interpane space with dry air, hermetically sealed.
8. Capillary Tubes: Provide tubes from air space for insulating glass units without inert type gas that have a change of altitude greater than 2500 feet between point of fabrication and point of installation to permit pressure equalization of air space.
    a. Capillary Tubes: Tubes to remain open and be of length and material type in accordance with insulating glass fabricator's requirements.
    b. Inert gas may be installed in the field into air space in accordance with insulating glass fabricator's and installer's requirements.

C. Type IG-1 - Insulating Glass Units: Vision glass, double glazed.

1. Applications: Exterior glazing unless otherwise indicated.
2. Space between lites filled with argon.
3. Outboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
    a. Tint: Bronze.
    b. Coating: Low-E (passive type), on #2 surface.
4. Inboard Lite: Fully tempered float glass, 1/4 inch thick, minimum.
    a. Tint: Clear.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value), Summer - Center of Glass: 0.21, maximum.
7. Visible Light Transmittance (VLT): 38 percent, minimum.
8. Solar Heat Gain Coefficient (SHGC): 0.26, maximum.
9. Visible Light Reflectance, Outside: 8 percent, nominal.

D. Type IG-L - Insulating Glass Units, Laminated: Vision glass, double glazed, laminated.

1. Applications: Exterior glazing at Pharmacy glazing.
2. Same as Type IG-1 except that Outboard Lite is Laminated glass, 1/4 inch thick, minimum, bronze tint, Low-E (passive type) on #2 surface.

E. Type SP-1 - Insulating Glass Units: Spandrel glazing.

1. Applications: Exterior spandrel glazing unless otherwise indicated.

2. Space between lites filled with air.
3. Outboard Lite: Annealed float glass, 1/4 inch thick, minimum.
    a. Tint: Bronze.
    b. Coating: Same as on vision units, on #2 surface.
4. Inboard Lite: Heat-strengthened float glass, 1/4 inch thick.
    a. Tint: Clear.
    b. Opacifier: Ceramic frit, on #4 surface.
    c. Opacifier Color: _____.
5. Total Thickness: 1 inch.
6. Thermal Transmittance (U-Value), Summer - Center of Glass: _____, nominal.

2.5. GLAZING UNITS

A. Type G-1 - Monolithic Interior Vision Glazing:
    1. Applications: Interior glazing unless otherwise indicated.
    2. Glass Type: Fully tempered float glass.
    3. Tint: Clear.
    4. Thickness: 1/4 inch, nominal at typical locations.
        a. 3/8 inch at reception counter locations.

B. Type G-2 - Fire-Resistance-Rated Glazing: Type, thickness, and configuration of glazing that contains flame, smoke, and blocks radiant heat, as required to achieve indicated fire-ratings.
    1. Applications:
        a. Glazing in fire-rated door assembly.
        b. Other locations as indicated on drawings.
    2. Provide products listed by 1 or 1 and approved by authorities having jurisdiction.
    3. Safety Glazing Certification: 16 CFR 1201 Category II.
    4. Fire-Rating Period: As indicated on drawings.
    5. Markings for Fire-Resistance-Rated Glazing Assemblies: Provide permanent markings on fire-resistance-rated glazing in compliance with 1, local building code, and authorities having jurisdiction.
        a. "D" - meets fire door assembly criteria of NFPA 252, UL 10B, or UL 10C fire test standards.
        b. "H" - meets fire door assembly hose stream test of NFPA 252, UL 10B, or UL 10C fire test standards.
        c. "T" - meets temperature rise of not more than 450 degrees F above ambient at end of 30 minutes fire exposure in accordance with NFPA 252, UL 10B, or UL 10C fire test standards.
        d. "XXX" - placeholder that represents fire-rating period, in minutes.

2.6. GLAZING COMPOUNDS

A. Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; non-bleeding, non-staining; ASTM C920, Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; color as selected.

B. Manufacturers:
    1. BASF Corporation: www.basf.com/us/en.html.
    2. Bostik Inc: www.bostik-us.com.

3. Dow Corning Corporation: www.dowcorning.com/construction.
4. Pecora Corporation: www.pecora.com.
5. Tremco Commercial Sealants & Waterproofing: www.tremcosealants.com/#sle.
6. Substitutions: Refer to Section 01 6000 - Product Requirements.

2.7. ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot of glazing or minimum 4 inch by width of glazing rabbet space minus 1/16 inch by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Minimum 3 inch long by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

C. Glazing Splines: Resilient silicone extruded shape to suit glazing channel retaining slot; ASTM C864 Option II; color black.

D. Rolling Reception Window Assemblies: See specification section 08 5659 Service and Teller Window Units.

E. Pharmacy Transaction Window Assemblies: See specification section 08 5659 Service and Teller Window Units.

2.8. SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

PART 3 EXECUTION

3.1. VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

C. Proceed with glazing system installation only after unsatisfactory conditions have been corrected.

3.2. PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.3. INSTALLATION, GENERAL

A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

B. Do not exceed edge pressures around perimeter of glass lites as stipulated by glass manufacturer.

C. Set glass lites of system with uniform pattern, draw, bow, and similar characteristics.

D. Set glass lites in proper orientation so that coatings face exterior or interior as indicated.

E. Prevent glass from contact with any contaminating substances that may be the result of construction operations such as, and not limited to the following; weld splatter, fire-safing, plastering, mortar droppings, etc.

3.4. INSTALLATION - DRY GLAZING METHOD (GASKET GLAZING)

A. Application - Exterior and/or Interior Glazed: Set glazing infills from either the exterior or the interior of the building.

B. Place setting blocks at 1/4 points with edge block no more than 6 inch from corners.

C. Rest glazing on setting blocks and push against fixed stop with sufficient pressure on gasket to attain full contact.

D. Install removable stops without displacing glazing gasket; exert pressure for full continuous contact.

3.5. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

C. Monitor and report installation procedures and unacceptable conditions.

3.6. CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove non-permanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.7. PROTECTION

A. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 08 9100 - LOUVERS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Louvers, frames, and accessories.

1.2. RELATED REQUIREMENTS

A. Section 07 2500 - Weather Barriers: Sealing frames to weather barrier installed on adjacent construction.

B. Section 07 6200 - Sheet Metal Flashing and Trim.

C. Section 07 9200 - Joint Sealants: Sealing joints between frames and adjacent construction.

1.3. REFERENCE STANDARDS

A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2012.

B. AMCA 511 - Certified Ratings Program for Air Control Devices; 2010.

C. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.

C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.

D. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.5. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.6. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.

1. Finish: Include twenty year coverage against degradation of exterior finish.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Louvers:

1. Airolite Company, LLC: www.airolite.com/#sle.

2. Construction Specialties, Inc; Acoustical Louver: www.c-sgroup.com/#sle.

3. Ruskin: www.ruskin.com/#sle.

4. Substitutions: See Section 01 6000 - Product Requirements.

2.2. LOUVERS

A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.

B. Stationary Louvers: Horizontal blade, extruded aluminum construction.

1. Blades: Straight.

2. Frame: 4 inches deep, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.

3. Aluminum Thickness: Frame 12 gauge, 0.0808 inch minimum; blades 12 gauge, 0.0808 inch minimum.

4. Aluminum Finish: Class I color anodized; finish welded units after fabrication.

a. Color: dark bronze.

5. Size: semi-circular shape and size as shown on the drawings.

2.3. ACCESSORIES

A. Insect Screen: 18 x 16 size aluminum mesh.

B. Flashings: Of same material as louver frame, formed to required shape, single length in one piece per location.

C. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.

3.2. INSTALLATION

A. Install louver assembly in accordance with manufacturer's instructions.

B. Install louvers level and plumb.

C. Install flashings and align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.

D. Secure louver frames in openings with concealed fasteners.

3.3. CLEANING

A. Strip protective finish coverings.

B. Clean surfaces and components.

END OF SECTION

SECTION 09 0561 - COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.1. SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:

1. Resilient tile and sheet.
2. Carpet tile.
3. Thin-set ceramic tile..

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. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.

1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.

F. Patching compound.

G. Remedial floor coatings.

1.2. RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Moisture emission reducing curing and sealing compound for slabs to receive adhered flooring, to prevent moisture content-related flooring failures; to remain in place, not to be removed.

1.3. REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in. or (50-mm) Cube Specimens); 2013.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters and Gypsum Concrete; 1999 (Reapproved 2014).

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

D. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

E. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2011.

F. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; Resilient Floor Covering Institute; October 2011.

1.4. 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. Recommendations for remediation of unsatisfactory surfaces.
6. Submit report to Architect.
7. Submit report not more than two business days after conclusion of testing.

D. Adhesive Bond and Compatibility Test Report.

E. Copy of RFCI (RWP).

1.5. QUALITY ASSURANCE

A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.

B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.

1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.

C. 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 when specified ambient conditions have been achieved and when testing will start.

1.6. FIELD CONDITIONS

A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or 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

2.1. MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:

1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

B. Alternate Flooring Adhesive: Floor covering manufacturer's recommended product, suitable for the moisture and pH conditions present; low-VOC. In the absence of any recommendation from flooring manufacturer, provide a product recommended by adhesive manufacturer as suitable for substrate and floor covering and for conditions present.

PART 3 EXECUTION

3.1. CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:

1. Existing concrete slabs (on-grade and elevated) with existing floor coverings:
    a. Visual observation of existing floor covering, for adhesion, water damage, alkaline deposits, and other defects.
    b. Removal of existing floor covering.
2. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
    a. Do not attempt to remove coating or penetrating material.
    b. Do not abrade surface.
3. Preliminary cleaning.
4. 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.
5. Internal relative humidity tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
6. Alkalinity (pH) tests; in same locations as moisture vapor emission tests, unless otherwise indicated.
7. Specified remediation, if required.
8. Patching, smoothing, and leveling, as required.
9. Other preparation specified.
10. Adhesive bond and compatibility test.
11. Protection.

B. 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 or remedial sheet membrane over entire suspect floor area.
3. Excessive Alkalinity (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 over entire suspect floor area.

3.2. REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI 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.

3.3. 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.

3.4. 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. Where this specification conflicts with the referenced test method, comply with the requirements of this section.

C. Test in accordance with ASTM F1869 and as follows.

D. 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.

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 test values exceed 3 pounds per 1000 square feet per 24 hours.

F. Report: Report the information required by the test method.

3.5. 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.

3.6. 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.

1. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.

2. 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.

3. Use of a digital pH meter with probe is acceptable; follow meter manufacturer's instructions.

C. The following procedure is the equivalent of that described in ASTM F710, repeated here for the Contractor's convenience.

D. Use a wide range alkalinity (pH) test paper, its associated chart, and distilled or deionized water.

E. 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.

F. 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.

3.7. PREPARATION

A. See individual floor covering section(s) for additional requirements.

B. Comply with recommendations of testing agency.

C. Comply with requirements and recommendations of floor covering manufacturer.

D. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.

E. Do not fill expansion joints, isolation joints, or other moving joints.

3.8. ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

3.9. 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

SECTION 09 2116 - GYPSUM BOARD ASSEMBLIES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Performance criteria for gypsum board assemblies.

B. Metal stud wall framing.

C. Metal channel ceiling framing.

D. Acoustic insulation.

E. Gypsum sheathing.

F. Gypsum wallboard.

G. Joint treatment and accessories.

1.2. RELATED REQUIREMENTS

A. Section 05 4000 - Cold-Formed Metal Framing: Exterior wind-load-bearing metal stud framing.

B. Section 06 1000 - Rough Carpentry: Wood blocking product and execution requirements.

C. Section 07 2500 - Weather Barriers: Water-resistive barrier over sheathing.

1.3. REFERENCE STANDARDS

A. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

B. ASTM C475/C475M - Standard Specification for Joint Compound and Joint Tape for Finishing Gypsum Board; 2015.

C. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2014.

D. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2012.

E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2015.

F. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2013.

G. ASTM C954 - Standard Specification for Steel Drill Screws for the Application of Gypsum Panel Products or Metal Plaster Bases to Steel Studs From 0.033 in. (0.84 mm) to 0.112 in. (2.84 mm) in Thickness; 2015.

H. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2014.

I. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2014a.

J. ASTM C1280 - Standard Specification for Application of Gypsum Sheathing Board; 2013.

K. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2014.

L. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2012.

M. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

N. ASTM E413 - Classification for Rating Sound Insulation; 2010.

O. GA-216 - Application and Finishing of Gypsum Board; 2013.

P. GA-600 - Fire Resistance Design Manual; 2015.

Q. UL (FRD) - Fire Resistance Directory; current edition.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on metal framing, gypsum board, accessories, and joint finishing system.

C. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.

1.5. QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum five years of experience.

B. Fire-Resistance-Rated Assemblies: For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E 119 by an independent testing agency.

PART 2 PRODUCTS

2.1. GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

B. Interior Partitions: Provide completed assemblies with the following characteristics:

1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.

C. Fire Rated Assemblies: Provide completed assemblies complying with applicable code.

1. Fire Rated Partitions: As indicated.

2. Head of Fire Rated Partitions: As indicated.

3. Gypsum Association File Numbers: Comply with requirements of GA-600 for the particular assembly.

4. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

2.2. METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:

1. Basis of Design: ClarkDietrich Building Systems: www.clarkdietrich.com/#sle.

2. Substitutions: See Section 01 6000 - Product Requirements.

B. Non-Loadbearing Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/240 at 5 psf.

1. Studs: "C" shaped with flat or formed webs.

2. Runners: U shaped, sized to match studs.

3. Ceiling Channels: C-shaped.

4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.

5. Resilient Furring Channels: 1/2 inch depth, for attachment to substrate through one leg only.

a. Products:

1) Basis of Design: ClarkDietrich; RC Deluxe; www.clarkdietrich.com.

2) Substitutions: See Section 01 6000 - Product Requirements.

C. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.

D. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.

1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100-12.
2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot dipped galvanized coating.
3. Provide components UL-listed for use in UL-listed fire-rated head of partition joint systems of fire rating and movement required.
4. Deflection and Firestop Track:
    a. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-rating of the wall assembly.

2.3. BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:

1. American Gypsum Company.
2. CertainTeed Corporation.
3. LaFarge North America, Inc.
4. National Gypsum Company.
5. USG Corporation.
6. Substitutions: See Section 01 6000 - Product Requirements.

B. Gypsum Wallboard: All gypsum board shall be mold resistant paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    a. Mold resistant board is required at all locations.
3. At Assemblies Indicated with Fire-Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
4. Thickness:
    a. Vertical Surfaces: 5/8 inch.
    b. Ceilings: 5/8 inch.
    c. Edges: Tapered.

C. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.

1. Application: Ceilings, unless otherwise indicated.
2. Thickness: 5/8 inch.
3. Edges: Tapered.

D. Exterior Sheathing Board: Sizes to minimize joints in place; ends square cut.

1. Application: Exterior sheathing, unless otherwise indicated.
2. Edges: Square.
3. Glass Mat Faced Products:
    a. American Gypsum Company; M-Glass Exterior Sheathing Type X.

b. American Gypsum Company; M-Glass Exterior Sheathing.

c. Continental Building Products; Weather Defense Platinum Exterior Sheathing.

d. Continental Building Products; Weather Defense Platinum Sheathing Type X.

e. Georgia-Pacific Gypsum; DensGlass Sheathing.

f. Georgia-Pacific Gypsum; DensGlass Fireguard Sheathing.

g. Substitutions: See Section 01 6000 - Product Requirements.

2.4. ACCESSORIES

A. Acoustic Insulation: ASTM C665; preformed glass fiber, friction fit type, unfaced. Thickness: 3-1/2 inch.

B. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.

C. Water-Resistive Barrier: As specified in Section 07 2500.

D. Beads, Joint Accessories, and Other Trim: ASTM C1047, galvanized steel or rolled zinc, unless noted otherwise.

E. Joint Materials: ASTM C475 and as recommended by gypsum board manufacturer for project conditions.

1. Tape: 2 inch wide, coated glass fiber tape for joints and corners, except as otherwise indicated.

2. Tape: 2 inch wide, creased paper tape for joints and corners, except as otherwise indicated.

3. Ready-mixed vinyl-based joint compound.

4. Chemical hardening type compound.

F. High Build Drywall Surfacer: Vinyl acrylic latex-based coating for spray application, designed to take the place of skim coating and separate paint primer in achieving Level 5 finish.

G. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inch in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion resistant.

H. Screws for Fastening of Gypsum Panel Products to Steel Members from 0.033 to 0.112 inch in Thickness: ASTM C954; steel drill screws, corrosion resistant.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.2. FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.

1. Level ceiling system to a tolerance of 1/1200.

2. Laterally brace entire suspension system.

3. Install bracing as required at exterior locations to resist wind uplift.

C. Studs: Space studs at 16 inches on center.

1. Extend partition framing to structure where indicated and to ceiling in other locations maximum spacing.

2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

3. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in

accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Standard Wall Furring: Install at existing former exterior walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.

F. Furring for Fire Ratings: Install as required for fire resistance ratings indicated and to GA-600 requirements.

G. Blocking: Install mechanically fastened sheet steel or fire treated wood blocking for support of:

1. Wall mounted cabinets.
2. Plumbing fixtures.
3. Toilet accessories.
4. Wall mounted door hardware.

3.3. ACOUSTIC ACCESSORIES INSTALLATION

A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.

B. Acoustic Sealant: Install in accordance with manufacturer's instructions.

1. Seal around all penetrations by conduit, pipe, ducts, and rough-in boxes, except where firestopping is provided.

3.4. BOARD INSTALLATION

A. Comply with ASTM C 840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Single-Layer Non-Rated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.

1. Exception: Tapered edges to receive joint treatment at right angles to framing.

C. Fire-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.

D. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.

E. Exterior Sheathing: Comply with ASTM C1280. Install sheathing vertically, with edges butted tight and ends occurring over firm bearing.

F. Installation on Metal Framing: Use screws for attachment of gypsum board.

3.5. INSTALLATION OF TRIM AND ACCESSORIES

A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.

B. Corner Beads: Install at external corners, using longest practical lengths.

C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.

3.6. JOINT TREATMENT

A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, bedded and finished with chemical hardening type joint compound.

B. Paper Faced Gypsum Board: Use paper joint tape, bedded with ready-mixed vinyl-based joint compound and finished with ready-mixed vinyl-based joint compound.

C. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:

1. Level 5: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
2. Level 1: Wall areas above finished ceilings, whether or not accessible in the completed construction.

D. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.

1. Feather coats of joint compound so that camber is maximum 1/32 inch.

E. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.

F. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

3.7. TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

END OF SECTION

SECTION 09 3000 - TILING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall base applications.

1.2. RELATED REQUIREMENTS

A. Section 09 0561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.3. REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2019.

B. ANSI A108.1a - American National Standard Specifications for Installation of Ceramic Tile in the Wet-Set Method, with Portland Cement Mortar; 2017.

C. ANSI A108.1b - American National Standard Specifications for Installation of Ceramic Tile on a Cured Portland Cement Mortar Setting Bed with Dry-Set or Latex-Portland Cement Mortar; 2017.

D. ANSI A108.1c - Specifications for Contractors Option: Installation of Ceramic Tile in the Wet-Set Method with Portland Cement Mortar or Installation of Ceramic Tile on a Cured Portland Cement Mortar Bed with Dry-Set or Latex-Portland Cement; 1999 (Reaffirmed 2016).

E. ANSI A108.2 - American National Standard General Requirements: Materials, Environmental and Workmanship; 2019.

F. ANSI A108.4 - American National Standard Specifications for Installation of Ceramic Tile with Organic Adhesives or Water Cleanable Tile-Setting Epoxy Adhesive; 2009 (Revised).

G. ANSI A108.5 - American National Standard Specifications for Installation of Ceramic Tile with Dry-Set Portland Cement Mortar or Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

H. ANSI A108.6 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy; 1999 (Reaffirmed 2010).

I. ANSI A108.8 - American National Standard Specifications for Installation of Ceramic Tile with Chemical Resistant Furan Resin Mortar and Grout; 1999 (Reaffirmed 2010).

J. ANSI A108.9 - American National Standard Specifications for Installation of Ceramic Tile with Modified Epoxy Emulsion Mortar/Grout; 1999 (Reaffirmed 2010).

K. ANSI A108.10 - American National Standard Specifications for Installation of Grout in Tilework; 2017.

L. ANSI A108.12 - American National Standard for Installation of Ceramic Tile with EGP (Exterior Glue Plywood) Latex-Portland Cement Mortar; 1999 (Reaffirmed 2010).

M. ANSI A108.13 - American National Standard for Installation of Load Bearing, Bonded, Waterproof Membranes for Thin-Set Ceramic Tile and Dimension Stone; 2005 (Reaffirmed 2016).

N. ANSI A108.19 - American National Standard Specifications for Interior Installation of Gauged Porcelain Tiles and Gauged Porcelain Tile Panels/Slabs by the Thin-Bed Method Bonded with Modified Dry-Set Cement Mortar or Improved Modified Dry-Set Cement Mortar; 2020.

O. ANSI A118.3 - American National Standard Specifications for Chemical Resistant, Water Cleanable Tile-Setting and -Grouting Epoxy and Water Cleanable Tile-Setting Epoxy Adhesive; 2013 (Revised).

P. ANSI A118.4 - American National Standard Specifications for Modified Dry-Set Cement Mortar; 2012 (Revised).

Q. ANSI A118.7 - American National Standard Specifications for High Performance Cement Grouts for Tile Installation; 2010 (Reaffirmed 2016).

R. ANSI A137.1 - American National Standard Specifications for Ceramic Tile; 2019.

S. ANSI A137.2 - American National Standard Specifications for Glass Tile; 2013.

T. ASTM F1869 - Standard Test Method for Measuring Moisture Vapor Emission Rate of Concrete Subfloor Using Anhydrous Calcium Chloride; 2011.

U. TCNA (HB) - Handbook for Ceramic, Glass, and Stone Tile Installation; 2019.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Shop Drawings: Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, control and expansion joints, thresholds, ceramic accessories, and setting details.

D. Samples for Verification:

1. Full-size units of each type and composition of tile and for each color and finish required.

2. Full-size units of each type of trim and accessory for each color and finish required.

E. Maintenance Data: Include recommended cleaning methods, cleaning materials, and stain removal methods.

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 Tile: 3 percent of each size, color, and surface finish combination matching production runs and dyelots of products installed.

1.5. QUALITY ASSURANCE

A. Installer Qualifications:

1. Company specializing in performing tile installation, with minimum of five years of documented experience.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Protect adhesives from freezing or overheating in accordance with manufacturer's instructions.

1.7. FIELD CONDITIONS

A. Do not install solvent-based products in an unventilated environment.

B. Maintain ambient and substrate temperature above 50 degrees F and below 100 degrees F during installation and curing of setting materials.

PART 2 PRODUCTS

2.1. TILE

A. Manufacturers: All products by the same manufacturer.

1. Dal-Tile Corporation: www.daltile.com/#sle.

B. Porcelain Tile, Type T-1:

1. Size: 12 by 24 inch, nominal.

2. Thickness: 3/8 inch.

3. Edges: Rectified.

4. Surface Finish: Matte glazed.

5. Color(s): As indicated on drawings.

6. Pattern: As indicated on drawings.

7. Trim Units, Type T-1: Matching bullnose shapes in sizes indicated.
    a. Size: 3 by 12 inches.
    b. Color: As indicated on drawings.

2.2. SETTING MATERIALS

A. Provide setting and grout materials from same manufacturer.

B. Manufacturers:

1. Basis of Design: Mapei, Inc..

C. Latex-Portland Cement Mortar Bond Coat: ANSI A118.4.

1. Applications: Use this type of bond coat where Large and Heavy Tile (LHT) mortar is indicated.
2. Products:
    a. Mapei, Inc., Ultraflex 2.
        1) For general use, wall and floors.

2.3. GROUTS

A. Provide setting and grout materials from same manufacturer.

B. Manufacturers:

1. Basis of Design: Mapei, Inc.

C. Quartz Grout: ANSI A118.3 chemical resistant and water-cleanable color-coated quartz grout.

1. Applications: Floors and walls.
2. Color(s): As selected by Architect from manufacturer's full line.
3. Products:
    a. Basis of Design: Mapei, Inc., Flexcolor CQ.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within the tolerances specified for that type of work and are ready to receive tile.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive tile.

C. Verify that subfloor surfaces are dust free and free of substances that could impair bonding of setting materials to subfloor surfaces.

D. Verify that concrete sub-floor surfaces are ready for tile installation by testing for moisture emission rate and alkalinity; obtain instructions if test results are not within the following limits:

1. Moisture Emission Rate: Not greater than 3 lb per 1000 sq ft per 24 hours, test in accordance with ASTM F1869.
2. Alkalinity (pH): Verify pH range of 5 to 9, test in accordance with ASTM F710.

E. Verify that required floor-mounted utilities are in correct location.

3.2. PREPARATION

A. Protect surrounding work from damage.

B. Vacuum clean surfaces and damp clean.

C. Seal substrate surface cracks with filler. Level existing substrate surfaces to acceptable flatness tolerances.

3.3. INSTALLATION - GENERAL

A. Install tile, thresholds, and stair treads and grout in accordance with applicable requirements of ANSI A108.1a through ANSI A108.19 , manufacturer's instructions, and TCNA (HB) recommendations.

B. Lay tile to pattern indicated. Do not interrupt tile pattern through openings.

C. Cut and fit tile to penetrations through tile, leaving sealant joint space. Form corners and bases neatly. Align floor joints.

D. Place tile joints uniform in width, subject to variance in tolerance allowed in tile size. Make grout joints without voids, cracks, excess mortar or excess grout, or too little grout.

E. Form internal angles square and external angles bullnosed.

F. Install thresholds where indicated.

G. Sound tile after setting. Replace hollow sounding units.

H. Keep control and expansion joints free of mortar, grout, and adhesive.

I. Prior to grouting, allow installation to completely cure; minimum of 48 hours.

J. Grout tile joints unless otherwise indicated. Use standard grout unless otherwise indicated.

K. At changes in plane and tile-to-tile control joints, use tile sealant instead of grout, with either bond breaker tape or backer rod as appropriate to prevent three-sided bonding.

3.4. INSTALLATION - FLOORS - THIN-SET METHODS

A. Over interior concrete substrates, install in accordance with TCNA (HB) Method F113, dry-set or latex-Portland cement bond coat, with standard grout, unless otherwise indicated.

1. Where waterproofing membrane is indicated, install in accordance with TCNA (HB) Method F122, with latex-Portland cement grout.

3.5. INSTALLATION - WALL TILE

A. Over gypsum wallboard on wood or metal studs install in accordance with TCNA (HB) Method W243, thin-set with dry-set or latex-Portland cement bond coat, unless otherwise indicated.

3.6. CLEANING

A. Clean tile and grout surfaces.

3.7. PROTECTION

A. Do not permit traffic over finished floor surface for 4 days after installation.

END OF SECTION

SECTION 09 5100 - ACOUSTICAL CEILINGS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.2. 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. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2013a.

C. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2013.

D. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2014.

E. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2014.

F. UL (FRD) - Fire Resistance Directory; current edition.

1.3. ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, mechanical and electrical items installed in the ceiling, and sprinklers installed in the ceiling.

C. Product Data: Provide data on suspension system components.

D. Samples: Submit two samples 6 by 6 inch in size illustrating material and finish of acoustical units.

E. Manufacturer's Installation Instructions: Indicate special procedures.

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 Acoustical Units: Quantity equal to 2 percent of total installed.

1.5. QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.6. FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Acoustic Tiles/Panels:

1. Armstrong World Industries, Inc: www.armstrong.com.
2. CertainTeed Corporation: www.certainteed.com/#sle.
3. USG: www.usg.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Suspension Systems:

1. Armstrong World Industries, Inc: www.armstrongceilings.com/#sle.
2. Substitutions: See Section 01 6000 - Product Requirements.

2.2. Performance Requirements

A. Seismic Performance: Ceiling systems designed to withstand the effects of earthquake motions determined according to ASCE 7 for Seismic Design Category C and complying with the following:

1. Local authorities having jurisdiction.

2.3. ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Source Limitations: Obtain each type of acoustical ceiling panel and supporting suspension system from single source from single manufacturer

C. Acoustical Tile Type ACT-1 (Typical): Painted mineral fiber, ASTM E1264 Type III, with the following characteristics:

1. Size: 24 by 24 inches.
2. Thickness: 3/4 inches.
3. Composition: Nodular, cast or molded.
4. Light Reflectance: 0.83 percent, determined in accordance with ASTM E1264.
5. NRC Range: 0.60 or better, determined in accordance with ASTM E1264.
6. Ceiling Attenuation Class (CAC): 35, determined in accordance with ASTM E1264.
7. Joint: Reveal sized to fit flange of exposed suspension-system members..
8. Edge: Beveled tegular.
9. Surface Color: White.
10. Surface Pattern: Non-directional fissured.
11. Products:
    a. Basis-of-Design Product: Armstrong World Industries, Inc. Cirrus.
    b. Or comparable from listed manufacturers meeting Basis of Design specifications.
    c. Substitutions: See Section 01 6000 - Product Requirements.

2.4. SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with stabilizer bars, clips, splices, perimeter moldings, and hold down clips as required.

B. Exposed Steel Suspension System: Formed galvanized steel, commercial quality cold rolled; intermediate-duty.

1. Profile: Tee; 15/16 inch wide face.

2. Construction: Double web.
3. Finish: White painted.
4. Products:
    a. Armstrong World Industries, Inc.; Prelude XL.
    b. Or comparable from listed manufacturers.
    c. Substitutions: See Section 01 6000 - Product Requirements.

2.5. ACCESSORIES

A. Support Channels and Hangers: Galvanized steel; size and type to suit application, seismic requirements, and ceiling system flatness requirement specified.

B. Seismic Clips: Manufacturer's standard clips for seismic conditions and to suit application.

C. Perimeter Moldings: Same material and finish as grid.
1. At Exposed Grid: Provide L-shaped molding for mounting at same elevation as face of grid.

D. Metal Edge Trim for "Cloud" Suspension Systems: Steel or extruded aluminum; provide attachment clips, splice plates, and preformed corner pieces for complete trim system.
1. Trim Height: 12 inch in locations as noted.
2. Finish: Baked enamel.
3. Color: White.
4. Products:
    a. Armstrong World Industries, Axiom.
    b. Substitutions: See Section 01 6000 - Product Requirements.

E. Acoustical Sealant For Perimeter Moldings: Non-hardening, non-skinning, for use in conjunction with suspended ceiling system.

F. Touch-up Paint: Type and color to match acoustical and grid units.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.2. INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Locate system on room axis according to reflected plan.

D. Install after major above-ceiling work is complete. Coordinate the location of hangers with other work.

E. Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

F. Seismic Suspension System, Seismic Design Category C: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Maintain a 3/8 inch clearance between grid ends and wall.

G. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

H. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

I. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.

J. Do not eccentrically load system or induce rotation of runners.

K. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.

1. Use longest practical lengths.
2. Overlap and rivet corners.

3.3. INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Lay directional patterned units with pattern parallel to longest room axis.

D. Fit border trim neatly against abutting surfaces.

E. Install units after above-ceiling work is complete.

F. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

G. Cutting Acoustical Units:

1. Make field cut edges of same profile as factory edges.
2. Double cut and field paint exposed reveal edges.

3.4. TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

END OF SECTION

SECTION 09 6500 - RESILIENT FLOORING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Resilient sheet flooring.

B. Resilient tile flooring.

C. Resilient base.

D. Installation accessories.

1.2. RELATED REQUIREMENTS

A. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation and concrete slab moisture and alkalinity testing and remediation procedures.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems: Grounding and bonding of static control flooring to building grounding system.

1.3. REFERENCE STANDARDS

A. ASTM E648 - Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source; 2019a, with Editorial Revision (2020).

B. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

C. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.

D. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

E. ASTM F1913 - Standard Specification for Vinyl Sheet Floor Covering Without Backing; 2019.

F. NFPA 253 - Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source; 2019.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Shop Drawings: Indicate seaming plans and floor patterns.

D. Verification Samples: Submit two samples, 6 by 6 inch in size illustrating color and pattern for each resilient flooring product specified.

E. Concrete Testing Standard: Submit a copy of ASTM F710.

F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.

H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

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. Extra Flooring Material: Quantity equivalent to 5 percent of each type and color in same production run/dyelot of material installed.

3. Extra Wall Base: 10 linear feet of each type and color.

1.5. QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.

D. Protect roll materials from damage by storing on end.

E. Do not double stack pallets.

1.7. FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

PART 2 PRODUCTS

2.1. SHEET FLOORING

A. Vinyl Sheet Flooring - Type SV-1: Homogeneous without backing, with color and pattern throughout full thickness.

1. Manufacturers:

a. Basis of Design: Mannington Commercial,BioSpec MD.

2. Minimum Requirements: Comply with ASTM F1913.

3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.

4. Thickness: 0.080 inch nominal.

5. Sheet Width: 78 inch minimum.

6. Seams: Heat welded.

7. Integral coved base with cap strip.

8. Color: As indicated on drawings.

9. Finish: Quantum Guard HP.

B. Welding Rod: Solid bead in material compatible with flooring, produced by flooring manufacturer for heat welding seams, and in color camouflaged to match field color.

2.2. TILE FLOORING

A. Luxury Vinyl Tile - Type LVT-1: Printed film type, with transparent or translucent wear layer.

1. Manufacturers:

a. Basis of Design: Mannington Commercial; Nature's PathNature's Path.

2. Minimum Requirements: Comply with ASTM F1700, of class corresponding to the type specified.

3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648.

4. Plank Tile Size: 4 by 36 inch.

5. Wear Layer Thickness: 0.020 inch.

6. Total Thickness: 0.098 inch.

7. Color: As indicated on drawings.

8. Finish: Quantum Guard Elite.
9. Edge: Micro-bevel.

B. Luxury Vinyl Tile (LVT-2): Printed film type, with transparent or translucent wear layer.

1. Manufacturers:
   a. Basis of Design: Mannington Commercial, Mannington Select.
2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
4. Plank Tile Size: 5 by 36 inch.
5. Wear Layer Thickness: 0.020 inch.
6. Total Thickness: .98 inch.
7. Color: As indicated on drawings.
8. Finish: Quantum Guard Elite.
9. Edge: Micro-bevel.

C. Luxury Vinyl Tile (LVT-3): Printed film type, with transparent or translucent wear layer.

1. Manufacturers:
   a. Basis of Design: Mannington Commercial, Color Anchor Collection, Stride.
2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
3. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
4. Plank Tile Size: 12 by 24 inch.
5. Wear Layer Thickness: 0.020 inch.
6. Total Thickness: .98 inch.
7. Color: As indicated on drawings.
8. Finish: Quantum Guard Elite.
9. Edge: Micro-bevel.

2.3. RESILIENT BASE

A. Resilient Base - Type RB-1: ASTM F1861, Type TP, rubber, thermoplastic; Style B, Cove.

1. Manufacturers:
   a. Johnsonite, a Tarkett Company; Perceptions, Flex: www.johnsonite.com/#sle.
2. Critical Radiant Flux (CRF): Minimum 0.45 watt per square centimeter, when tested in accordance with ASTM E648 or NFPA 253.
3. Height: 4 1/4 inch.
4. Thickness: 0.125 inch.
5. Finish: Satin.
6. Length: Roll.
7. Color: As indicated on drawings.
8. Accessories: Premolded external corners and internal corners.

2.4. ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.
   1. Epoxy (non-water soluble) in Toilet Rooms.

C. Moldings, Transition and Edge Strips: as shown below.
   1. Metal Edge strip for exposed edges of flash cove base conditions.
      a. Finish: Stainless Steel
      b. Outside Corners: Preformed 6 inch return.
         1) Manufacturers:
            (a) Basis of Design: Flash Cove; www.flashcove.com.

D. Rubber moldings, transition and edge strips:
   1. Tarkett; www.tarkett.com
      a. Profile: SLT-XX-B
         1) Luxury Vinyl Tile to Sheet Vinyl
         2) Color: Silk 129
      b. Profile: SLT-XX-A
         1) Carpet to Luxury Vinyl Tile
         2) Color: Silk 129
      c. Profile: SLT-XX-H
         1) Carpet to Sheet Vinyl
         2) Color: Silk 129
      d. Profile: SLT-XX-L
         1) Carpet to Concrete
         2) Color: Silk 129
   2. Schluter Systems; www.schluter.com
      a. Profile: Schiene
         1) Tile to Carpet

E. Filler for Coved Base: Plastic.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

B. Verify that wall surfaces are smooth and flat within the tolerances specified for that type of work, are dust-free, and are ready to receive resilient base.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
   1. Test as Follows:
      a. Alkalinity (pH): ASTM F710.
   2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.2. PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

C. Prohibit traffic until filler is fully cured.

D. Clean substrate.

3.3. Installation - General

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

C. Adhesive-Applied Installation:

1. Spread only enough adhesive to permit installation of materials before initial set.

2. Place copper grounding strip in conductive adhesive and apply additional adhesive to top side of strip before installing static control flooring. Allow strip to extend beyond flooring in accordance with static control flooring manufacturer's instructions. Refer to Section 26 0526 for grounding and bonding to building grounding system.

3. Fit joints and butt seams tightly.

4. Set flooring in place, press with heavy roller to attain full adhesion.

D. Where type of floor finish, pattern, or color are different on opposite sides of door, terminate flooring under centerline of door.

E. Install edge strips at unprotected or exposed edges, where flooring terminates, and where indicated.

1. Metal Strips: Attach to substrate before installation of flooring using stainless steel screws.

2. Resilient Strips: Attach to substrate using adhesive.

F. Scribe flooring to walls, columns, cabinets, floor outlets, and other appurtenances to produce tight joints.

G. At movable partitions, install flooring under partitions without interrupting floor pattern.

3.4. Installation - Sheet Flooring

A. Lay flooring with joints and seams parallel to longer room dimensions, to produce minimum number of seams. Lay out seams to avoid widths less than 1/3 of roll width; match patterns at seams.

B. Cut sheet at seams in accordance with manufacturer's instructions.

C. Seal seams by heat welding where indicated on approved shop drawings, per manufacturer's written held welding instructions.

D. Coved Base: Install as detailed on drawings, using coved base filler as backing at floor to wall junction. Extend sheet flooring vertically to height indicated, and cover top edge with metal cap strip.

3.5. Installation - Tile Flooring

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

3.6. Installation - Resilient Base

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

3.7. CLEANING

A. Remove excess adhesive from floor, base, and wall surfaces without damage.

B. Clean in accordance with manufacturer's written instructions.

3.8. PROTECTION

A. Prohibit traffic on resilient flooring for 48 hours after installation.

END OF SECTION

SECTION 09 6813 - TILE CARPETING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Carpet tile, fully adhered.

B. Removal of existing carpet tile.

1.2. RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied flooring.

B. Section 09 0561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

C. Section 09 0561 - Common Work Results for Flooring Preparation: Concrete slab moisture and alkalinity testing and remediation procedures.

1.3. REFERENCE STANDARDS

A. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2011.

B. CRI 104 - Standard for Installation of Commercial Carpet; 2015.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

E. Manufacturer's Installation Instructions: Indicate special procedures.

F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.

G. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning.

H. 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 Carpet Tiles: Quantity equal to 5 percent of total installed of each color and pattern installed.

1.5. QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience.

1.6. FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Tile Carpeting:

1. Basis of Design: Aladdin Commercial; www.aladdincommercial.com.

2.2. MATERIALS

A. Tile Carpeting, Type CPT-1: Tufted, manufactured in one color dye lot.

1. Product: Onward Bound manufactured by Aladdin Commercial.

2. Tile Size: 24 by 24 inch, nominal.
3. Color: As indicated on drawings.
4. Gauge: 1/12 inch.
5. Stitches: 12.2 per inch.
6. Fiber System: Colorstrand SD Nylon.
7. Dye Method: 100% Solution Dyed.
8. Primary Backing Material: Non-Woven Synthetic Fiber.
9. Secondary Backing Material: Ultraset.
10. Stain & Soil Protection: Mohawk Protection Plus Soil & Stain.
11. Installation Method: Monolithic.

2.3. ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: As specified in Section 09 6500.

C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that subfloor surfaces are smooth and flat within tolerances specified for that type of work and are ready to receive carpet tile.

B. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

C. Cementitious Subfloor Surfaces: Verify that substrates are ready for flooring installation by testing for moisture and alkalinity (pH).

1. Test as Follows:

a. Alkalinity (pH): ASTM F710.

2. Obtain instructions if test results are not within limits recommended by flooring material manufacturer and adhesive materials manufacturer.

D. Verify that required floor-mounted utilities are in correct location.

3.2. PREPARATION

A. Remove existing carpet tile.

B. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

C. Remove subfloor ridges and bumps. Fill minor or local low spots, cracks, joints, holes, and other defects with subfloor filler.

D. Apply, trowel, and float filler to achieve smooth, flat, hard surface. Prohibit traffic until filler is cured.

E. Vacuum clean substrate.

3.3. INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Locate change of color or pattern between rooms under door centerline.

G. Trim carpet tile neatly at walls and around interruptions.

H. Complete installation of edge strips, concealing exposed edges.

3.4. CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 09 9113 - EXTERIOR PAINTING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish exterior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated, including the following:

1. Exposed surfaces of steel lintels and ledge angles.

2. Mechanical and Electrical:

a. On the roof and outdoors, paint equipment that is exposed to weather or to view, including factory-finished materials.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.

2. Items indicated to receive other finishes.

3. Items indicated to remain unfinished.

4. Fire rating labels, equipment serial number and capacity labels, and operating parts of equipment.

5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, zinc, and lead.

6. Floors, unless specifically indicated.

7. Glass.

8. Concealed pipes, ducts, and conduits.

1.2. RELATED REQUIREMENTS

A. Section 05 5100 - Metal Stairs: Shop-primed items.

B. Section 09 9123 - Interior Painting.

1.3. DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4. REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.

C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2017).

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

E. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1; 2016.

F. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual, Volume 2; 2015.

G. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

H. SSPC-SP 2 - Hand Tool Cleaning; 2018.

I. SSPC-SP 3 - Power Tool Cleaning; 2018.

J. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

K. SSPC-SP 13 - Surface Preparation of Concrete; 1997 (Reaffirmed 2003).

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.

2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.

3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, have been approved.

D. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

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 Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.

3. Label each container with color in addition to the manufacturer's label.

1.6. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.8. FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply exterior paint and finishes during rain or snow, or when relative humidity is outside the humidity ranges required by the paint product manufacturer.

D. Minimum Application Temperatures for Latex Paints: 50 degrees F for exterior; unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Provide paints and finishes used in any individual system from the same manufacturer; no exceptions.

B. Paints:

1. Basis of Design Manufacturer, PPG Paints: www.ppgpaints.com/#sle. The Owner has identified the Basis of Design Manufacturer as a requirement for this project.

C. Primer Sealers: Same manufacturer as top coats.

2.2. PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless required to be a field-catalyzed paint.

1. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

2. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

3. Supply each paint material in quantity required to complete entire project's work from a single production run.

4. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:

a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

b. Architectural coatings VOC limits of the State in which the Project is located.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated on drawings.

1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.

2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2.3. PAINT SYSTEMS - EXTERIOR

A. Paint E-OP - Exterior Surfaces to be Painted, Unless Otherwise Indicated: Including concrete and primed metal.

1. Two top coats and one coat primer.

2. Top Coat(s): Exterior Latex; MPI #10, 11, 15, 119, or 214.

a. Products:

1) PPG Paints Speedhide Exterior Latex, 6-610XI Series, Flat. (MPI #10)

2) PPG Paints Speedhide Exterior Latex, 6-2045XI Series, Satin. (MPI #15)

3) PPG Paints Speedhide Exterior Latex, 6-900XI Series, Semi-Gloss. (MPI #11)

2.4. PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Alkali Resistant Water Based Primer; MPI #3.

a. Products:

1) PPG Paints Series Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #3)

2) PPG Paints Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI. (MPI #3)

2. Anti-Corrosive Alkyd Primer for Metal; MPI #79.

a. Products:

1) PPG Paints 7-Line Interior/Exterior Rust Inhibitive Steel Primer, 7-852 Series. (MPI #79)

2) PPG Paints Multiprime Multi-Purpose Primer, 4160 Series. (MPI #79)

3. Water Based Primer for Galvanized Metal; MPI #134.

a. Products:

1) PPG Paints Pitt-Tech Plus DTM Industrial Primer, 4020 PF Series. (MPI #134)

4. Rust-Inhibitive Water Based Primer; MPI #107.

a. Products:

1) PPG Paints Pitt-Tech Plus DTM Industrial Primer, 4020 PF Series.

5. Interior/Exterior Quick Dry Primer for Aluminum; MPI #95.

a. Products:

1) PPG Paints Multiprime Multi-Purpose Primer, 4160 Series. (MPI #95)

6. Bonding Primer, Water Based; MPI #17.

a. Products:

1) PPG Paints Seal Grip Interior/Exterior Acrylic Universal Primer/Sealer, 17-921XI Series. (MPI #17)

2.5. ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1. EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Exterior Plaster and Stucco: 12 percent.
2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.

3.2. PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces for finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi at 6 to 12 inches. Allow to dry.
3. Clean concrete according to ASTM D4258. Allow to dry.

H. Exterior Plaster: Fill hairline cracks, small holes, and imperfections with exterior patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.

I. Aluminum: Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

J. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.
2. Prepare surface according to SSPC-SP 2.

K. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

3.3. APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.

D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

E. Apply each coat to uniform appearance.

F. Dark Colors and Deep Clear Colors: Regardless of number of coats specified, apply additional coats until complete hide is achieved.

G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4. CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5. PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 09 9123 - INTERIOR PAINTING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Surface preparation.

B. Field application of paints.

C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.

1. Mechanical and Electrical:

a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.

b. In finished areas, paint shop-primed items.

D. Do Not Paint or Finish the Following Items:

1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.

2. Items indicated to receive other finishes.

3. Items indicated to remain unfinished.

4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.

5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.

6. Floors, unless specifically indicated.

7. Ceramic and other tiles.

8. Glass.

9. Concealed pipes, ducts, and conduits.

1.2. RELATED REQUIREMENTS

A. Section 05 5100 - Metal Stairs: Shop-primed items.

B. Section 09 9113 - Exterior Painting.

1.3. DEFINITIONS

A. Comply with ASTM D16 for interpretation of terms used in this section.

1.4. REFERENCE STANDARDS

A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.

B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.

C. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.

D. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.

E. SSPC V1 (PM1) - Good Painting Practice: Painting Manual, Volume 1; 2016.

F. SSPC V2 (PM2) - Systems and Specifications: Steel Structures Painting Manual, Volume 2; 2015.

G. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).

H. SSPC-SP 2 - Hand Tool Cleaning; 2018.

I. SSPC-SP 3 - Power Tool Cleaning; 2018.

J. SSPC-SP 6 - Commercial Blast Cleaning; 2007.

K. SSPC-SP 13 - Surface Preparation of Concrete; 1997 (Reaffirmed 2003).

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:

1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").

2. MPI product number (e.g. MPI #47).

3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.

C. Samples: Submit three paper "draw down" samples, 8-1/2 by 11 inches in size, illustrating range of colors available for each finishing product specified.

1. Where sheen is specified, submit samples in only that sheen.

2. Allow 15 days for approval process, after receipt of complete samples by Architect.

3. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as wood doors, have been approved.

D. Manufacturer's Instructions: Indicate special surface preparation procedures.

E. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Paint and Finish Materials: 1 gallon of each color; from the same product run, store where directed.

3. Label each container with color in addition to the manufacturer's label.

1.6. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified, with minimum three years documented experience.

B. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 5 years experience and approved by manufacturer.

C. Preparation and Workmanship: Comply with requirements in "MPI Architectural Painting Specification Manual" for products and paint systems indicated.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.

B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.

C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

1.8. FIELD CONDITIONS

A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.

B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.

D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.

E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Provide paints and finishes from the same manufacturer to the greatest extent possible.

B. Paints:

1. Basis of Design Manufacturer: PPG Paints: www.ppgpaints.com/#sle. The Owner has identified the Basis of Design Manufacturer as a project requirement.

C. Primer Sealers: Same manufacturer as top coats.

2.2. PAINTS AND FINISHES - GENERAL

A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.

1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at www.paintinfo.com, for specified MPI categories, except as otherwise indicated.

2. Provide paints and finishes of a soft paste consistency, capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.

3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.

4. Supply each paint material in quantity required to complete entire project's work from a single production run.

5. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

B. Volatile Organic Compound (VOC) Content:

1. Provide paints and finishes that comply with the most stringent requirements specified in the following:

a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.

2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.

C. Flammability: Comply with applicable code for surface burning characteristics.

D. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.

E. Colors: As indicated on drawings.

1. Extend colors to surface edges; colors may change at any edge as directed by Architect.

2. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.

3. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color coding scheme indicated.

2.3. PAINT SYSTEMS - INTERIOR

A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board.

1. Two top coats and one coat primer.
2. Top Coat(s): Interior Latex; MPI #44.
    a. Products:
        1) PPG Paints Speedhide Zero Interior Latex, 6-4110XI Series, Flat. (MPI #53).
        2) PPG Paints Speedhide Zero Interior Latex, 6-4310XI Series, Eggshell. (MPI #44).

B. Paint I-OP-MD-DT - Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and concrete:

1. Medium duty applications include exposed factory primed metal (public spaces), doors, door frames, and concrete columns.
2. Two top coats and one coat primer.
3. Top Coat(s): Interior Light Industrial Coating, Water Based; MPI #151, 153 or 154.
    a. Products:
        1) PPG Paints Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-90 Series, Flat. (MPI #151)
        2) PPG Paints Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-510 Series, Semi-Gloss. (MPI #153)

2.4. PRIMERS

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

1. Alkali Resistant Water Based Primer; MPI #3.
    a. Products:
        1) PPG Paints Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI. (MPI #3)
2. Interior Institutional Low Odor/VOC Primer Sealer; MPI #149.
    a. Products:
        1) PPG Paints Speedhide Zero Interior Latex Sealer, 6-4900XI. (MPI #149)
        2) Substitutions: Section 01 6000 - Product Requirements.
3. Interior Rust-Inhibitive Water Based Primer; MPI #107.
    a. Products:
        1) PPG Paints Pitt-Tech Plus Interior/Exterior DTM Waterborne Acrylic Primer/Finish, 4020 PF Series.

2.5. ACCESSORY MATERIALS

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

PART 3 EXECUTION

3.1. EXAMINATION

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. Test shop-applied primer for compatibility with subsequent cover materials.

E. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Gypsum Wallboard: 12 percent.
2. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
3. Concrete Floors and Traffic Surfaces: 8 percent.

3.2. PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Remove or repair existing paints or finishes that exhibit surface defects.

D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.

E. Seal surfaces that might cause bleed through or staining of topcoat.

F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.

G. Concrete:

1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi at 6 to 12 inches. Allow to dry.

H. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.

I. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.

J. Galvanized Surfaces:

1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.

K. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Remove rust, loose mill scale, and other foreign substances using using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

L. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

3.3. APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions and recommendations in "MPI Architectural Painting Specification Manual".

C. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.

D. Apply each coat to uniform appearance in thicknesses specified by manufacturer.

E. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.

F. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

3.4. CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

3.5. PROTECTION

A. Protect finishes until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

3.6. SCHEDULE - PAINT SYSTEMS

A. Concrete : Finish surfaces exposed to view.

1. Concrete Columns:

a. Prime Coat(s): Alkali Resistant Water Based Primer; MPI #3.

1) PPG Paints Perma-Crete Interior/Exterior Alkali Resistant Primer, 4-603XI. (MPI #3)

b. Intermediate Coat: Latex, Interior matching topcoat.

c. Top Coat: Interior Light Industrial Coating, Water Based; MPI #151, 153 or 154.

1) PPG Paints Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-90 Series, Flat. (MPI #151)

d. Locations: Concrete Columns

B. Gypsum Board: Finish surfaces exposed to view.

1. Interior Walls:

a. Prime Coat(s): Primer Sealer, Latex.

1) PPG Paints Speedhide Zero Interior Latex Sealer, 6-4900XI. (MPI #149)

b. Intermediate Coat: Latex, Interior matching topcoat.

c. Top Coat: Latex, Interior Eggshell, (Gloss Level 3)

1) PPG Paints Speedhide Zero Interior Latex, 6-4310XI Series, Eggshell. (MPI #44)

d. Locations: General use, U.N.O.

2. Ceilings and Soffits:

a. Prime Coat(s): Primer Sealer, Latex.

1) PPG Paints Speedhide Zero Interior Latex Sealer, 6-4900XI. (MPI #149)

b. Intermediate Coat: Latex, Interior matching topcoat.

c. Top Coat: Latex, Interior Flat

1) PPG Paints Speedhide Zero Interior Latex, 6-4110XI Series, Flat. (MPI #53)

d. Locations: Ceilings and Soffits

C. Steel Doors and Frames: Finish surfaces exposed to view.

1. Prime Coat:
    a. PPG Paints Pitt-Tech Plus Interior/Exterior DTM Waterborne Acrylic Primer/Finish, 4020 PF Series.
2. Intermediate Coat: Latex interior, institutional low-odor/VOC, matching topcoat.
3. Top Coat:
    a. PPG Paints Pitt-Glaze WB1 Pre-Catalyzed Water-Borne Acrylic Epoxy, 16-510 Series, Semi-Gloss. (MPI #153)

END OF SECTION

SECTION 10 2113.19 - PLASTIC TOILET COMPARTMENTS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Solid plastic toilet compartments.

1.2. RELATED REQUIREMENTS

A. Section 10 2800 - Toilet, Bath, and Laundry Accessories.

1.3. REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

B. NFPA 286 - Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth; 2015.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Shop Drawings: Indicate partition plan, elevation views, dimensions, details of wall supports, door swings.

D. Samples: Submit two samples of partition panels, approximately 6 by 6 inch in size illustrating panel finish, color, and sheen.

E. Manufacturer's Installation Instructions: Indicate special procedures.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Solid Plastic Toilet Compartments:

1. Basis of Design - Scranton Products; Hiny Hiders Partitions: www.scrantonproducts.com/#sle.

2. Substitutions: Section 01 6000 - Product Requirements.

2.2. PLASTIC TOILET COMPARTMENTS

A. Solid Plastic Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid molded high density polyethylene (HDPE), tested in accordance with NFPA 286; floor-mounted unbraced.

1. Color: As shown on the Drawings.

2. Doors:

a. Thickness: 1 inch.

b. Width: 24 inch.

c. Width for Handicapped Use: 36 inch, out-swinging.

d. Height: 55 inch.

3. Panels:

a. Thickness: 1 inch.

b. Height: 55 inch.

4. Pilasters:

a. Thickness: 1 inch.

b. Width: As required to fit space; minimum 3 inch.

5. Screens: Without doors; to match compartments; mounted to wall with two panel brackets.

2.3. ACCESSORIES

A. Pilaster Shoes: Stainless steel, satin finish, 3 inches high; concealing floor fastenings.

B. Head Rails: Extruded aluminum,.

1. Size: Manufacturer's standard size.

C. Wall and Pilaster Brackets: Stainless steel; manufacturer's standard type for conditions indicated on drawings.

D. Attachments, Screws, and Bolts: Stainless steel, tamper proof type.

E. Hinges: Stainless steel, manufacturer's standard finish.

1. Continuous-type hinge, self closing.

F. Door Hardware: Stainless steel, manufacturer's standard finish.

1. Door Latch: Slide type with exterior emergency access feature.

2. Provide door pull for outswinging doors.

G. Coat Hook: One per compartment, mounted on door.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.2. INSTALLATION

A. Floor mounted, Overhead braced.

B. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

C. Maintain 3/8 inch to 1/2 inch space between wall and panels and between wall and end pilasters.

D. Attach panel brackets securely to walls using anchor devices.

E. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.3. TOLERANCES

A. Maximum Variation From True Position: 1/4 inch.

B. Maximum Variation From Plumb: 1/8 inch.

3.4. ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch.

B. Adjust hinges to position doors in partial opening position when unlatched. Return out-swinging doors to closed position.

C. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 10 2600 - WALL AND DOOR PROTECTION

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Protective corridor handrails.

B. Corner guards.

C. Impact-resistant wall covering.

1.2. 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. Section 09 2116 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

1.3. REFERENCE STANDARDS

A. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).

B. ASTM D543 - Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents; 2020.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

D. ASTM F476 - Standard Test Methods for Security of Swinging Door Assemblies; 2014.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Indicate 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..

C. Shop Drawings: Include plans, elevation, sections, and attachment details. For each impact-resistant wall protection unit showing locations and extent.

D. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.

1. Submit two sections of corner guards and protective corridor handrails, 24 inches long.

2. Submit two samples of protective wall covering and door surface protection, 6 by 6 inches square.

E. Warranty Documentation: Submit manufacturer warranty and ensure that 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.

2. Extra Stock Materials: One package(s) of minimum 96 inches long unit of each kind of covers for corner guards and protective corridor handrails.

3. Extra Stock Materials: 2 percent, or no fewer than 2 full sheets of each type of protective wall covering.

1.5. DELIVERY, STORAGE, AND HANDLING

A. Deliver wall and door protection items in original, undamaged protective packaging. Label items to designate installation locations.

B. Protect work from moisture damage.

C. Protect work from UV light damage.

D. Do not deliver products to project site until areas for storage and installation are fully enclosed, and interior temperature and humidity are in compliance with manufacturer's recommendations for each type of item.

E. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.6. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Correct defective Work within a one year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Protective Corridor Handrails and Corner Guards:

1. Inpro; : www.inprocorp.com/#sle.

B. Protective Wall Covering:

1. Inpro; : www.inprocorp.com/#sle.

2.2. PERFORMANCE CRITERIA

A. Impact Strength: Unless otherwise noted, provide protection products and assemblies that have been successfully tested for compliance with applicable provisions of ASTM D256 and/or ASTM F476.

B. Chemical and Stain Resistance: Unless otherwise noted, provide protection products and assemblies with chemical and stain resistance complying with applicable provisions of ASTM D543.

2.3. PRODUCT TYPES

A. Protective Corridor Handrails: Factory- or shop-fabricated, with preformed end caps and internal and external corners:

1. Material: Polyethylene terephthalate (PET or PETG); PVC-free, color as indicated on drawings.
2. Mounting: Surface.

B. Corner Guards - Surface Mounted:

1. Material: Polyethylene terephthalate (PET or PETG); PVC-free with full height extruded aluminum retainer.
2. Performance: Resist lateral impact force of 100 lbs at any point without damage or permanent set.
3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
4. Width of Wings: CG-1, 3 inches. CG-2 & CG-3, 2 inches.
5. Corner: Square.
6. Color: As indicated on drawings.
7. Length: One piece.
8. Preformed end caps.

C. Protective Wall Covering:

1. Material: Polyethylene terephthalate (PET or PETG); PVC and PBTs-free.
2. Thickness: 0.040 inch.
3. Surface Burning Characteristics: Provide assemblies with flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
4. Color: As indicated on drawings.
5. Texture: Suede.
6. Mounting: Adhesive.

2.4. FABRICATION

A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that field measurements are as indicated on drawings.

C. Verify that substrate surfaces for adhered items are clean and smooth.

D. Start of installation constitutes acceptance of project conditions.

3.2. INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position top of corridor hand rail 36 inches from finished floor.

C. Position corner guard 4 inches above finished floor to ceiling.

D. Terminate rails 1 inch short of door openings and intersecting walls.

E. Position protective wall covering no less than 1 inch above finished floor to allow for floor level variation.

1. Wainscot Installation: Establish a level line at the specified height for entire length of run. Install by aligning top of edge of covering with this line.

2. Apply adhesive with 1/8 inch V-notch trowel to an area of wall surface that can be completed within cure time of the adhesive.

3. Install trim pieces as required for a complete installation. Allow tolerance for thermal movement.

4. At joints indicated to be caulked, allow for a minimum 1/16 inch wide gap between edges of sheets. Gaps are required to be of consistent width throughout the project.

3.3. TOLERANCES

A. Maximum Variation From Level or Plane For Visible Length: 1/4 inch.

3.4. CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 10 2800 - TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Commercial toilet accessories.

B. Under-lavatory pipe supply covers.

1.2. RELATED REQUIREMENTS

A. Section 10 2113.19 - Plastic Toilet Compartments.

1.3. REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a (Reapproved 2019).

C. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

D. ASTM C1036 - Standard Specification for Flat Glass; 2011.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2012.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

G. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2004, with Editorial Revision (2016).

H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

I. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement and reinforcement of toilet partitions to receive anchor attachments.

B. Coordinate the work with Toilet Accessories to be provided and installed by the Owner. These include but may not be limited to:

1. Diaper Changing Stations.
2. Toilet Tissue Dispensers.
3. Paper Towel Dispensers.
4. Liquid Soap Dispensers.
5. Sanitary Napkin Disposals.
6. Mop and Broom Holders.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

C. Product Schedule: Indicating types, quantities, sizes, and installation locations by room of each accessory required.

1. Identify locations using room designations indicated.
2. Identify products using designations indicated.

D. Closeout Submittals:

1. Maintenance Data: For toilet accessories to include in maintenance manuals.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:

1. AJW Architectural Products: www.ajw.com/#sle.
2. American Specialties, Inc: www.americanspecialties.com/#sle.
3. Bobrick Washroom Equipment, Inc.: www.bobrick.com/#sle.
4. Bradley Corporation: www.bradleycorp.com/#sle.
5. Georgia-Pacific Professional: www.blue-connect.com/#sle.
6. Substitutions: Section 01 6000 - Product Requirements.

2.2. MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Keys: Provide six keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

2.3. FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

2.4. Commercial Toilet Accessories

A. [T7] Mirrors: Stainless steel framed, 1/4 inch thick annealed float glass; ASTM C1036.

1. Size: 24" x 36".
2. Frame: 0.05 inch angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.
3. Products:
   a. Basis of Design: Bobrick; B-165 2436..
   b. Substitutions: Section 01 6000 - Product Requirements.

B. Grab Bars: Stainless steel, smooth surface.

1. Standard Duty Grab Bars:
   a. Push/Pull Point Load: 250 pound-force, minimum.
   b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
   c. Finish: Smooth, No. 4 finish (satin) on ends and slip-resistant texture in grip area..
   d. Length and Configuration: As indicated on drawings.
   e. Basis of Design Products::
      1) [T1] Bobrick; B-5806.99 x 42
      2) [T2] Bobrick; B-5806.99 x 36
      3) [T3] Bobrick; B-5806.99 x 18
      4) Substitutions: Section 01 6000 - Product Requirements.

2.5. Commercial Shower and Bath Accessories

A. [T12] Recessed Specimen Pass-Thru Cabinet: Stainless steel, self-closing doors, interlocking mechanism for sight barrier, removeable stainless steel tray, satin finish.

1. Products:

a. Basis of Design: Brobrick; B-505.

b. Substitutions: Section 01 6000 - Product Requirements.

B. [T13] Robe Hook: Heavy-duty stainless steel, single-prong, circular-shaped bracket and backplate for concealed attachment, satin finish.

1. Capacity: 300 lbs

2. Products:

a. Basis of Design: Bobrick; B-2116..

b. Substitutions: Section 01 6000 - Product Requirements.

2.6. UNDER-LAVATORY PIPE AND SUPPLY COVERS

A. [T9] Under-Lavatory Pipe and Supply Covers:

1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.

2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.

3. Construction: 1/8 inch flexible PVC.

a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.

b. Comply with ICC A117.1.

c. Microbial and Fungal Resistance: Comply with ASTM G21.

4. Color: White.

5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.

6. Products:

a. Basis of Design: Truebro; Lav Guard 2..

b. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

3.2. PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.3. INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Wall backing: Install concealed wall backing as required to support each item.

D. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.4. PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 10 4400 - FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.2. REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; current edition.

B. NFPA 10 - Standard for Portable Fire Extinguishers; 2017, with Errata (2018).

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.3. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide extinguisher ratings and classifications, color and finish, and installation instructions.

C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, and accessories required for complete installation.

D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.

E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

1.4. FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.1. FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

1. Provide extinguishers labeled by UL (DIR) or FM (AG) for purpose specified and as indicated.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.

1. Class: A:B:C type.

2. Size: 10 pound.

3. Temperature range: Minus 40 degrees F to 120 degrees F.

2.2. FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.

B. Cabinet Configuration: Semi-recessed type.

1. Size to accommodate accessories.

2. Cabinet to project 4-inches maximum from face of wall.

3. Projected trim with rolled edge.

C. Door: 0.036 inch metal thickness, reinforced for flatness and rigidity with roller type catch. Hinge doors for 180 degree opening with two butt hinges.

D. Door Glazing: Acrylic plastic, clear, 1/8 inch thick, flat shape and set in resilient channel glazing gasket.

1. Vertical black "Fire Extinguisher" lettering.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Fabrication: Weld, fill, and grind components smooth.

G. Finish of Cabinet Exterior Trim and Door: Baked enamel, white color.

H. Finish of Cabinet Interior: White colored enamel.

2.3. ACCESSORIES

A. Extinguisher Brackets: Formed steel, galvanized and enamel finished.

B. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify existing conditions before starting work.

B. Verify rough openings for cabinet are correctly sized and located.

3.2. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install cabinets plumb and level in wall openings, 42 inches from finished floor to top of cabinet.

C. Secure rigidly in place.

D. Place extinguishers in cabinets.

END OF SECTION

SECTION 10 7316.13 - METAL CANOPIES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Shop fabricated aluminum overhead hanger rod style canopy.

1.2. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit product data sheets, including material descriptions and finishes, and preparation instructions and recommendations.

C. Shop Drawings: Prior to commencement of fabrication, submit detailed shop drawings, showing profiles, sections of components, finishes, and fastening details, anchorage and accessory items.

D. Delegated Design submittal: For prefabricated aluminum canopies and associated anchorage.

E. Design Data: Submit comprehensive structural analysis of design for the specified loads. Stamp and sign calculations by professional engineer.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.3. QUALITY ASSURANCE

A. Delegated Design: Engage a qualified professional engineer to design aluminum canopy.

1. Canopy design shall conform with applicable building codes.

B. Designer Qualifications: Perform design under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

1. Comply with applicable code for submission of design calculations as required for acquiring permits.

1.4. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Metal Canopies: Correct defective work within a two year period after Date of Substantial Completion.

PART 2 PRODUCTS

2.1. METAL CANOPIES

A. Shop Fabricated Metal Canopy Type: Aluminum overhead hanger rod style canopy.

B. Basis-of-Design Product: Super Lumideck Aluminum Canopy by Mapes Architectural Canopies.

1. Size and configuration of canopy as shown on the Drawings.

2. Canopy shall have rear draingage with downspout.

C. Substitutions: See Section 01 6000 - Product Requirements.

D. Materials.

1. Decking shall consist of an interlocking roll-form 2 ½ W style pan. Minimum .032” aluminum.

2. Intermediate framing members shall be extruded aluminum.

3. Hanger rods and attachment hardware shall be powder coated.

4. Fascia shall be 8” extruded J style. See drawings for additional information.

5. Downspout shall be nominally 2 1/2" x 3" roll formed aluminum and include drain stub.

E. Finishes

1. Canopy: Prefinished dark bronze anodized aluminum finish.

2. Downspout: Color to match red brick Type B.

2.2. FABRICATION, GENERAL

A. Shop Assembly: Preassemble items in the shop to greatest extent possible. Use connections that maintain structural value of joined pieces.

B. Cut, drill, and punch metals cleanly and accurately. Remove burrs and ease edges. Remove sharp or rough areas on exposed surfaces.

C. Weld corners and seams continuously to comply with 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.

D. Form exposed connections with hairline joints, flush and smooth, using concealed fasteners or welds where possible. Locate joints where least conspicuous.

E. Fabricate seams and other connections that are exposed to weather in a manner to exclude water. Provide weep holes where water may accumulate

PART 3 EXECUTION

3.1. EXAMINATION

A. Examine substrates and site area for conditions that might prevent satisfactory installation.

B. Do not proceed with installation until all conditions are satisfactory.

3.2. INSTALLATION, GENERAL

A. Field measure project conditions prior to preparation of shop drawing submittal and fabrication.

B. Cutting, Fitting, and Placement: Perform cutting, drilling, and fitting required for installing aluminum canopy. Set canopy 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. Fit exposed connections accurately together to form hairline joints.

D. Fastening to In-Place Construction: Provide anchorage devices and fasteners where metal fabrications are required to be fastened to in-place construction.

E. Field cut Drainage holes.

F. Downspout: as shown on drawings.

3.3. TOUCH UP PAINING

A. Touchup Painting: Immediately after erection, clean field welds, bolted connections, and abraded areas. Paint uncoated and abraded areas with the same material as used for shop painting to comply with SSPC-PA 1 for touching up shop-painted surfaces.

3.4. TOLERANCES

A. Maximum Variation from Level: Plus/Minus 1/8 inch.

3.5. CLEANING

A. Clean surfaces of dust and debris; follow manufacturer's cleaning instructions for the finish used.

3.6. PROTECTION

A. Protect canopy after installation to prevent damage due to other work until Date of Substantial Completion.

SECTION 12 3600 - COUNTERTOPS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Countertops for architectural cabinet work.

B. Wall-hung counters and vanity tops.

C. Window sills.

1.2. RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework.

B. Section 22 4000 - Plumbing Fixtures: Sinks.

1.3. REFERENCE STANDARDS

A. ANSI A208.1 - American National Standard for Particleboard; 2009.

B. ANSI A208.2 - American National Standard for Medium Density Fiberboard for Interior Use; 2009.

C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014.

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.0; 2016.

E. ISFA 2-01 - Classification and Standards for Solid Surfacing Material; 2013.

F. SEFA 3 - Work Surfaces; 2010.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's data sheets on each product to be used, including:

1. Preparation instructions and recommendations.

2. Storage and handling requirements and recommendations.

3. Specimen warranty.

C. Shop Drawings: Complete details of materials and installation; combine with shop drawings of cabinets and casework specified in other sections.

D. Verification Samples: For each finish product specified, minimum size 8 inches square, representing actual product, color, and patterns.

E. Test Reports: Chemical resistance testing, showing compliance with specified requirements.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

G. Maintenance Data: Manufacturer's instructions and recommendations for maintenance and repair of countertop surfaces.

1.5. QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.

B. Quality Certification:

1. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.

2. Provide designated labels on shop drawings as required by certification program.

3. Provide designated labels on installed products as required by certification program.

4. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7. FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimum results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 PRODUCTS

2.1. COUNTERTOPS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS), unless noted otherwise.

B. Solid Surfacing Countertops: Solid surfacing sheet or plastic resin casting over continuous substrate.

1. Flat Sheet Thickness: 1/2 inch, minimum.

2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic or polyester resin, meineral filler, and pigments; homogenous, non-porous an dcapable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.

a. Manufacturers:

1) Dupont: www.corian.com/#sle.

2) Substitutions: See section 01 6000 - Product Requirements.

b. Other Components Thickness: 1/2 inch, minimum.

c. Back and End Splashes: Same sheet material, Square top; minimum 4 inches high.

1) Adhesive and Grout: Materials and installation as specified in Section 09 3000.

2) Back and End Splashes: Same material, coved joint, eased top edge.

d. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.

e. Color and Pattern: As indicated on drawings.

C. Solid Surfacing Window Sills: Solid surfacing sheet or plastic resin casting self-supporting over structural members.

1. Flat Sheet Thickness: 1/2 inch, minimum.

2. Solid Surfacing Sheet and Plastic Resin Castings: Complying with ISFA 2-01 and NEMA LD 3; acrylic resin, unfilled, and pigments; homogenous, non-porous and capable of being worked and repaired using standard woodworking tools; no surface coating; color and pattern consistent throughout thickness.

a. Manufacturers:

1) Dupont; Corian: www.corian.com.

b. Finish on Exposed Surfaces: Matte, gloss rating of 5 to 20.

c. Color and Pattern: As indicated on drawings.

3. Other Components Thickness: 1/2 inch, minimum.

4. Exposed Edge Treatment: Minimum 1/2 inch thick; 1/8 inch radiused edge.

5. Fabricate in accordance with AWI/AWMAC/WI (AWS), Section 11 - Countertops, Premium Grade.

2.2. ACCESSORY MATERIALS

A. Wood-Based Components:

1. Wood fabricated from old growth timber is not permitted.

B. Particleboard for Supporting Substrate: ANSI A208.1 Grade 2-M-2, 45 pcf minimum density; minimum 1/2 inch thick; join lengths using metal splines.

C. Medium Density Fiberboard for Supporting Substrate: ANSI A208.2.

D. Adhesives: Chemical resistant waterproof adhesive as recommended by manufacturer of materials being joined.

E. Joint Sealant: Mildew-resistant silicone sealant, white.

F. Support Brackets for countertops without base cabinets: Heavy-duty steel

1. Provide where shown on plans and elevations and at 48" o.c. maximum.

a. Color: To be selected by Architect from Manufacturer's entire selection.

2. Manufacturers:

a. Knape and Vogt; 208 TI 550 Ultimate L-Bracket: www.kv.com.

b. A & M Hardware, Inc.; 18X24 Regular Brackets: www.aandmhardware.com.

c. Architect approved equal.

d. Substitutions: See Section 01 6000 - Product Requirements.

G. Grommets: Round, 2" Dia, molded plastic and matching plastic caps with slot for wire passage.

1. Basis of Design: Doug Mockett, TG1 Grommet Sleeve.

a. Color: To be selected by Architect from manufacturer's full range of colors.

2.3. FABRICATION

A. Fabricate tops and splashes in the largest sections practicable, with top surface of joints flush.

1. Join lengths of tops using best method recommended by manufacturer.

2. Fabricate to overhang fronts and ends of cabinets 1 inch except where top butts against cabinet or wall.

3. Prepare all cutouts accurately to size; replace tops having improperly dimensioned or unnecessary cutouts or fixture holes.

B. Provide back splash wherever counter edge abuts vertical surface unless otherwise indicated.

1. Secure to countertop with concealed fasteners and with contact surfaces set in waterproof glue.

2. Height: 4 inches, unless otherwise indicated.

C. Wall-Mounted Counters: Provide skirts, aprons, brackets, and braces as indicated on drawings, finished to match.

PART 3 EXECUTION

3.1. EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

C. Verify that wall surfaces have been finished and mechanical and electrical services and outlets are installed in proper locations.

3.2. PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

3.3. INSTALLATION

A. Securely attach countertops to cabinets using concealed fasteners. Make flat surfaces level; shim where required.

B. Attach plastic laminate countertops using screws with minimum penetration into substrate board of 5/8 inch.

C. Install tile as specified in Section 09 3000.

D. Seal/caulk joint between back/end splashes and vertical surfaces.

3.4. TOLERANCES

A. Variation From Horizontal: 1/8 inch in 10 feet, maximum.

B. Offset From Wall, Countertops: 1/8 inch maximum; 1/16 inch minimum.

C. Field Joints: 1/8 inch wide, maximum.

3.5. CLEANING

A. Clean countertops surfaces thoroughly.

3.6. PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 21 0500 - COMMON WORK RESULTS FOR FIRE SUPPRESSION

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Above ground piping.

B. Escutcheons.

C. Pipe, fittings, sleeves, escutcheons, seals, and connections for sprinkler systems.

D. Mechanical couplings.

E. Pipe hangers and supports.

F. Pipe sleeves.

1.2. RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

C. Section 21 0553 - Identification for Fire Suppression Piping and Equipment: Piping identification.

D. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

1.3. 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; 2016.

E. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2017.

F. ASME B16.9 - Factory-Made Wrought Buttwelding Fittings; 2018.

G. ASTM A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2018).

H. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

I. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2009 (Reapproved 2014).

J. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.

K. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

L. ASTM A795/A795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2013 (Reapproved 2020).

M. ASTM C592 - Standard Specification for Mineral Fiber Blanket Insulation and Blanket-Type Pipe Insulation (Metal-Mesh Covered) (Industrial Type); 2016.

N. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).

O. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.

P. AWWA C606 - Grooved and Shouldered Joints; 2015.

Q. ITS (DIR) - Directory of Listed Products; current edition.

R. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

S. UL (DIR) - Online Certifications Directory; Current Edition.

1.4. 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. Installer's Qualification Statement.

E. Operation and Maintenance Data: Include installation instructions and spare parts lists.

F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.5. QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing work of the type specified in this section.

1. Minimum three years experience.

B. Comply with UL (DIR) requirements.

C. Valves: Bear UL (DIR) product listing label or marking. Provide manufacturer's name and pressure rating marked on valve body.

D. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

E. Clean equipment, pipes, valves, and fittings of grease, metal cuttings, and sludge that may have accumulated from the installation and testing of the system.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.1. FIRE PROTECTION SYSTEMS

A. Sprinkler Systems: Comply with NFPA 13.

B. Welding Materials and Procedures: Comply with ASME BPVC-IX.

2.2. ABOVE GROUND PIPING

A. Steel Pipe: ASTM A795 Schedule 10 or ASTM A53 Schedule 40, black.

1. Steel Fittings: ASME B16.9, wrought steel, buttwelded, ASTM A234/A234M, wrought carbon steel or alloy steel, or ASME B16.5, steel flanges and fittings.

2. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A47/A47M.

3. 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.

4. 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.

2.3. PIPE SLEEVES

A. Not required for wall hydrants for fire department connections or in drywall construction.

B. 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.

2.4. ESCUTCHEONS

A. Manufacturers:

1. Fire Protection Products, Inc: www.fppi.com/#sle.com.
2. Tyco Fire Protection Products: www.tyco-fire.com.
3. Viking Group Inc: www.vikinggroupinc.com.

B. Material:

1. Metals and Finish: Comply with ASME A112.18.1.

C. Construction:

1. One-piece for mounting on chrome-plated tubing or pipe and one-piece type elsewhere.
2. Internal spring tension devices or setscrews to maintain a fixed position against a surface.

2.5. PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 1-1/2 inch: Malleable iron, adjustable swivel, split ring.

1. Manufacturers:
   a. AFCON, a brand of Anvil International: www.anvilintl.com.
   b. Ferguson Enterprises Inc: www.fnw.com.

B. Hangers for Pipe Sizes 2 inches and Over: Carbon steel, adjustable, clevis.

1. Manufacturers:
   a. AFCON, a brand of Anvil International: www.anvilintl.com.
   b. Ferguson Enterprises Inc: www.fnw.com.

2.6. MECHANICAL COUPLINGS

A. Manufacturers:

1. Anvil International: www.anvilintl.com.
2. Shurjoint Piping Products, Inc: www.shurjoint.com.
3. Tyco Fire Protection Products: www.tyco-fire.com.
4. Victaulic Company; FireLock Style 009H: www.victaulic.com.

B. 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

3.1. 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.

3.2. 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. 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.

G. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

H. 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.

I. Provide sleeves when penetrating walls and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. 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.
2. 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.
3. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

J. 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. Use chrome plated escutcheons in occupied spaces and to conceal openings in construction.

K. 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.

L. 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.

3.3. 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 21 0513 - COMMON MOTOR REQUIREMENTS FOR FIRE SUPPRESSION EQUIPMENT

<<<< UPDATE NOTES

PART 1 GENERAL

2.1. SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

2.2. RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

2.3. REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; 2018.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

2.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

E. Operation Data: Include instructions for safe operating procedures.

F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

2.5. QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.6. DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

2.7. WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Provide five year manufacturer warranty for motors larger than 20 horsepower.

PART 2 PRODUCTS

3.1. GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service: Refer to Section 26 0583 for required electrical characteristics.

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.

3.2. 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 fans, blowers, and pumps: Capacitor start, capacitor run type.

3.3. SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

3.4. THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

PART 3 EXECUTION

4.1. 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

SECTION 21 0523 - GENERAL-DUTY VALVES FOR WATER-BASED FIRE-SUPPRESSION PIPING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Two-piece ball valves with indicators.

B. Iron butterfly valves with indicators.

C. Check valves.

D. Bronze OS&Y gate valves.

E. Iron OS&Y gate valves.

F. Trim and drain valves.

1.2. RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 21 0500 - Common Work Results for Fire Suppression: Pipe and fittings.

C. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

D. Section 21 1300 - Fire-Suppression Sprinkler Systems.

E. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3. ABBREVIATIONS AND ACRONYMS

A. EPDM: Ethylene-propylene diene monomer.

B. NRS: Non-rising stem.

C. OS&Y: Outside screw and yoke.

D. PTFE: Polytetrafluoroethylene.

1.4. 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. AWWA C508 - Swing-Check Valves for Waterworks Service, 2-In. Through 48-In. (50-mm Through 1,200-mm) NPS; 2017.

D. AWWA C606 - Grooved and Shouldered Joints; 2015.

E. FM (AG) - FM Approval Guide; current edition.

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. UL (DIR) - Online Certifications Directory; Current Edition.

H. UL 262 - Gate Valves for Fire-Protection Service; Current Edition, Including All Revisions.

I. UL 312 - Check Valves for Fire-Protection Service; Current Edition, Including All Revisions.

J. UL 1091 - Standard for Butterfly Valves for Fire-Protection Service; Current Edition, Including All Revisions.

1.5. 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. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

1.6. QUALITY ASSURANCE

A. Manufacturer Qualifications:

1. Obtain valves for each valve type from single manufacturer.

B. Where listed products are specified, provide products listed, classified, and labeled by UL (DIR) as suitable for the purpose indicated.

C. Installer Qualifications:

1. Company specializing in performing the work of this section with minimum five years documented experience.

1.7. 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. 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.

C. Use the following precautions for handling:

1. Do not use operating handles or stems as lifting or rigging points.

PART 2 PRODUCTS

2.1. 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.
    a. Level 1: HLOT - Valves.
    b. Level 3: HLUG - Ball Valves, System Control.
    c. Level 3: HLXS - Butterfly Valves.
    d. Level 3: HMER - Check Valves.
    e. Level 3: HMRZ - Gate Valves.
2. Main Level: VDGT - Sprinkler System & Water Spray System Devices.
    a. Level 1: VQGU - Valves, Trim, and Drain.

B. ASME Compliance:

1. ASME B16.1 for flanges on iron valves.
2. ASME B1.20.1 for threads on threaded-end valves.

C. Comply with AWWA C606 for grooved-end connections.

D. Comply with NFPA 13 for valves.

E. Valve Pressure Ratings: Not less than minimum pressure rating indicated or higher as required.

F. Valve Sizes: Same as upstream piping unless otherwise indicated.

G. 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.

2.2. TWO-PIECE BALL VALVES WITH INDICATORS

A. UL 1091, except with ball instead of disc and FM (AG) standard listing for indicating valves (butterfly or ball type), Class Number 1112.

B. Description:

1. Minimum Pressure Rating: 175 psig.
2. Body Design: Two piece.
3. Body Material: Forged brass or bronze.
4. Port Size: Full or standard.
5. Seat: PTFE.
6. Stem: Bronze or stainless steel.
7. Ball: Chrome-plated brass.
8. Actuator: Worm gear or traveling nut.
9. Supervisory Switch: Internal or external.
10. End Connections for Valves 1 NPS through 2 NPS: Threaded ends.
11. End Connections for Valves 2-1/2 NPS: Grooved ends.

2.3. IRON BUTTERFLY VALVES WITH INDICATORS

A. UL 1091 and FM (AG) standard listing for indicating valves (butterfly or ball type), Class Number 112.

B. Minimum Pressure Rating: 175 psig.

C. Body Material: Cast or ductile iron with epoxy coating.

D. Seat: EPDM.

E. Stem: Stainless steel.

F. Disc: Ductile iron, nickel plated.

G. Actuator: Worm gear or traveling nut.

H. Supervisory Switch: Internal or external.

I. Body Design: Grooved-end connections.

2.4. 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.

2.5. 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.

2.6. 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.

2.7. 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

3.1. 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.

3.2. 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.
C. Valves in horizontal piping installed with stem at or above the pipe center.
D. Position valves to allow full stem movement.
E. 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

1.1. SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.2. REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.3. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

D. Manufacturer's Installation Instructions: Indicate special procedures, and installation instructions.

PART 2 PRODUCTS

2.1. IDENTIFICATION APPLICATIONS

A. Control Panels: Nameplates.

B. Piping: Tags.

C. Pumps: Nameplates.

D. Valves: Nameplates.

2.2. NAMEPLATES

A. Manufacturers:

1. Brimar Industries, Inc: www.pipemarker.com.
2. Kolbi Pipe Marker Company: www.kolbipipemarkers.com.
3. Seton Identification Products, a Tricor Direct Company: www.seton.com.

B. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.
4. Thickness: 1/8 inch.
5. Plastic: Comply with ASTM D709.

2.3. TAGS

A. Manufacturers:

1. Brimar Industries, Inc: www.pipemarker.com.
2. Kolbi Pipe Marker Company: www.kolbipipemarkers.com.
3. Seton Identification Products, a Tricor Direct Company: www.seton.com.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4. PIPE MARKERS

A. Manufacturers:

1. Brimar Industries, Inc: www.pipemarker.com.
2. Kolbi Pipe Marker Company: www.kolbipipemarkers.com.
3. Seton Identification Products, a Tricor Company: www.seton.com.

B. Color: Comply with ASME A13.1.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

D. Color code as follows:

1. Fire Quenching Fluids: Red with white letters.

PART 3 EXECUTION

3.1. PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2. 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 tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Use tags on piping 3/4 inch diameter and smaller.

1. 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.

END OF SECTION

SECTION 21 1300 - FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Wet-pipe sprinkler system.

B. System design, installation, and certification.

C. Fire department connections.

1.2. RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 21 0500 - Common Work Results for Fire Suppression: Pipe and fittings.

C. Section 21 0523 - General-Duty Valves for Water-Based Fire-Suppression Piping.

D. Section 21 0553 - Identification for Fire Suppression Piping and Equipment.

E. Section 21 3000 - Fire Pumps.

F. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3. REFERENCE STANDARDS

A. ITS (DIR) - Directory of Listed Products; current edition.

B. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. NFPA 1963 - Standard for Fire Hose Connections; 2019.

D. UL (DIR) - Online Certifications Directory; Current Edition.

E. UL 405 - Fire Department Connection Devices; Current Edition; Including All Revisions.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:

1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.

2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.

3. Submit shop drawings to Authorities Having Jurisdiction for approval. Submit proof of approval to Architect.

D. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements.

E. Designer's Qualification Statement.

F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

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 Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.
3. Sprinkler Wrenches: For each sprinkler type.

1.5. QUALITY ASSURANCE

A. Comply with UL (DIR) requirements.

B. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this type of work and licensed in the State in which the Project is located.

C. Installer Qualifications: Company specializing in performing the work of this section.

D. Equipment and Components: Provide products that bear UL (DIR) label or marking.

E. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

1.6. 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

2.1. MANUFACTURERS

A. Sprinklers, Valves, and Equipment:
1. Anvil International: www.anvilintl.com.
2. Tyco Fire Protection Products: www.tyco-fire.com.
3. Viking Corporation: www.vikinggroupinc.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

2.2. SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for entire building.

B. Occupancy: Light hazard; comply with NFPA 13.

C. Water Supply: Determine volume and pressure from water flow test data.

D. Provide fire department connections where indicated.

E. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.3. SPRINKLERS

A. Suspended Ceiling Type: Concealed pendant type with matching push on cover plate.
1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Chrome plated.
4. Escutcheon Plate Finish: Chrome plated.
5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

B. Exposed Area Type: Upright type.
1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Brass.
4. Fusible Link: Glass bulb type temperature rated for specific area hazard.

C. Sidewall Type: Semi-recessed horizontal sidewall type with matching push on escutcheon plate.

1. Response Type: Quick.
2. Coverage Type: Standard.
3. Finish: Chrome plated.
4. Escutcheon Plate Finish: Chrome plated.
5. Fusible Link: Glass bulb type temperature rated for specific area hazard.

D. 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. Manufacturers:
   a. FlexHead Industries, a brand of Anvil International: www.anvilintl.com.
   b. Victaulic Company; Vic-Flex: www.victaulic.com.

2.4. PIPING SPECIALTIES

A. Test Connections:

1. Inspector's Test Connection:
   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.

B. Electric Alarm: Electrically operated red enameled gong with pressure alarm switch.

C. 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.

1. Manufacturers:

D. 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.
   f. Manufacturers:
      1) Elkhart Brass Manufacturing Company, Inc: www.elkhartbrass.com.
      2) Fire End & Croker Corporation: www.croker.com.

E. Supervisory Switches:

1. Manufacturers:

PART 3 EXECUTION

3.1. INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard.

B. Install equipment in accordance with manufacturer's instructions.

C. Locate fire department connection with sufficient clearance from walls, obstructions, or adjacent siamese connectors to allow full swing of fire department wrench handle.

D. Locate outside alarm gong on building wall as indicated.

E. Place pipe runs to minimize obstruction to other work.

F. Place piping in concealed spaces above finished ceilings.

G. 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.

H. Install and connect to fire pump system in accordance with Section 21 3000.

I. Flush entire piping system of foreign matter.

J. Hydrostatically test entire system.

K. Require test be witnessed by Fire Marshal.

END OF SECTION

SECTION 21 3000 - FIRE PUMPS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Fire pump package, including fire pump, electric motor drive, controller, and accessories.

B. Electric jockey pump.

C. System maintenance.

1.2. RELATED REQUIREMENTS

A. Section 21 0500 - Common Work Results for Fire Suppression: Fire protection piping.

B. Section 21 0513 - Common Motor Requirements for Fire Suppression Equipment.

C. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3. REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; 2018.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

C. NFPA 13 - Standard for the Installation of Sprinkler Systems; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 20 - Standard for the Installation of Stationary Pumps for Fire Protection; 2018.

E. UL (DIR) - Online Certifications Directory; Current Edition.

F. UL 448 - Centrifugal Stationary Pumps for Fire-Protection Service; Current Edition, Including All Revisions.

G. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturers literature including general assembly, pump curves showing performance characteristics with pump and system, operating point indicated, NPSH curve, controls, wiring diagrams, and service connections.

C. Shop Drawings: Indicate layout, general assembly, components, dimensions, weights, clearances, and methods of assembly.

D. Certificates: Certify that fire pumps meet or exceed specified requirements at specified operating conditions and that the installation complies with regulatory requirements. Submit summary and results of shop tests performed in accordance with NFPA 20.

E. Test Reports: Indicate results of hydrostatic test and field acceptance tests.

F. Manufacturer's Instructions: Indicate support details, connection requirements, for fire pump system.

G. Operation Data: Include manufacturers instructions, start-up data, trouble-shooting check lists, for pumps, drivers, and controllers.

H. Maintenance Data: Include manufacturers literature, cleaning procedures, replacement parts lists, and repair data for pumps, drivers and controllers.

I. Project Record Documents: Record actual locations of components and accessories.

1.5. QUALITY ASSURANCE

A. Comply with NFPA 13 and NFPA 20; where requirements differ comply with the most stringent.

B. Design fire pump system under direct supervision of a Professional Fire Protection Engineer experienced in design of this work and licensed at the State in which the Project is located.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

D. Provide certificate of compliance from authority have jurisdiction indicating approval of field acceptance tests.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Deliver fire pumps and components in factory packing. Comply with manufacturer's rigging and installation instructions.

B. Protect fire pumps and components from physical damage including effects of weather, water, and construction debris.

PART 2 PRODUCTS

2.1. FIRE PUMPS

A. Description: Refer to the fire protection drawings for fire pump requirements.

B. Fire Pumps: Vertical in-line type; UL 448 and UL 778; single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 250 psi.

1. Casing: Cast or ductile iron, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.

2. Impeller: Bronze, fully enclosed, keyed directly to motor shaft.

3. Shaft: Solid alloy steel with bronze sleeve.

4. Seal: Packing gland with minimum four rings graphite impregnated packing and bronze lantern rings, 230 degrees F maximum continuous operating temperature.

5. Performance:

a. Motor: 20 hp, 208 volt, three phase, 60 Hz.

2.2. PRESSURE BOOSTER (JOCKEY) PUMP

A. Description: Refer to the fire protection drawings for jockey pump requirements.

B. Electrically operated, horizontal turbine type with standard open drip-proof horizontal motor.

C. Control by automatic jockey pump controller with full voltage starter and minimum run timer to start pump on pressure drop in system and stay in operation for minimum period of time. Fire pump shall start automatically on further pressure drop or on jockey pump failure.

D. Electrical Characteristics:

1. 2 hp.

2. ____ volts, single phase, 60 Hz.

PART 3 EXECUTION

3.1. INSTALLATION

A. Install in accordance with NFPA 20.

B. Provide access space around pumps for service; no less than minimum as recommended by manufacturer.

C. Install piping in accordance with Section 21 0500. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. For base mounted pumps, provide supports under elbows on pump suction and discharge.

D. Provide drains for bases and seals, piped to and discharging into floor drains.

E. Provide for connection to electrical service. Refer to Section 26 0583.

F. Lubricate pumps before start-up.

3.2. FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with Section 01 4000 - Quality Requirements.

B. Perform hydrostatic tests, flushing, and field acceptance tests as specified in NFPA 20.

C. Perform field acceptance tests in the presence of Fire Marshal.

3.3. CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

3.4. MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide service and maintenance of equipment installed under this section for one year from the Date of Substantial Completion.

END OF SECTION

SECTION 22 0517 - SLEEVES AND SLEEVE SEALS FOR PLUMBING PIPING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Pipe sleeves.

1.2. RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 22 0523 - General-Duty Valves for Plumbing Piping.

C. Section 22 0553 - Identification for Plumbing Piping and Equipment: Piping identification.

D. Section 22 0719 - Plumbing Piping Insulation.

1.3. 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).

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

PART 2 PRODUCTS

2.1. PIPE SLEEVES

A. Manufacturers:

1. Flexicraft Industries; Pipe Wall Sleeve: www.flexicraft.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

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 Mechanical, Laundry, and Animal 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.

D. 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.

PART 3 EXECUTION

3.1. 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.

3.2. 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. Structural Considerations:

1. Do not penetrate building structural members unless indicated.

E. Provide sleeves when penetrating walls and partitions. Seal pipe including sleeve penetrations to achieve fire resistance equivalent to fire separation required.

1. 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.

2. 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.

3. Caulk exterior wall sleeves watertight with lead and oakum or mechanically expandable chloroprene inserts with mastic-sealed components.

F. 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.

3.3. 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 22 0519 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

1.2. REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014, with Editorial Revision (2017).

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.3. 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.

PART 2 PRODUCTS

2.1. PRESSURE GAUGES

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Moeller Instrument Company, Inc: www.moellerinstrument.com.
3. Substitutions: See Section 01 6000 - Product Requirements.

B. 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.

2.2. PRESSURE GAUGE TAPPINGS

A. Gauge Cock: Tee or lever handle, brass for maximum 150 psi.

2.3. STEM TYPE THERMOMETERS

A. Manufacturers:

1. Dwyer Instruments, Inc: www.dwyer-inst.com.
2. Omega Engineering, Inc: www.omega.com.
3. Weksler Glass Thermometer Corp: www.wekslerglass.com.

B. 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. Stem: 3/4 inch NPT brass.
4. Accuracy: 2 percent, per ASTM E77.
5. Calibration: Degrees F.

2.4. THERMOMETER SUPPORTS

A. Socket: Brass separable sockets for thermometer stems with or without extensions as required, and with cap and chain.

PART 3 EXECUTION

3.1. 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. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

D. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

3.2. SCHEDULES

A. Pressure Gauges, Location and Scale Range:

1. Pressure tanks, 0 to 100 psi.
2. Backflow preventers, 0 to 100 psi.

B. Stem Type Thermometers, Location and Scale Range:

1. Heat exchangers - inlets and outlets, 0 to 200 degrees F.
2. Domestic hot water supply and recirculation, 0 to 200 degrees F.

END OF SECTION

SECTION 22 0523 - GENERAL-DUTY VALVES FOR PLUMBING PIPING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Applications.

B. General requirements.

C. Ball valves.

D. Butterfly valves.

E. Check valves.

F. Gate valves.

G. Globe valves.

H. Plug valves.

1.2. RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 22 0553 - Identification for Plumbing Piping and Equipment.

C. Section 22 0719 - Plumbing Piping Insulation.

D. Section 22 1005 - Plumbing Piping.

1.3. REFERENCE STANDARDS

A. ASME B1.20.1 - Pipe Threads, General Purpose (Inch); 2013 (Reaffirmed 2018).

B. ASME B16.5 - Pipe Flanges and Flanged Fittings NPS 1/2 Through NPS 24 Metric/Inch Standard; 2017.

C. ASME B16.10 - Face-to-Face and End-to-End Dimensions of Valves; 2017.

D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.

E. ASME B16.34 - Valves - Flanged, Threaded and Welding End; 2017.

F. ASTM A48/A48M - Standard Specification for Gray Iron Castings; 2003 (Reapproved 2016).

G. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2019).

H. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

I. ASTM B62 - Standard Specification for Composition Bronze or Ounce Metal Castings; 2017.

J. MSS SP-45 - Bypass and Drain Connections; 2003 (Reaffirmed 2008).

K. MSS SP-67 - Butterfly Valves; 2017.

L. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 2011.

M. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

N. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

O. NSF 61 - Drinking Water System Components - Health Effects; 2019.

P. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.4. 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. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts listings.

D. 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.

1.5. QUALITY ASSURANCE

A. Manufacturer:

1. Obtain valves for each valve type from single manufacturer.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Use the following precautions during storage:

1. Maintain valve end protection and protect flanges and specialties from dirt.

a. Maintain caps in place until installation.

2. Store valves in shipping containers and maintain in place until installation.

PART 2 PRODUCTS

2.1. APPLICATIONS

A. Provide the following valves for the applications if not indicated on drawings:

1. Shutoff: Ball, butterfly, gate or plug.

2. Throttling: Provide globe, angle, or ball.

3. Swing Check (Pump Outlet):

a. 2 NPS and Smaller: Bronze swing check valves with bronze or nonmetallic disc.

B. 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.

C. 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.

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.

D. Domestic, Hot and Cold Water Valves:

1. 2 NPS and Smaller:

a. Bronze and Brass: Provide with solder-joint or threaded ends.

b. Ball: Two piece, full port, brass or bronze with brass trim.

c. Bronze Swing Check: Class 125, bronze disc.

d. Bronze Gate: Class 125, NRS.

2.2. 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 except plug valves.
3. Wrench: Plug valves with square heads.

D. Valves in Insulated Piping: With 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. Memory Stops: Fully adjustable after insulation is installed.

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.

F. General ASME Compliance:

1. Ferrous Valve Dimensions and Design Criteria: ASME B16.10 and ASME B16.34.
2. Solder-joint Connections: ASME B16.18.

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. Source Limitations: Obtain each valve type from a single manufacturer.

2.3. BRASS BALL VALVES

A. 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 or soldered.
6. Seats: PTFE.
7. Stem: Brass.
8. Ball: Chrome-plated brass.
9. Manufacturers:
    a. Apollo Valves: www.apollovalves.com.
    b. Nibco Valves.
    c. Milwaukee Valve
    d. Watts

2.4. BRONZE BALL VALVES

A. Two Piece, Full 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.
7. Stem: Bronze.
8. Ball: Chrome plated brass.
9. Manufacturers:
    a. Apollo Valves: www.apollovalves.com.
    b. Nibco Valves.
    c. Milwaukee Valve
    d. Watts

2.5. 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.
7. Manufacturers:
    a. Apollo Valves: www.apollovalves.com.
    b. Substitutions: See Section 01 6000 - Product Requirements.

2.6. BRONZE SWING CHECK VALVES

A. Class 125: CWP Rating: 200 psig (1380 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.
6. Manufacturers:
    a. Apollo Valves: www.apollovalves.com.
    b. Nibco Valve.
    c. Milwaukee Valve.
    d. Watts

2.7. BRONZE GATE VALVES

A. Non-Rising Stem (NRS):

1. Comply with MSS SP-80, Type I.

2. Class 125: CWP Rating: 200 psig:.
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.
9. Manufacturers:
    a. Apollo Valves: www.apollovalves.com.
    b. Nibco Valves.
    c. Milwaukee Valve
    d. Watts

2.8. BRONZE GLOBE VALVES

A. Class 125: CWP Rating: 200 psig:.

1. Comply with MSS SP-80, Type 1.
2. Body: ASTM B62, bronze with integral seat and screw-in bonnet.
3. Ends: Threaded or solder joint.
4. Stem: Bronze.
5. Disc: PTFE.
6. Packing: Asbestos free.
7. Handwheel: Malleable iron or aluminum.
8. Manufacturers:
    a. Apollo Valves: www.apollovalves.com.
    b. Nibco Valves.
    c. Milwaukee Valve.
    d. Watts

2.9. LUBRICATED PLUG VALVES

A. Regular Gland with Threaded Ends:

1. Comply with MSS SP-78, Type II.
2. Class 125: CWP Rating: 200 psig.
3. Body: ASTM A48/A48M or ASTM A126, cast iron with lubrication sealing system.
4. Pattern: Regular or short.
5. Plug: Cast iron or bronze with sealant groove.
6. Manufacturers:
    a. DeZurik.
    b. A Y McDonald.
    c. Flowserve Corporation.

PART 3 EXECUTION

3.1. 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.

3.2. 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. 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

1.1. SECTION INCLUDES

A. Support and attachment components for equipment, piping, and other plumbing work.

1.2. 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.

1.3. 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; 2014.

D. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

E. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

F. MFMA-4 - Metal Framing Standards Publication; 2004.

G. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to provide additional framing and materials required for installation.

2. Coordinate compatibility of support and attachment components with mounting surfaces at the installed locations.

3. Coordinate the arrangement of supports with ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

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.

1.5. 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, nonpenetrating rooftop supports, post-installed concrete and masonry anchors, and thermal insulated pipe supports.

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.

1.6. QUALITY ASSURANCE

A. Comply with applicable building code.

B. Installer Qualifications for Field-Welding: As specified in Section 05 5000.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1. 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 plumbing 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 wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
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. 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. Metal Channel (Strut) Framing Systems:

1. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
    b. Thomas & Betts Corporation: www.tnb.com.
    c. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.
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.

C. 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.

D. Beam Clamps: MSS SP-58 Types 19 through 23, 25 or 27 through 30 based on required load.

1. Manufacturers:

a. Ferguson Enterprises Inc: www.fnw.com.

b. Substitutions: See Section 01 6000 - Product Requirements.

c. 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.

E. Strut Clamps: Two-piece pipe clamp.

1. Manufacturers:

a. Ferguson Enterprises Inc: www.fnw.com.

b. Substitutions: See Section 01 6000 - Product Requirements.

c. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

F. Anchors and Fasteners:

1. Manufacturers - Mechanical Anchors:

a. Hilti, Inc: www.us.hilti.com.

b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com.

c. Powers Fasteners, Inc: www.powers.com.

d. Substitutions: See Section 01 6000 - Product Requirements.

2. Manufacturers - Powder-Actuated Fastening Systems:

a. Hilti, Inc: www.us.hilti.com.

b. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com.

c. Powers Fasteners, Inc: www.powers.com.

3. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.

5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.

6. Steel: Use beam clamps, machine bolts, or welded threaded studs.

7. Wood: Use wood screws.

8. 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.

G. Pipe Installation Accessories:

1. Copper Pipe Supports:

a. Manufacturers:

1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com.

2) Substitutions: See Section 01 6000 - Product Requirements.

2. Overhead Pipe Supports:
   a. Manufacturers:
      1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com.
      2) Substitutions: See Section 01 6000 - Product Requirements.
      3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.
3. Inserts and Clamps:
   a. Manufacturers:
      1) HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com.
      2) Substitutions: See Section 01 6000 - Product Requirements.
      3) Source Limitations: Furnish supports, associated fittings, accessories, and hardware produced by a single manufacturer.

PART 3 EXECUTION

3.1. 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.

3.2. 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. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.

D. 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. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

E. Preset Concrete Inserts: Use manufacturer-provided closure strips to inhibit concrete seepage during concrete pour.

F. Secure fasteners according to manufacturer's recommended torque settings.

G. Remove temporary supports.

3.3. 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 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Nameplates.

B. Tags.

C. Pipe markers.

1.2. RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

1.3. REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.

C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1. IDENTIFICATION APPLICATIONS

A. Heat Transfer Equipment: Nameplates.

B. Piping: Tags.

C. Pumps: Nameplates.

D. Tanks: Nameplates.

E. Valves: Tags.

F. Water Treatment Devices: Nameplates.

2.2. NAMEPLATES

A. Manufacturers:

1. Brimar Industries, Inc: www.pipemarker.com.
2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
3. Seton Identification Products: www.seton.com.

B. Description: Laminated three-layer plastic with engraved letters.

1. Letter Color: White.
2. Letter Height: 1/4 inch.
3. Background Color: Black.
4. Plastic: Comply with ASTM D709.

2.3. TAGS

A. Manufacturers:

1. Brimar Industries, Inc: www.pipemarker.com.
2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
3. Seton Identification Products: www.seton.com.

B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

C. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.4. PIPE MARKERS

A. Manufacturers:

1. Brimar Industries, Inc: www.pipemarker.com.
2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com.
3. Seton Identification Products: www.seton.com.

B. Comply with ASME A13.1.

C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.1. PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

B. Prepare surfaces in accordance with Section 09 9123 for stencil painting.

3.2. 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. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. 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.

END OF SECTION

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Piping insulation.

1.2. RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 22 1005 - Plumbing Piping: Placement of hangers and hanger inserts.

1.3. 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 C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2019.

C. ASTM C552 - Standard Specification for Cellular Glass Thermal Insulation; 2017, with Editorial Revision (2018).

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; 2020.

F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4. 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 that ensure acceptable workmanship and installation standards will be achieved.

1.5. 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.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

PART 2 PRODUCTS

2.1. 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.

2.2. GLASS FIBER

A. Manufacturers:

1. CertainTeed Corporation: www.certainteed.com.

2. Johns Manville Corporation: www.jm.com.

3. Knauf Insulation; Earthwool 1000 Degree Pipe Insulation: www.knaufinsulation.com.

4. Owens Corning Corporation; Fiberglas Pipe Insulation ASJ: www.ocbuildingspec.com.
5. Owens Corning Corporation; VaporWick Pipe Insulation: www.ocbuildingspec.com.

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.

2.3. CELLULAR GLASS

A. Manufacturers:
1. Owens Corning Corporation: www.ocbuildingspec.com.
2. Substitutions: See Section 01 6000 - Product Requirements.

B. 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.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2. 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: Insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, 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.

E. 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.

F. 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.

G. 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.

H. 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.

I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with canvas jacket sized for finish painting.

END OF SECTION

SECTION 22 0719.11 - UNDER-LAVATORY PIPE AND SUPPLY COVERS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Under-lavatory pipe and supply covers.

1.2. RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

1.3. REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.

C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

1.4. SUBMITTALS

A. Product Data: Provide catalog illustrations of covers, sizes, and finishes.

B. Manufacturer's Instructions: Indicate installation methods and procedures.

PART 2 PRODUCTS

2.1. UNDER-LAVATORY PIPE and SUPPLY COVERS

A. Basis of Design: Plumberex Specialty Products, Inc; www.plumberex.com.

1. Fusion Molded Under-Lavatory Insulators (Non-Sewn): Plumberex Handy-Shield Maxx.
2. Slim Fit Under-Lavatory Insulators (Non-Sewn): Plumberex Trap Gear.
3. Under-Lavatory Covers with Snap-Lock Fasteners (Molded): Plumberex Pro-Extreme.

B. General:

1. Insulate exposed drainage piping including hot, cold, and tempered water supplies under lavatories or sinks per ADA Standards.
2. Adhesives, sewing threads, and two-ply laminated materials are prohibited.
3. Exterior Surfaces: Smooth nonabsorbent with no finger recessed indentations for easy cleaning.
4. Construction: 1/8 inch PVC with antimicrobial, antifungal, and ultraviolet light (UV) resistant properties.
    a. Comply with ASTM C1822 for covers on accessible lavatory piping.

C. ASTM E84 Compliant, Under-Lavatory Insulators:

1. Manufacturers:
    a. Plumberex Specialty Products, Inc: Plumberex Handy-Shield Maxx; www.plumberex.com/#sle.
2. Construction: Soft, non-laminated, flexible PVC with antimicrobial, antifungal, and UV-resistant properties. Fusion molded one piece universal design for multiple P-trap configurations. Adhesives, sewing threads, and two ply laminated materials shall not be allowed. Exterior surfaces shall be smooth nonabsorbent with no finger recessed indentations for easy cleaning. Supply riser shall be flexible and a minimum of 15 inches inches in length.

D. Under-Lavatory Covers with Snap-Lock Fasteners:

1. Manufacturers:
    a. Plumberex Specialty Products, Inc: Plumberex Pro-Extreme; www.plumberex.com/#sle.
2. Construction: PVC with antimicrobial, antifungal, and UV-resistant properties, one piece injected molded design with internal bridge at top of J-bend to prevent separating.

3. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces. No cable ties allowed.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that walls, floor finishes, lavatories, and piping are prepared and ready for installation of under-lavatory guards.

B. Confirm location and size of fixtures and piping before installation.

3.2. INSTALLATION

A. Install under-lavatory guards according to manufacturer's written instructions..

3.3. PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace damaged products before Date of Substantial Completion.

END OF SECTION

SECTION 22 1005 - PLUMBING PIPING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.

1. Sanitary sewer.
2. Domestic water.
3. Storm water.
4. Flanges, unions, and couplings.
5. Pipe hangers and supports.
6. Manufactured sleeve-seal systems.
7. Valves.
8. Check.
9. Strainers.

1.2. RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 08 3100 - Access Doors and Panels.

C. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.

D. Section 22 0553 - Identification for Plumbing Piping and Equipment.

E. Section 22 0719 - Plumbing Piping Insulation.

F. Section 31 2316 - Excavation.

G. Section 31 2316.13 - Trenching.

H. Section 31 2323 - Fill.

1.3. REFERENCE STANDARDS

A. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.

B. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.

C. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.

D. ASME B16.26 - Cast Copper Alloy Fittings for Flared Copper Tubes; 2018.

E. ASME B31.1 - Power Piping; 2018.

F. ASME B31.9 - Building Services Piping; 2017.

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 A47/A47M - Standard Specification for Ferritic Malleable Iron Castings; 1999, with Editorial Revision (2018).

I. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

J. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2020.

K. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.

L. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

M. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2020.

N. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.

O. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

P. ASTM B813 - Standard Specification for Liquid and Paste Fluxes for Soldering of Copper and Copper Alloy Tube; 2016.

Q. ASTM B828 - Standard Practice for Making Capillary Joints by Soldering of Copper and Copper Alloy Tube and Fittings; 2016.

R. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2020a.

S. AWWA C105/A21.5 - Polyethylene Encasement for Ductile-Iron Pipe Systems; 2010.

T. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2017.

U. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2017, with Errata (2018).

V. AWWA C606 - Grooved and Shouldered Joints; 2015.

W. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2017 (Revised 2018).

X. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2012 (Revised 2018).

Y. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

Z. NSF 61 - Drinking Water System Components - Health Effects; 2019.

AA. NSF 372 - Drinking Water System Components - Lead Content; 2016.

1.4. 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.

1.5. 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.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1. 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.

2.2. SANITARY SEWER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.

1. Fittings: Cast iron.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C564 neoprene gaskets or lead and oakum.

2.3. SANITARY SEWER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.

2. Joints: CISPI 310, neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.4. DOMESTIC WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Copper Pipe: ASTM B42, annealed.

1. Fittings: ASME B16.26, cast bronze.

2. Joints: Flared.

B. Ductile Iron Pipe: AWWA C151/A21.51.

1. Fittings: Ductile or gray iron, standard thickness.

2. Joints: AWWA C111/A21.11, styrene butadiene rubber (SBR) or vulcanized SBR gasket with 3/4 inch diameter rods.

2.5. DOMESTIC WATER PIPING, ABOVE GRADE

A. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), Drawn (H).

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.

a. Manufacturers:

1) Anvil International: www.anvilintl.com.

2) Apollo Valves: www.apollovalves.com.

3) Grinnell Products: www.grinnell.com.

4) Viega LLC: www.viega.us.

2.6. STORM WATER PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A74 extra heavy weight.

1. Fittings: Cast iron.

2. Joint Seals: ASTM C564 neoprene gaskets, or lead and oakum.

2.7. STORM WATER PIPING, ABOVE GRADE

A. Cast Iron Pipe: CISPI 301, hubless, service weight.

1. Fittings: Cast iron.

2. Joints: Neoprene gaskets and stainless steel clamp-and-shield assemblies.

2.8. NATURAL GAS PIPING, BURIED WITHIN 5 FEET OF BUILDING

A. Steel Pipe: ASTM A53/A53M Schedule 40 black.

1. Fittings: ASTM A234/A234M, wrought steel welding type.

2. Joints: ASME B31.1, welded.

3. Jacket: AWWA C105/A21.5 polyethylene jacket or double layer, half-lapped 10 mil polyethylene tape.

2.9. 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.

2.10. 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. 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. Bolts and Nuts: Hot dipped galvanized or zinc-electroplated steel.
4. When pipe is field grooved, provide coupling manufacturer's grooving tools.
5. Manufacturers:
   a. Anvil International: www.anvilintl.com.
   b. Apollo Valves: www.apollovalves.com.
   c. Grinnell Products: www.grinnell.com.

C. No-Hub Couplings:

1. Gasket Material: Neoprene complying with ASTM C564.
2. Band Material: Stainless steel.
3. Eyelet Material: Stainless steel.
4. Manufacturers:
   a. MIFAB, Inc: www.mifab.com.
   b. Substitutions: See Section 01 6000 - Product Requirements.

D. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.11. 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.

B. Plumbing Piping - Drain, Waste, and Vent:

1. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis.

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. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.12. STRAINERS

A. Manufacturers:
1. Armstrong International, Inc: www.armstronginternational.com.
2. Green Country Filter Manufacturing: www.greencountryfilter.com.
3. WEAMCO: www.weamco.com.

B. 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.

C. 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

3.1. EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2. 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.

3.3. INSTALLATION

A. Install in accordance with manufacturer's instructions.
B. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.
C. Install piping to maintain headroom, conserve space, and not interfere with use of space.
D. Group piping whenever practical at common elevations.
E. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment. Refer to Section 22 0516.
F. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.
G. Provide access where valves and fittings are not exposed.
1. Coordinate size and location of access doors with Section 08 3100.
H. Provide support for utility meters in accordance with requirements of utility companies.
I. Excavate in accordance with Section 31 2316.
J. Backfill in accordance with Section 31 2323.
K. Install bell and spigot pipe with bell end upstream.
L. Install valves with stems upright or horizontal, not inverted. Refer to Section 22 0523.
M. Install water piping to ASME B31.9.
N. 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.

O. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.
2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
3. Provide copper plated hangers and supports for copper piping.

3.4. APPLICATION

A. Install gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

B. Install globe valves for throttling, bypass, or manual flow control services.

C. Provide spring-loaded check valves on discharge of water pumps.

D. Provide flow controls in water recirculating systems where indicated.

3.5. DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

3.6. 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, and sand strainer.

END OF SECTION

SECTION 22 1006 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Drains.

B. Cleanouts.

C. Hose bibbs.

D. Hydrants.

E. Backflow preventers.

F. Water hammer arrestors.

G. Mixing valves.

1.2. RELATED REQUIREMENTS

A. Section 22 1005 - Plumbing Piping.

B. Section 22 3000 - Plumbing Equipment.

C. Section 22 4000 - Plumbing Fixtures.

1.3. REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASME A112.6.3 - Floor and Trench Drains; 2019.

C. ASME A112.6.4 - Roof, Deck, and Balcony Drains; 2008 (Reaffirmed 2012).

D. ASSE 1011 - Performance Requirements for Hose Connection Vacuum Breakers; 2017.

E. ASSE 1012 - Performance Requirements for Backflow Preventers with an Intermediate Atmospheric Vent; 2009.

F. ASSE 1013 - Performance Requirements for Reduced Pressure Principle Backflow Preventers and Reduced Pressure Principle Fire Protection Backflow Preventers; 2011.

G. ASSE 1019 - Performance Requirements for Wall Hydrant with Backflow Protection and Freeze Resistance; 2011 (Reaffirmed 2016).

H. DIN 19580 - Drainage channels for vehicular and pedestrian areas - Durability, mass per unit area and evaluation of conformity; 2010.

I. NSF 61 - Drinking Water System Components - Health Effects; 2019.

J. NSF 372 - Drinking Water System Components - Lead Content; 2016.

K. PDI-WH 201 - Water Hammer Arresters; 2017.

1.4. 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. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

D. Operation Data: Indicate frequency of treatment required for interceptors.

E. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.5. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

PART 2 PRODUCTS

2.1. GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2. DRAINS

A. Roof Drains:

1. Description: refer to the plumbing drawings for roof drain requirements.
2. Body: Lacquered cast iron with sump.
3. Strainer: Removable polyethylene dome with vandal proof screws.

B. Downspout Nozzles:

1. Description: refer to the plumbing drawings for downspout nozzle requirements.

C. Floor Drains:

1. Description: Refer to the plumbing drawings for floor drain requirements.

D. Floor Trench Drain:

1. Description: Refer to the plumbing drawings for trench drain requirements.

E. Floor Sink:

1. Description: Refer to the plumbing drawings for floor sink requirements.

2.3. CLEANOUTS

A. Description: refer to the plumbing drawings for cleanout requirements.

2.4. HOSE BIBBS

A. Description: Refer to the plumbing drawings for hose bibb requirements.

2.5. SILLCOCKS

A. Description: Refer to the plumbing drawings for sillcock requirements.

2.6. BACKFLOW PREVENTERS

A. Description: Refo the plumboing drawings for backflow preventer requirements.

2.7. WATER HAMMER ARRESTORS

A. Manufacturers:

1. Cash Acme, a brand of Reliance Worldwide Corporation: www.cashacme.com.
2. Jay R. Smith Manufacturing Company: www.jayrsmith.com.
3. Watts Regulator Company, a part of Watts Water Technologies: www.wattsregulator.com.
4. Zurn Industries, LLC: www.zurn.com.

B. 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.

2.8. MIXING VALVES

A. Description: Refer to the plumbing drawings for thermostatic mixing valve requirements.

PART 3 EXECUTION

3.1. 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 lavatory sinks or quick-closing valve locations.

END OF SECTION

SECTION 22 3000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Domestic water heat exchangers.

B. Domestic hot water storage tanks.

C. Diaphragm-type compression tanks.

D. Water softeners.

E. In-line circulator pumps.

F. Pressure booster systems.

1.2. RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3. REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2019.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

C. NEMA MG 1 - Motors and Generators; 2018.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

E. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Product Data:

1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.

2. Indicate pump type, capacity, power requirements.

3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

4. Provide electrical characteristics and connection requirements.

C. Shop Drawings:

1. Indicate heat exchanger dimensions, size of tappings, and performance data.

2. Indicate dimensions of tanks, tank lining methods, anchors, attachments, lifting points, tappings, and drains.

D. Manufacturer's Instructions: Indicate _____

E. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

F. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.5. QUALITY ASSURANCE

A. Certifications:

1. Water Heaters: NSF approved.

2. Pressure Vessels for Heat Exchangers: ASME labeled to ASME BPVC-VIII-1.

3. Water Tanks: ASME labeled to ASME BPVC-VIII-1.
4. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

B. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.7. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide five year manufacturer warranty for domestic water heaters.

PART 2 PRODUCTS

2.1. DOMESTIC WATER HEAT EXCHANGERS

A. Description: Refer to the plumbing drawings for domestic water heat exchanger requirements.

2.2. DOMESTIC HOT WATER STORAGE TANKS

A. Description: Refer to the plumbing drawings for domestic hot water storage tank requirements.

2.3. WATER SOFTENERS

A. Description: Refer to the plumbing drawings for water softener requirements.

2.4. PRESSURE BOOSTER SYSTEMS

A. Description: Refer to the plumbing drawings for domestic water booster pump requirements.

2.5. ELECTRICAL WORK

A. Provide electrical motor driven equipment specified complete with motors, motor starters, controls, and wiring.

B. Electrical characteristics to be as specified or indicated.

C. Furnish motor starters complete with thermal overload protection and other appurtenances necessary for the motor control specified.

D. Supply manual or automatic control and protective or signal devices required for the operation specified, and any control wiring required for controls and devices not shown.

PART 3 EXECUTION

3.1. INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Coordinate with plumbing piping and related fuel piping work to achieve operating system.

C. Domestic Water Heat Exchangers:

1. Install domestic water heat exchangers with clearance for tube bundle removal without disturbing other installed equipment or piping.
2. Pipe relief valves and drains to nearest floor drain.

D. Domestic Water Storage Tanks:

1. Provide steel pipe support, independent of building structural framing members.
2. Clean and flush prior to delivery to site. Seal until pipe connections are made.

E. Pumps:

1. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

END OF SECTION

SECTION 22 4000 - PLUMBING FIXTURES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Water closets.

B. Urinals.

C. Lavatories.

D. Sinks.

E. Mop sinks.

F. Under-lavatory pipe supply covers.

G. Electric water coolers.

1.2. RELATED REQUIREMENTS

A. Section 06 4100 - Architectural Wood Casework: Preparation of counters for sinks and lavatories.

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.

1.3. REFERENCE STANDARDS

A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

B. ASHRAE Std 18 - Methods of Testing for Rating Drinking-Water Coolers with Self-Contained Mechanical Refrigeration; 2013.

C. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; 1997 (Reaffirmed 2017).

D. ASME A112.18.1 - Plumbing Supply Fittings; 2018, with Errata.

E. ASME A112.19.2 - Ceramic Plumbing Fixtures; 2018.

F. ASME A112.19.3 - Stainless Steel Plumbing Fixtures; 2017.

G. ASME A112.19.5 - Flush Valves and Spuds for Water Closets, Urinals, and Tanks; 2017.

H. ASSE 1070 - Performance Requirements for Water Temperature Limiting Devices; 2015.

I. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.

J. ITS (DIR) - Directory of Listed Products; current edition.

K. NSF 61 - Drinking Water System Components - Health Effects; 2019.

L. NSF 372 - Drinking Water System Components - Lead Content; 2016.

M. UL (DIR) - Online Certifications Directory; Current Edition.

1.4. 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.

1.5. 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.

1.6. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1. 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.

2.2. 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.

2.3. **WATER CLOSETS**

A. Description: Refer to the plumbing drawings for water closet requirements.

2.4. **URINALS**

A. Description: Refer to the plumbing drawings for urinal requirements.

2.5. LAVATORIES

A. Description: Refer to the plumbing drawings for Lavatory requirements.

2.6. SINKS

A. Description: Refer to the plumbing drawings for Sink requirements.

2.7. ELECTRIC WATER COOLERS

A. Description: Refer to the plumbing drawings for Electric Water Cooler requirements.

2.8. MOP SINKS

A. Description: Refer to the plumbing drawings for Mop Sink requirements.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2. PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3. 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.

3.4. INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5. ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6. CLEANING

A. Clean plumbing fixtures and equipment.

3.7. 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 22 4500 - EMERGENCY PLUMBING FIXTURES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Hand-held emergency drench hose.

B. Emergency-fixture water-tempering valves.

1.2. REFERENCE STANDARDS

A. ANSI Z358.1 - American National Standard for Emergency Eyewash and Shower Equipment; 2014.

B. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.

C. UL (DIR) - Online Certifications Directory; Current Edition.

1.3. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Manufacturer's catalog sheets for fixtures, fittings, accessories, and supplies.

PART 2 PRODUCTS

2.1. HAND-HELD EMERGENCY DRENCH HOSE

A. Description: Refer to the Plumbing Drawings for Emergency Drench Hose requirements.

B. ANSI Z358.1, 15 gallon drench hose with flanged spray head assembly.

C. Hose:

1. 8 feet long, flexible reinforced PVC with fitted male swivel water connection.
2. Maximum Working Pressure: 275 psi.

D. Handle: Full flow, self closing, quick to open plastic covered metal lever handle.

E. Tepid Supply Water Temperature: Set to 95 degrees F.

2.2. EMERGENCY-FIXTURE WATER-TEMPERING VALVES

A. Description: Refer to the plumbing drawing for Emergency-Fixture Water Tempering Valve requirements.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that fixtures and accessories are of the correct type and size prior to installation.

B. Verify that deck, wall and floor finishes are prepared and ready for fixture installation.

3.2. INSTALATION

A. Install fixtures and fittings in accordance with the manufacturer's instructions.

B. Adjust water flow rates to comply with manufacturer's rating of the fixture.

3.3. FIELD QUALITY CONTROL

A. Operational Tests: Upon completion and sterilization of plumbing systems, conduct operating tests to demonstrate satisfactory, functional, and operating efficiency.

3.4. CLEANING

A. Thoroughly clean plumbing fixtures and equipment.

3.5. PROTECTION

A. Protect installed products from damage due to subsequent construction operations.

B. Repair or replace products damaged before Date of Substantial Completion.

END OF SECTION

SECTION 23 0010 - MECHANICAL GENERAL REQUIREMENTS

PART 1 GENERAL

1.1. GENERAL

A. All work under this section shall comply with the contract requirements noted on the architectural drawings and/or specifications and shall include all mechanical sections specified herein. All work under this section shall comply with the contract requirements noted on architectural drawings and specifications general requirements.

B. All cavity spaces between ceiling and structure (plenum spaces) are to be considered return air plenums and all material installed in plenum shall be rated and UL listed for return air plenums.

C. Mechanical contractor shall schedule start-up session to start HVAC equipment. Schedule one full day of start-up at least two weeks prior to substantial completion.

1.2. RELATED REQUIREMENTS

A. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

1.3. WORK INCLUDED

A. Provide all labor, materials, equipment and tools required for completely finished and operational HVAC and mechanical systems to fulfill the design intent shown on the documents.

B. Work shall be of the finest quality of construction, materials and workmanship.

C. Install equipment in accordance with manufacturer recommendations.

D. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.

1. Commissioning agent is engaged to document the completion of the mechanical, life safety, and building control systems for the project. Section defines the role of each member of the commissioning team.

2. Comply with the requirements of Division 1 for the commissioning of the various building systems.

E. The plans are diagrammatic and generally show the locations of fixtures, equipment, ductwork and piping and shall not be scaled. Provide all offsets, fittings and components required for a complete system even if not explicitly called out on the drawings.

1.4. COORDINATION AND VERIFICATION

A. Refer to the architectural interior details, floor plans, elevations and other contract drawings as well as existing structural, mechanical, fire protection, electrical systems and other existing conditions. Coordinate work with that of the other trades to avoid interference.

B. All dimensions and existing conditions shall be field verified prior to the commencement of the work.

C. Contract Documents:

1. General: The Contract Documents are diagrammatic, showing certain physical relationships which must be established within the mechanical work and its interface with other work. Such establishment is the exclusive responsibility of the Contractor. Drawings shall not be scaled for the purpose of establishing material quantities.

2. When electronic CAD files or building information modeling (BIM) files have been provided to the contractor, the contractor shall only consider the files as design to only show the intent of the design. The contractor shall be responsible for the Coordination drawings based on the design.

3. Work out all “tight” conditions in advance of installation. If necessary, and before work proceeds in those areas, prepare coordination drawings showing all work in congested areas. Provide

additional work necessary to overcome congested conditions at no increase in contract sum or schedule.

4. Clearly indicate solutions to space problems. Identification of space problems without solutions is not acceptable. Only areas clearly identified will be reviewed.
5. Acceptance by the Architect/Engineer does not imply acceptance of any deviations from contract documents requirements or acceptance of uncoordinated work. Review is for general conformance to the design concept and general compliance with the information given in the contract documents.
6. Locate equipment requiring periodic servicing so that it is readily accessible. Provide means of service access, following appropriate manufacturer's recommended service clearance space or, as applicable, means of access using duct, wall, or ceiling access doors.
7. Install ductwork and piping to leave sufficient space for AHJ inspection of wall construction.
8. Supplemental Instructions: The exact location for some items in this Specification may not be shown on the Drawings. The location of such items may be established by the Engineer during the progress of the work.
9. If prevented by project conditions, prepare drawings showing proposed rearrangement of Work, including changes to Work specified in other sections. Obtain permission of Architect before proceeding.
10. Discrepancies:
    a. Examine Drawings and Specifications.
    b. Report any discrepancies to the Architect and obtain written instructions before proceeding.
    c. Should there be a conflict within or between the Specifications or Drawings, the more stringent or higher quality requirements shall apply.
    d. Items called for in either specifications or drawings shall be required as if called for in both.
    e. Be responsible for providing proper documentation of equipment product data and shop drawings to all entities providing service.

1.5. UTILITY DISRUPTIONS

A. Existing buildings and their facilities must remain functional while the Work under this Contract is performed. All system shutdowns and outages must be minimized, provided with temporary heating or cooling systems as part of the base bid and coordinated with the Owner.

B. Cause as little interference or interruption of existing utilities and services as possible. Schedule work which will cause interference or interruption a minimum of two weeks in advance with Owner, authorities having jurisdiction, and all affected trades.

C. The Contractor shall provide temporary or new services to all existing facilities and utility streams as required to maintain their proper operation when normal services are disrupted as a result of the work being accomplished under this project.

D. The time allowed for outages will not be during normal working hours unless otherwise approved by the Owner. All costs of outages, including any overtime charges for night and weekend work, and temporary systems shall be included in the contract amount.

1.6. CODES, REGULATIONS, FEES, PERMITS

A. Conform to the codes in force at the time of construction in the jurisdiction of the project.

B. Call for inspections from the authority having jurisdiction. If discrepancies exist between the contract documents and the local requirements, the more stringent shall apply.

C. Contractor shall obtain all required permits prior to the start of the project.

D. Post permits as required.

E. Contractor shall pay all permit fees, tap fees and inspection fees. Owner shall pay any required development fees.

1.7. PROTECTION

A. People

1. Comply with all applicable health and safety regulations. Set barricades and signs as necessary to minimize hazards for building occupants and trades.

2. Equipment, materials or other potential hazards to the public and working occupants of the building shall not be left overnight outside of the designated working or construction areas.

B. Work

1. Take all necessary measure to protect the work during and after installation to ensure that it will be unblemished, undamaged and clean when turned over to the owner.

C. Mechanical Systems

1. All specified filters shall be installed in air handling equipment prior to startup. Provide additional sets of filters during construction as required to maintain cleanliness of system.

2. In addition to specified filters, install a roughing filter upstream of mixed air filter. Roughing filter shall consist of two layers of roll filter media clipped and sealed to entering side of filter frame. Change roughing filter as necessary to minimize dust collection on specified filters.

3. Replace filters in existing and new mechanical equipment that was in use during construction prior to turn-over to owner.

4. During periods of excessive dust generation such as drywall sanding, seal off return and exhaust openings and grilles to prevent dust from accumulating in ductwork.

5. If outside air source contains less dust than building air, adjust A/C unit dampers to operate with as much outside air as possible without causing a freezing condition for coil or exceeding capacity of coil to adequately condition supply air.

6. Do not operate any air handling unit without all temporary construction filters, and scheduled filters, pre and final, installed.

7. Replace filters in existing and new mechanical equipment that was in use during construction prior to turn-over to owner.

D. Equipment and Materials

1. Deliver equipment in its original unbroken package to prevent damage or entrance of foreign matter. Perform all handling and shipping in accordance with manufacturer's recommendations. Provide protective coverings during construction. Identifying labels intact and legible.

2. Immediately upon delivery, identify and inspect materials and equipment delivered to Site to assure compliance with Contract Documents, approved submittals and reviewed Shop Drawings.

3. Protect from loss, damage, dust, water, etc., until notice of completion has been filed. Promptly replace lost, damaged or defective materials and equipment with new at no increase in Contract Sum. Remove damaged or defective materials from site.

4. Do not store equipment or materials outdoors unprotected. Remove improperly stored equipment and materials from site. Contractor shall provide storage in appropriate enclosed wharehouse as required at contractors expense.

5. Ductwork and piping shall be delivered to site with ends sealed. Seal shall remain in place until installed. Provide seal on end of all open ductwork and piping at end of day.

6. Refer to Division 1 for additional requirements.

1.8. OWNER-FURNISHED EQUIPMENT

A. All equipment called out in the Specifications or shown on the Drawings as "Owner-Furnished Equipment" or equipment furnished by other Divisions shall be installed and connected under this Contract. Provide all connection components as required, including but not limited to, reducers, pressure regulators, back-flow preventers, flexible connectors, unions, gauges, thermometers, and isolation valves as required by manufacturer's installation requirements or contract document details. Provide rough-ins for all future connections indicated.

1.9. CUTTING AND PATCHING

A. Cut and patch as necessary for the installation of the materials and equipment. Coordinate patching with the architectural contractor.

B. Do not cut any structural members without prior approval from the architect or structural engineer.

1.10. OPERATION AND MAINTENANCE MANUAL

A. Refer to Division 01 for O&M Manual requirements. Provide most stringent between items noted below and in Division 1. If there are no requirements in Division 1, the requirements below shall apply.

B. Upon substantial completion of the work, submit one O&M Manual to the engineer for review and comment. Respond to comments and submit a total of 3 copies of the O&M Manual to the architect upon project completion.

C. Manual shall be in a 3-ring binder with edge and front labels. Include a table of contents and include:

1. Final approved submittals indicating all model numbers, serial numbers, cut sheets, and all performance criteria on furnished equipment
2. Installation, Operation and Maintenance Instructions
3. Parts Lists
4. Test and Balance Report
5. Certificates of Inspection
6. Executed Warranties

D. Provide PDF format copy of O&M manual as noted above. PDF shall be bookmarked with titles per specification section and per piece of equipment within each section.

1.11. WARRANTIES

A. Provide a one year warranty on all mechanical work installed under contract. Provide an additional 4 year warranty for all refrigerant compressors installed.

B. Include executed warranties in O&M Manual.

C. Warranty shall include parts, labor, and shipping and shall cover any damage caused by failures in the covered mechanical systems.

1.12. RECORD DRAWINGS

A. Refer to Division 01 for requirements. At a minimum comply with the following requirements.

B. Maintain a set of redlined drawings at the jobsite with all changes to the Contract Documents, whether generated by addenda, change orders, or field conditions, and dimensioned locations of underground utilities. Maintain a daily record of these changes and keep current set of drawings showing these changes. Submit set of redlined drawings to the owner at project close-out.. Record changes and locations of installed systems drawn to scale and fully dimensioned, and as specified in Division 1, but a minimum of:

1. Work concealed behind or within other work, in an inaccessible arrangement.
2. Mains and branches of piping systems:

a. With valves and control devices located and numbered.

b. With concealed unions located.

c. With items requiring maintenance located (traps, strainers, expansion compensators, tanks, etc.) and clearly labeled.

3. Underground piping and ducts, both exterior and interior.

4. Ductwork layouts, including locations of coils, dampers, filters, boxes and similar units.

5. Concealed control system devices and sensors.

C. Deliver record drawings to Architect within 30 days of Substantial Completion.

1.13. DEMONSTRATION

A. Provide factory trained personnel to instruct operating staff in maintenance and adjustment and operation of mechanical equipment. Provide instruction during regular work hours prior to acceptance and turn over to operating staff. Scheduling of training shall be at owner's direction. Use operating and maintenance manual and updated as-constructed drawings for instruction purposes.

B. Demonstrate normal start-up and shut-down, emergency shut-down and seasonal change over. Review operation of safety devices and control systems.

C. Inspections and Tests:

1. Arrange for all required inspections and tests.

2. Pay all charges.

3. Notify Architect / Engineer two (2) business days before tests.

4. Submit one copy for Owner’s records of permits, licenses, inspection reports and test reports.

PART 2 PRODUCTS

2.1. SUBMITTALS

A. Bidders shall quote on brands and manufacturers of equipment as requested in these Specifications and Drawings. See appropriate section of the Contract Documents for requirements governing the prior approval process.

B. Coordinate submittals 3 weeks (min.) prior to expected order date so that work will not be delayed by submittals.

C. No extension of time will be allowed because of failure to properly coordinate and sequence submittals.

D. Submittals from subcontractors and equipment suppliers are to be carefully checked by the Contractor for space requirements and conformance to the Drawings and Specifications. These submittals shall be so noted by the Contractor prior to forwarding to the Architect/Engineer for checking. No deviations from the Drawings and Specifications will be allowed, recognized or considered unless brought to the attention of the Architect/Engineer at the time the submittals are submitted by the Contractor. Submittals not processed by the Contractor before forwarding to the Architect/Engineer for approval will be returned to the Contractor for his prior processing.

E. Submittal is for information and record, unless otherwise indicated, and is not a change order request.

F. Submitting Contractor is responsible for routing reviewed submittals to all parties affected including but not limited to electrical, structural, temperature control, and test and balance subcontractors.

G. Submittals shall include catalog cut-sheets with submitted products and options clearly identified, written descriptions, and specification sheets detailing the associated product, item and assembly.

H. No substitution for brands named in the Contract Documents will be considered unless written request has been submitted to the Engineer. Each such request shall include a complete description

of the proposed substitute, drawings, cut sheets, performance and test data, and any other data or information necessary for complete evaluation. The burden of proving acceptability of a proposed product rests on the party submitting the request for approval. Request for product approval substitutions shall be submitted in writing to the Engineer a minimum of ten (10) working days in advance of the bid date.

I. Shop drawings shall include details, installation drawings, assembly drawings, fabrication drawings, diagrams, and other information which show adaptation or installation of Contractor-furnished products or materials for overall project.

J. The purpose of submittals and shop drawings is to ensure Contractor understands design requirements and demonstrates understanding by indicating and detailing intended materials, methods, and installation practices. Submittals and shop drawings are not a method of requesting substitutions or deviation from Specifications. If discrepancies between submittals, shop drawings, and Contract Documents are discovered either prior to or after submittals and shop drawings are reviewed, requirements of Contract Documents shall take precedence.

K. Catalog numbers referenced throughout the Division 23 Drawings and Specifications are intended to convey a general understanding of the type and quality of the product required. Where written descriptions differ from information conveyed by a catalog number, the written description shall govern. No extra shall be allowed because a catalog number is found to be incomplete or obsolete.

L. Group complete information of related systems, products, and accessories in a single submittal. If submitted as a hard copy, submittals shall be submitted in a three-ring binder, with separate sections for each type or category of equipment, with labeled tabs indicating the contents of the section. If submitted electronically, the submittal shall be in a PDF file with each section bookmarked with labels. Within each section, each sub item or equipment tag shall be bookmarked with a corresponding tag.

M. In the front of each submittal binder, the Mechanical Contractor shall include a signed letter from the project Electrical Contractor indicating that the Electrical Contractor has reviewed the mechanical submittals and has verified that the equipment being submitted will conform to the design of the project electrical systems.

N. After Architect/Engineer review, submittals and shop drawings will be returned together with Submittal Review Sheet which indicates comments on submittals and shop drawings and with specific actions such as "No Exception Taken", "Make Corrections Noted", "Rejected", and "Resubmit". Continue to resubmit submittals and shop drawings until "No Exception Taken" or "Make Corrections Noted-Resubmittal Not Required" action is indicated.

O. Resubmittals will be reviewed for compliance with comment made on the original submittal only. Clearly identify replied-to comments with a resubmittal number and date. If any other changes are made that are not in reply to comments, clearly identify the changes. Indicate dates of previous submissions and submittal numbers. Direct specific attention to any changes made in addition to those made in reply to previous review comments.

P. If more than two submittals (either for products, materials, shop drawings, record drawings, or test and balance reports) are made by the Contractor of basis of design, listed general equivalents or substitutions, the Owner reserves the right to charge the Contractor for subsequent reviews by their consultants at their consultants current published hourly rate. Such extra fees may be deducted from payments by the Owner to the Contractor.

Q. Refer to individual specification sections for submittal requirements. However, a minimum, shop drawings shall be submitted for each of the following items as applicable to the project:

1. Air Distribution Devices
2. Air Handling Units
3. Automatic Dampers

4. Automatic Flow Control Valves
5. Boilers
6. Chillers
7. Cooling Towers
8. Condensing Units
9. Controls & Control Diagrams including Wiring Plans
10. Duct Access Doors/Panels
11. Ductwork & Ductwork Construction
12. Electric Heaters
13. Fans
14. Fire & Smoke Dampers
15. Flexible Ductwork
16. Hot Water Unit Heaters
17. HVAC Pipe Accessories
18. Manual Dampers
19. Pipe & Duct Insulation & Accessories
20. Pipe Accessories
21. Pipe and Pipe Fittings
22. Pipe Hangers, Supports & Accessories
23. Pipe Identification Systems
24. Pressure Gauges
25. Pressure Reducing Valves
26. Pumps
27. Relief Valves
28. Roof Curbs
29. Thermometers
30. Air Terminal Units
31. Vibration Isolation Equipment

2.2. HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," "Rectangular Duct Hangers Minimum Size," "Minimum Hanger Sizes for Round Duct."

D. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.
2. Supports for Stainless-Steel Ducts: Stainless-steel shapes and plates.
3. Supports for Aluminum Ducts: Aluminum or galvanized steel coated with zinc chromate.

E. Fasteners for all galvanized, stainless steel or aluminum supports shall be stainless steel.

F. All galvanized supports with coating damaged by drilling, cutting, welding or other means shall be coated with two coats of cold-galvanizing.

2.3. EQUIPMENT SUPPORTS

A. Structural steel for supports: ASTM A36.

B. Use galvanized members installed in fan plenums or areas of high humidity or condensation, and outside. All fasteners shall be stainless steel. Any damage caused by cutting, drilling, or welding or any other means to galvanized surface must be repaired by apply two coats of cold-galvanizing.

C. Furnish other members with shop coat of red primer.

D. Retouch primer after field welding.

E. Cut, fit, and place miscellaneous metal supports accurately in location, alignment, and elevation to properly support and anchor HVAC materials and equipment.

F. Comply with AWS D1.1 for field welding.

2.4. SLEEVES

A. Sleeve Material

1. Concrete floors, concrete and masonry walls: ASTM A 53, Type E, Grade B, schedule 40 black steel pipe.

2. Drywall partitions: 18 gauge galvanized steel sheet metal.

B. Sleeves shall be sized such that the annular space between outside surface of pipe or pipe insulation and the inside surface of the sleeve is not less than 1/2". Increase space as required to allow for uninterrupted insulation and free longitudinal movement. Provide larger annular space if required by firestopping product installation instructions.

C. Sleeves through floor assemblies shall extend 4" above the slab and provide a watertight seal .

D. Stack Sleeve Fittings: Manufactured, cast-iron sleeve with integral clamping flange. Include clamping ring and bolts and nuts for membrane flashing.

1. Underdeck Clamp: Clamping ring with set screws.

2.5. GROUT

A. Description: ASTM C 1107, Grade B, nonshrink and nonmetallic, dry hydraulic-cement grout.

B. Characteristics: Post-hardening, volume-adjusting, nonstaining, noncorrosive, nongaseous, and recommended for interior and exterior applications.

C. Design Mix: 5000-psi, 28-day compressive strength.

D. Packaging: Premixed and factory packaged.

2.6. ESCUTCHEONS

A. Split-casting, cast-brass type with chrome finish, with concealed hinge and set screw with an ID to closely fit around pipe, tube and insulation of insulated piping and an OD that completely covers opening.

2.7. WALL AND CEILING ACCESS PANELS

A. Style and type as required for material in which installed.

B. Size: 24"x24" minimum, as indicated, or as required to allow inspection, service and removal of items served.

C. 14 gauge minimum sheet metal for doors, 16 gauge frames of cadmium-plated or galvanized construction. Doors shall have expanded plaster rings where located in plaster walls or flanged finish where located in drywall or block construction.

D. For all doors installed outside, in ambient conditions, in wet areas, or in areas of high humidity , door shall be aluminum construction. Areas included, but not limited to, are outside air plenums, unconditioned penthouses, bathrooms, and kitchens. Door shall be a minimum of 1/8" thick aluminum with ¼" extruded aluminum frame with mitered and welded corners. Hinge shall be continuous stainless steel.

E. Panels shall have spring hinges with screwdriver locks in non-public areas. Key lock, keyed alike, for panels in public areas.

F. Prime painted or rust inhibitive paint finish.

G. UL labeled when in fire-rated construction, 1-1/2 hour rating.

H. Provide in walls, floors, and ceilings to permit access to all equipment and piping requiring service or adjustment. Examples of such equipment needing access are fire and/or smoke dampers, mechanical system valves, and equipment needing periodic or replacement maintenance.

I. Furnish and locate access panels under this Division. Coordinate with trades who are responsible for building system in which panels are to be installed.

J. Acceptable manufactures: Milcor, Nystrom, Karp, J.L. Industries, or Williams Brothers.

1. For masonry and drywall construction: Milcor Style M.
2. For plastered masonry walls and ceiling: Milcor Style K.
3. For ceramic tile or glazed structural tile: Use stainless steel panels.
4. For aluminum doors: Milcor Style CT, downward swing door.

PART 3 EXECUTION

3.1. DEMOLITION

A. The Contractor shall be responsible for loss or damage to the existing facilities caused by him and his workmen, and shall be responsible for repairing or replacing such loss or damage. The Contractor shall send proper notices, make necessary arrangements, and perform other services required for the care, protection and in-service maintenance of all mechanical services for the new and existing facilities. The Contractor shall erect temporary barricades, with necessary safety devices, as required to protect personnel from injury, removing all such temporary protection upon completion of the work.

B. The Contractor shall modify, remove, and/or relocate all materials and items so indicated or as required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Survey the project with the Owner's Representative before demolition begins and determine all materials that the Owner specifically chooses to be salvaged. Pre-establish with the Owner locations where salvaged materials are to be stored. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion and upon the approval of the Owner, substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

C. All items that are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.

D. When items scheduled for relocation are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner to such items and receive further instructions before removal. Items damaged in repositioning operations are the Contractor's

responsibility and shall be repaired or replaced by the Contractor as approved by the Owner, at no additional cost to the Owner.

E. Ductwork, service lines and piping to items to be removed, salvaged, or relocated shall be removed to points indicated on the Drawings, specified, or acceptable to the Owner. Utilities and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Owner. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner as herein above specified.

1. Piping to Be Removed: Remove portion of piping indicated to be removed and cap or plug remaining piping with same or compatible piping material.
2. Ducts to Be Removed: Remove portion of ducts indicated to be removed and plug remaining ducts with same or compatible ductwork material. Insulate to match existing to remain duct if required and seal to existing to maintain vapor barrier.
3. Equipment to Be Removed: Disconnect and cap services and remove equipment.
4. Equipment to Be Removed and Reinstalled: Disconnect and cap services and remove, clean, and store equipment; when appropriate, reinstall, reconnect, and make equipment operational.
5. Equipment to Be Removed and Salvaged: Disconnect and cap services and remove equipment and deliver to Owner.
6. Insulation: If duct, pipe or equipment insulation to remain is damaged in appearance, performance or is unserviceable, remove damaged or unserviceable portions and replace with new products of equal capacity and quality. Seal vapor barrier from new to existing.

F. Certain work during the demolition and alteration phase of construction may require overtime or nighttime shifts or temporary evacuation of the occupants. Coordinate times with the Owner. All overtime costs shall be part of the contract, including any Sunday work.

G. Include in the contract price all rerouting of existing ductwork, piping, air devices, fixtures, and similar items and the reconnecting of existing fixtures and devices as necessitated by field conditions to allow the installation of the new systems regardless of whether or not such rerouting, reconnecting or relocating is shown on the Drawings. Furnish all temporary ductwork and piping, and similar items as required to maintain service for the existing areas with a minimum of interruption.

H. Within the remodeled or alteration areas where existing ceilings are being removed and new ceilings are installed, all existing air devices, other ceiling mounted devices and their appurtenances shall be removed and reinstalled into the new ceiling, unless otherwise shown or specified.

I. Within the remodeled or alteration areas where existing walls are being removed, all existing fixtures, thermostats, other materials and equipment and their appurtenances shall be removed and relocated if necessary where required by the remodel work either shown or specified.

J. All existing air devices materials, equipment and appurtenances not included in the remodel or alteration areas are to remain in place and shall remain in service.

K. Mechanical equipment and building systems equipment, and similar items which are to remain but which are served by controls, ductwork or piping that is disturbed by the remodeling work, shall be reconnected in such a manner as to leave it in proper operating condition.

L. Any salvageable equipment as determined by the Owner, shall be delivered to the Owner, and placed in storage at the location of his choice. All other debris shall be removed from the site immediately and recycled or disposed of legally.

3.2. INSTALLATION

A. Execute work such that all components function together as a complete, workable system. Make slight alterations necessary to make adjustable parts fit with fixed parts. Execute work to contribute to efficiency of operation, accessibility, sightliness, and minimum maintenance clearances. Leave equipment properly adjusted and in working order.

B. Verify dimensions indicated and report any error or inconsistency before commencing work.

C. Coordinate work with other trades through the General Contractor so that equipment, especially in the ceiling, will fit to patterns of finished materials, and locate all elements to carry harmony of architectural design throughout the building. Coordinate work with other trades to avoid conflicts, especially in places where close, careful fitting is required. Coordination problems and field solutions must be approved through the General Contractor and the Architect/Engineer before proceeding with work.

D. Conform and accommodate systems to the building structure, equipment and usage so that they do not interfere with the operation of any other system or operational part of the building.

E. Preparation: Final installation of materials and equipment shall be based on actual dimensions and conditions at the job site. Field measure for materials or equipment requiring exact fit.

F. Workmanship: Perform work in accordance with good commercial practice and all applicable trade standards, including current SMACNA standards. The finished appearance of the work shall be of equal importance with its mechanical efficiency.

G. Clearances: The Subcontractors working under this Division shall be responsible for the sufficiency of the size of shafts and chases, and clearances in double partitions and hung ceilings for proper equipment installation. Cooperate with Contractors of other Divisions whose work is in the same space and advise the General Contractor of requirements. Such spaces and clearances shall be kept to the minimum size required.

1. Install equipment, ductwork, piping and accessories:
    a. Straight and true.
    b. Aligned with other work and with general lines of the building.
    c. Concealed in occupied spaces, unless noted otherwise.
    d. Out-of-the-way with maximum passageway and headroom remaining in each space.
2. Except as otherwise indicated, arrange mechanical services and overhead equipment to not obstruct windows, doors or other openings. Clearance shall be a minimum of:
    a. 7'-6" headroom in mechanical spaces.
    b. 9'-6" headroom in unfinished or shell spaces.
3. Give the right-of-way to piping systems required to slope for drainage (over other service lines and ductwork).

H. Locate all equipment which must be serviced, operated or maintained in fully accessible positions. Equipment shall include, but not be limited to, valves, shock absorbers, traps, cleanouts, motors, controllers, switchgear, drain points, manual dampers, and smoke and fire dampers. If required for accessibility, the Contractor shall furnish access doors for this purpose, subject to the following:

1. Access door shall be sized to permit removal of equipment, or 24"x24" if used for service only.
2. Furnish doors to trades performing work in which they are to be installed. Group valves, devices and other equipment to permit use of minimum number of access doors.
3. Doors shall be lockable and suitable for painting to match adjacent finishes.

I. Minor deviations from the Drawings may be allowed to provide for better equipment accessibility. The General Contractor shall approve of any change prior to this Contractor making the change.

J. Properly locate anchors, chases, recesses and openings required for the proper installation of the work. Arrange with the proper contractors for the building of anchors, etc., and for the leaving of the required chases, recesses and openings in sufficient time to be installed in the normal course of work. Install equipment and materials in accordance with manufacturer recommendations unless specifically indicated otherwise, or where local codes or regulations take precedence. This includes the performance of tests the manufacturer recommends. It is intended that anything, whether labor or materials, which is usually furnished as a part of any equipment specified and which is necessary for the best operation shall be furnished as a part of the contract without additional cost, whether or not shown or described.

K. Anchor and secure all equipment to the building substrate and structure. Provide all supplemental steel, anchors and attachments as required to properly support and anchor materials in this division.

L. Erect, install, and secure components in a structurally sound and appropriate manner.

M. Where necessary, temporarily brace, shore, or otherwise support members until final connections are installed.

N. Leave all temporary bracing, shoring, or other structural supports in place as long as practical for safety and to maintain proper alignment.

O. Handle materials in a manner to prevent scratching, abrading, distortion, chipping, breaking, or other disfigurement.

P. Conduct work in a manner to avoid injury or damage to previously placed work. Any work so impaired or damaged shall be replaced at no expense to Owner.

Q. Fabricate and install materials true to line, plumb, and level.

R. Leave finished surfaces smooth and flat, free from wrinkles, warps, scratches, dents, and other imperfections.

S. Testing: See individual Specification sections in Division 23 for testing of mechanical work.

T. Protection: Cover and seal ends of pipe and ductwork during construction to prevent entry of foreign material and moisture. Protect insulation against dirt, water, chemical or mechanical damage before, during and after installation. Protect fixtures and equipment against damage during mechanical work. All air handling equipment shall be fitted with all specified filters prior to any startup or operation. Provide additional sets of filters during construction as required to maintain cleanliness of system. Filter to be as scheduled or at a minimum high-quality, 30% min. efficient pleated filters. The use of "construction filters" is NOT authorized. Failure to provide required filters will cause the contractor to provide, at their own cost, the services of an independent third party provider to clean and sterilize all contaminated duct systems.

U. Freeze Protection: Do not run piping in outside walls, or locations where freezing may occur. Piping next to outside walls shall be in furred spaces with insulation between the piping and the outside wall. Insulation of piping shall not be considered freeze protection. Water piping exposed to freezing conditions shall be insulated as specified, with aluminum weather jacket and electric heating cable, thermostatically controlled, as specified under 23 0533. Heat tracing shall be coordinated with Electrical Contractor and installed on all exterior water piping, per applicable Division 23 and 26 Specifications.

V. Scaffolding, Rigging and Hoisting: Provide all scaffolding, rigging, hoisting and services necessary for erection and delivery into the premises of any equipment and apparatus furnished; remove same from premises when no longer required.

W. Wherever possible, arrange for the movement and positioning of equipment so that enclosing partitions, walls and roofs will not be delayed or need to be removed. Otherwise, advise General Contractor of opening requirements to be maintained for the subsequent entry of equipment.

X. Coordinate the movement of heavy items with shoring and bracing so that the building structure will not be overloaded during the movement and installation.

Y. Where products to be installed on an existing roof are too heavy to be hand-carried, do not transport across the existing roof deck; position by crane or other device so as to avoid overloading the roof deck.

Z. Materials and apparatus required for the work to be new, of first-class quality, and to be furnished, delivered, installed, connected and finished in every detail. Equipment shall be selected and arranged such that it fits properly into the building space provided. Where no specific kind or quality of material is given, a first-class standard article shall be furnished.

AA. Equipment start-up and adjustment of all HVAC equipment and water heaters shall be performed by certified factory representatives of the respective equipment manufacturer.

AB. Furnish the services of an experienced superintendent, who will be constantly in charge of installation of the work, together with all skilled tradesmen, fitters, helpers and labor required to unload, transfer, erect, connect, adjust, start, operate and test each system.

3.3. HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Hangers and Supports."

B. Hangers Exposed to View: Threaded rod and angle or channel supports. Coordinate with Architect for required painting of exposed supports.

3.4. THROUGH PENETRATIONS

A. References:

1. ASTM E 814: Standard Test Methods for Fire Tests of Through-Penetration Firestops.
2. UL 1479 Standard for Fire Tests of Through-Penetration Firestops, including optional air leakage test.

B. Non-Rated Walls

1. All penetrations through concrete or masonry walls shall be sleeved with a steel standard weight pipe sleeve which shall be grouted in place. Closures shall be provided between the pipe and sleeve wherever an exterior wall or is penetrated. Use Link-Seal modular rubber seals as manufactured by Thunderline Corp., Wayne, Michigan.

C. Fire Resistance Rated Assemblies

1. Performance Requirements
   a. Penetrations: Provide through-penetration firestop systems that are installed to resist the spread of fire, passage of smoke and other hot gases according to requirements indicated, to restore the original fire-resistance rating of assembly penetrated.
      1) Install complete through penetration firestop systems that have been tested and are listed by recognized testing agencies per ASTM E 814 or UL 1479 fire tests in a configuration that is representative of site conditions.
      2) F-Rated Systems: Install through-penetration firestop systems with F-ratings indicated, as determined per ASTM E 814 or UL 1479, but not less than the fire resistance rating of the assembly being penetrated.
      3) T-Rated Systems: Install through-penetration firestop systems with T-ratings indicated, as well as F-ratings, as determined per ASTM E 814 or UL 1479, where required by the Building Code.
      4) L-Rated Systems: Install through-penetration firestop systems with L-ratings as determined by UL 1479 and as required by the owner, architect or Authority Having Jurisdiction.

5) W-Rated Systems: Install through-penetration firestop systems meeting W-Rating Class 1 Requirements as determined by the UL Water Leakage Test for systems tested and listed in accordance with UL 1479 and as required by the owner, architect or Authority Having Jurisdiction.

6) For piping penetrations for plumbing and wet-pipe sprinkler systems, provide moisture-resistant through-penetration firestop systems.

7) For penetrations involving insulated piping, provide through-penetration firestop systems not requiring removal of insulation.

2. Schedules

a. Unless otherwise noted on the drawings. Provide the fire stop systems or their approved equal as listed below:

1) Metallic Pipe, Metallic Ductwork, Non-Metallic Pipe smaller than 2".

2) a. 3M Fire Barrier Sealant CP 25WB+:

3) b. Material Description: Intumescent latex/water based caulk

4) c. Formulation: No-sag, non-halogen formula. Fast drying. Paintable

5) d. Water Resistance: Provide water resistant seal

6) Non-Metallic Pipe 2"-4"

7) a. 3M Fire Barrier FS-195+ Wrap/Strip with 3M Fire Barrier RC-1 Restricting Collar:

8) b. FS-195+ Material Description: One-part, organic/inorganic intumescent elastomeric strip with foil on one side.

3. Installation of Through-Penetration Firestop Systems

a. General

1) Install through-penetration firestop systems to comply with "Performance Requirements" above and firestop systems manufacturer's written installation instructions and published drawings for products and applications indicated.

2) Install forming/damming/backing materials and other accessories of types required to support fill material during their application and in the position needed to produce cross-sectional shapes and depths required to achieve fire ratings indicated. After installing fill materials, remove combustible forming materials and other accessories not indicated as permanent components of firestop system.

3) Install fill materials for firestop systems by proven techniques to produce the following results:

4) Fill voids and cavities formed by openings, forming materials, accessories and penetrating items as required to achieve the fire-resistance ratings indicated.

5) Apply materials so they contact and adhere to substrates formed by openings and penetrating items.

b. For fill materials that will remain exposed after completing work, finish to produce smooth, uniform surfaces that are flush with adjoining surfaces.

c. Watertight. Meets UL Water Leakage Test - Class 1 requirements for systems tested and listed in accordance with the criteria of ASTM E 814 (UL 1479) Standard Test Method for Fire Tests of Through-Penetration Fire Stops. W Rating - Class 1 requirements include a minimum water column exposure of 3 ft. for 72 hours prior to the standard time / temperature curve for the fire test.

4. Field Quality Control

a. Proceed with enclosing through-penetration firestop systems with other construction only after inspection and approval by Authority Having Jurisdiction.

b. Where deficiencies are found, repair or replace through-penetration firestop systems so they comply with requirements.

3.5. GROUTING

A. Mix and install grout for HVAC equipment base bearing surfaces, pump and other equipment base plates, and anchors.

B. Clean surfaces that will come into contact with grout.

C. Provide forms as required for placement of grout.

D. Avoid air entrapment during placement of grout.

E. Place grout, completely filling equipment bases.

F. Place grout on concrete bases and provide smooth bearing surface for equipment.

G. Place grout around anchors.

H. Cure placed grout.

3.6. CLEANING

A. Cleaning During Construction and Final Cleaning: Comply with General Requirements.

B. Clean exposed surfaces of piping, hangers, ducts and other exposed items of grease, dirt or other foreign material. Clean and polish plumbing fixtures, fittings, and exposed plated piping. Leave clean and free from paint, grease, dirt, etc. Remove labels from exposed equipment. Carefully and thoroughly clean all items of equipment. If finishes have been damaged, refinish to original condition using factory-provided matching paint, and leave all equipment in proper working order and intended appearance. At the completion of the work, remove all rubbish, cleaning supplies and debris resulting from the operation and leave spaces clean and ready to use.

C. Replace air filters in all equipment immediately prior to Owner's Date of Acceptance. Clean ducts, blowers and coils if units were operated without filters at any time during construction. Provide one (1) complete set of clean filters to Owner at project turnover.

D. Flush all piping systems free of foreign substances before installing valves or making final connections. Notify the Owner/Architect seven (7) days in advance of final flushing so that Owner/Architect may attend and verify the cleanliness of the pipe.

3.7. MECHANICAL SERVICE AND MAINTENANCE

A. Include four (4) complete service and maintenance calls plus emergency calls spaced at reasonable intervals throughout one (1) year warranty period. During each maintenance call, technicians shall:

1. Verify proper working order of safety devices on each piece of equipment.
2. Check lubrication of all moving parts and lubricate as necessary.
3. Adjust V-belt drives for proper belt tension.
4. Verify proper operating temperatures, pressures, flows, etc. for each major piece of equipment.

END OF SECTION

SECTION 23 0513 - COMMON MOTOR REQUIREMENTS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1. SECTION INCLUDES

A. General construction and requirements.

B. Applications.

C. Single phase electric motors.

D. Three phase electric motors.

E. Electronically Commutated Motors (ECM).

F. General requirements for general-purpose, horizontal, small and medium, squirrel-cage induction motors for use on ac power systems up to 600 V and installed at equipment manufacturer's factory or shipped separately by equipment manufacturer for field installation.

1.2. RELATED REQUIREMENTS

A. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3. REFERENCE STANDARDS

A. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2017.

B. IEEE 841 - IEEE Standard for Petroleum and Chemical Industry- Premium Efficiency, Severe-Duty, Totally Enclosed, Fan-Cooled (TEFC) Squirrel Cage Induction Motors UP to and Including 370 kW (500 HP), 2009.

C. NEMA MG 1 - Motors and Generators; 2018.

D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide wiring diagrams with electrical characteristics and connection requirements.

C. Test Reports: Indicate test results verifying nominal efficiency and power factor for three phase motors larger than 1/2 horsepower.

D. Manufacturer's Installation Instructions: Indicate setting, mechanical connections, lubrication, and wiring instructions.

E. Operation Data: Include instructions for safe operating procedures.

F. Maintenance Data: Include assembly drawings, bearing data including replacement sizes, and lubrication instructions.

1.5. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture of electric motors for Commercial use, and their accessories, with minimum three years documented product development, testing, and manufacturing experience.

B. Comply with NFPA 70.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

1.7. COORDINATION

A. Coordinate features of motors, installed units, and accessory devices to be compatible with the following:

1. Motor controllers.
2. Torque, speed, and horsepower requirements of the load.
3. Ratings and characteristics of supply circuit and required control sequence.
4. Ambient and environmental conditions of installation location.

PART 2 PRODUCTS

2.1. GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:

1. Motors 1/2 HP and Smaller: 120 volts, single phase, 60 Hz.
2. Motors Larger than 1/2 Horsepower: 208 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. Severe-Duty Motors: Comply with IEEE 841.

D. 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.

E. 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.

2.2. 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, multi-speed motors: Variable torque, permanent split-capacitor type.

C. Single phase motors 1/20 HP and smaller: Shaded-pole type.

D. Single phase motors for shaft mounted fans, oil burners, and centrifugal pumps: Split phase type.

E. Single phase motors for shaft mounted fans or blowers: Permanent split capacitor type.

F. Single phase motors for fans, pumps, blowers, and air compressors: Capacitor start type.

G. Single phase motors for fans, blowers, and pumps: Capacitor start, capacitor run type.

H. Motors located in exterior locations, wet air streams downstream of sprayed coil dehumidifiers, draw through cooling towers, air cooled condensers, humidifiers, direct drive axial fans, roll filters, explosion proof environments, and dust collection systems: Totally enclosed type.

I. Motors located in outdoors, in wet air streams downstream of sprayed coil dehumidifiers, in draw through cooling towers, and in humidifiers: Totally enclosed weatherproof epoxy-treated type.

J. Motors located outdoors and in draw through cooling towers: Totally enclosed weatherproof epoxy-sealed type.

K. Bearings: Preluricated, antifriction ball bearings or sleeve bearings suitable for radial and thrust loading.

L. Thermal Protection: Internal protection to automatically open power supply circuit to motor when winding temperature exceeds a safe value calibrated to temperature rating of motor insulation. Thermal protection device shall automatically reset when motor temperature returns to normal range.

2.3. SINGLE PHASE POWER - SPLIT PHASE MOTORS

A. Starting Torque: Less than 150 percent of full load torque.

B. Starting Current: Up to seven times full load current.

C. Breakdown Torque: Approximately 200 percent of full load torque.

2.4. SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.5. SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

2.6. THREE PHASE POWER - INDUCTION MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Comply with NEMA MG 1 for Design B motors.

E. Rotor: Random-wound, squirrel cage.

F. Service Factor: 1.15.

G. Multispeed Motors: Separate winding for each speed.

H. Insulation System: NEMA Class B or better.

I. Temperature Rise: Match insulation rating.

J. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

K. Motor Frames: NEMA Standard T-Frames of cast iron for motor frame sizes 324T and larger and rolled steel for motor frame sizes smaller than 324T with end brackets of cast iron or aluminum with steel inserts.

L. Code Letter Designation:

1. Motors 15 HP and larger: NEMA starting Code F or Code G.
2. Motors Smaller than 15 HP: Manufacturer's standard starting characteristic.

M. Thermistor System (Motor Frame Sizes 254T and Larger): Three PTC thermistors embedded in motor windings and epoxy encapsulated solid state control relay for wiring into motor starter; refer to Section 26 2913.

N. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

O. Sound Power Levels: To NEMA MG 1.

P. Part Winding Start Where Indicated: Use part of winding to reduce locked rotor starting current to approximately 60 percent of full winding locked rotor current while providing approximately 50 percent of full winding locked rotor torque.

Q. Weatherproof Epoxy Sealed Motors: Epoxy seal windings using vacuum and pressure with rotor and starter surfaces protected with epoxy enamel; bearings double shielded with waterproof non-washing grease.

R. Motors Used with Variable Frequency Controllers: Ratings, characteristics, and features coordinated with and approved by controller manufacturer.

1. Windings: Copper magnet wire with moisture-resistant insulation varnish, designed and tested to resist transient spikes, high frequencies, and short time rise pulses produced by pulse-width modulated inverters.
2. Energy- and Premium-Efficient Motors: Class B temperature rise; Class F insulation.
3. Inverter-Duty Motors: Class F temperature rise; Class H insulation.
4. Thermal Protection: Comply with NEMA MG 1 requirements for thermally protected motors.

S. Efficiency: Energy efficient as define in NEMA MG 1.

2.7. 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.
   b. Power Roof Ventilator (PRV):
      1) Operating Mode: Constant cfm.
      2) Input: Motor manufacturer to coordinate control requirements with the control board of the PRV and/or specified sequence of operation.
      3) Shaft Extension: Single.
   c. Hydronic Pump:
      1) Operating Mode: Constant speed.
      2) Input: Motor manufacturer to coordinate control requirements with the control board of the hydronic pump and/or specified sequence of operation.
      3) Flange Configuration: "C".

PART 3 EXECUTION

3.1. 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

SECTION 23 0516 - EXPANSION FITTINGS AND LOOPS FOR HVAC PIPING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Flexible pipe connectors.

B. Expansion joints and compensators.

C. Pipe loops, offsets, and swing joints.

1.2. RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

1.3. REFERENCE STANDARDS

A. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2015a (Reapproved 2019).

B. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2014).

C. EJMA (STDS) - EJMA Standards; Tenth Edition.

1.4. 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. Maintenance Data: Include adjustment instructions.

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 Packing for Packed Expansion Joints: One set for each joint.

PART 2 PRODUCTS

2.1. FLEXIBLE PIPE CONNECTORS - STEEL PIPING

A. Manufacturers:

1. Mercer Rubber Company.

2. The Metraflex Company.

B. Inner Hose: Bronze.

C. Exterior Sleeve: Single braided, stainless steel.

D. Pressure Rating: 125 psi and 450 degrees F.

E. Joint: Flanged.

F. Size: Use pipe sized units.

G. Maximum offset: 3/4 inch on each side of installed center line.

2.2. EXPANSION JOINTS - FLEXIBLE METAL HOSE (BRONZE)

A. Manufacturers:

1. Mercer Rubber Company; Model.

2. Metraflex Company; Model [MN]: www.metraflex.com.

3. [Unaflex, LLC.].
4. [U.S. Bellows, Inc.].
5. [Flexicraft Industries: Model N].

B. Manufacturered assembly with inlet and outlet 120 degree elbow fittings, two flexible-metal-hose legs joined by a 60 degree elbow.

C. Inner Hose: Corrugated bronze.

D. Exterrior Sleeve: Braided bronze.

E. Pressure Rating: 250 psi and 400 degrees F.

F. Maximum Compression:

G. Maximum Extension:

H. Maximum Offset:

I. Joint: Threaded.

J. Size: Use pipe sized units.

K. Application: Steel piping 2 inch diameter and smaller.

2.3. EXPANSION JOINTS - FLEXIBLE METAL HOSE (STAINLESS STEEL)

A. Manufacturers:

1. Mercer Rubber Company/Mason Industires; Model VEE: www.mercer-rubber.com.
2. Metraflex Company; Model MetraLoop ML: www.metraflex.com.
3. Flexicraft Industries: Model ML.
4. Hyspan Precision Products, Inc.; Series 4500.

B. Manufacturered assembly with inlet and outlet 45, 60, or 90 degree elbow fittings, two flexible-metal-hose legs joined by a 90, 120, or 180 degree elbow.

C. Inner Hose: Corrugated stainless steel.

D. Exterior Sleeve: Braided stainless steel.

E. Pressure Rating: 125 psi and 400 degrees F.

F. Maximum Compression: 4 inches.

G. Maximum Extension: 4 inches.

H. Maximum Offset: 4 inches.

I. Joint: Flanged.

J. Size: Use pipe sized units.

K. Application: Steel piping 2-1/2 inch diameter and greater.

2.4. EXPANSION JOINTS - STAINLESS STEEL BELLOWS TYPE

A. Manufacturers:

1. Metraflex Company; Model MN: www.metraflex.com.
2. Unaflex, LLC..
3. U.S. Bellows, Inc..
4. Flexicraft Industries: Model N.

B. Pressure Rating: 125 psi and 400 degrees F.

C. Maximum Compression: 1-1/2 inches.

D. Maximum Extension: 3/4 inch.

E. Joint: Flanged.

F. Application: Steel piping 2-1/2 inch diameter and greater.

2.5. ACCESSORIES

A. Stainless Steel Pipe: ASTM A269/A269M, seamless type, Grade TP304.

B. Pipe Alignment Guides:

1. Manufacturers:

a. Hyspan Precision Products, Inc.; Series 9500.

b. Cooper Industries; B-Line series 3280 by Eaton.

c. [Metraflex Co.; Pipe Guide Style IV: www.metraflex.com].

d. [PHD Manufacturing Inc.; Series 670].

e. ERICO International Corp.; Model 650.

2. 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.

3. Two piece welded steel with enamel paint, bolted, with spider to fit standard pipe, frame with four mounting holes, clearance for minimum insulation thickness for pipe service, minimum 3 inches travel.

C. Engineered Riser Anchor Clamps:

1. Provide two piece, ductile iron in compliance with ASTM A536. Use with metal pipes with an outer diameter of 2.5 inches to 8 inches.

D. Swivel Joints:

1. Fabricated steel body, double ball bearing race, field lubricated, with rubber (Buna-N) o-ring seals.

E. Pipe Anchor Materials:

1. Steel Shapes and Plates: ASTM A 36/A 36M.

2. Bolts and Nuts: ASME B18.10 or ASTM A 183, steel hex head.

3. Washers: ASTM F 844, steel, plain, flat washers.

4. Mechanical Fasteners: Insert-wedge-type stud with expansion plug anchor for use in hardened portland cement concrete, with tension and shear capacities appropriate for application.

a. Stud: Threaded, zinc-coated carbon steel.

b. Expansion Plug: Zinc-coated steel.

c. Washer and Nut: Zinc-coated steel.

PART 3 EXECUTION

3.1. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install flexible pipe connectors on pipes connected to vibration isolated equipment. Provide line size flexible connectors.

C. Provide support and equipment required to control expansion and contraction of piping. Provide loops, pipe offsets, and swing joints, or expansion joints where required.

D. Substitute grooved piping for vibration isolated equipment instead of flexible connectors. Grooved piping need not be anchored.

END OF SECTION

SECTION 23 0519 - METERS AND GAGES FOR HVAC PIPING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Pressure gauges and pressure gauge taps.

B. Thermometers and thermometer wells.

C. Static pressure gauges.

D. Filter gauges.

1.2. RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping.

1.3. REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014, with Editorial Revision (2017).

D. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

1.4. 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.

2. Extra Pressure Gauges: One of each type and size.

1.5. 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

2.1. PRESSURE GAUGES

A. Manufacturers:

1. Dwyer Instruments, Inc.

2. Ashcroft, Inc..

3. Trerice.

4. Watts.

5. Substitutions: See Section 01 6000 - Product Requirements.

B. Pressure Gages: ASME B40.100, for hydronic systems, with front recalibration adjustment.

1. Case: Liquid-filled type, Drawn steel.

2. Size: 4-1/2 inch diameter.

3. Window: Plastic.

4. Ring: Metal.

5. Dial: Nonreflective aluminum with black scale on white background and permanently etched scale markings.
6. Pointer: Dark-colored metal.
7. Pressure-Element Assembly: Brass bourdon tube.
8. Pressure Connection: Brass, with NPS 1/4, ASME B1.20.1 pipe threads aand bottom-outlet tyype unless back-outlet type is indicated.
9. Movement: Mechanical, with link to pressure element and connection to pointer.
10. Accuracy; Grade A, plus or minus 1 percent of middle half of scale range.
11. Scale: PSI.

2.2. 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, ASME B40.100, brass with 1/4 inch connections, ASME B1.20.1 pipe threads, and Piston-type surge-dampening device. Include extension for use on insulated piping.

D. Syphon: Loop shaped section of Steel, Schedule 40 pipe/tubing, 1/4 inch angle or straight pattern, and ASME B1.20.1 pipe threads.

2.3. STEM TYPE THERMOMETERS

A. Manufacturers:

1. Dwyer Instruments, Inc.
2. Weksler Glass Thermometer Corp.
3. Trerice.
4. Watts.
5. Substitutions: See Section 01 6000 - Product Requirements.

B. Thermometers - Fixed Mounting: Red- or blue-appearing non-toxic liquid in glass; ASTM E1 and ASME B40.200; lens front tube, cast aluminum case with enamel finish.

1. Window: Clear Lexan.
2. Tube Background: Nonreflective with permanently etched scale markings graduated in deg F.
3. Stem: Aluminum of lengtth to suit installation.
    a. Design for Air-Duct installation: With ventilated shroud.
    b. Design for Thermowell Installation: Bare stem.
4. Connector: 3/4 inch, with ASME B1.1 screw threads.
5. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
6. Calibration: Degrees F.

C. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E1 and ASTM B40.200; 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. Stem: 3/4 inch NPT brass.

4. Connector: 1-1/4 inch, with ASME B1.1 screw threads.
5. Accuracy: Plus or minus 1 percent of scale range or one scale division, to a maximum of 1.5 percent of scale range.
6. Calibration: Degrees F.

2.4. TEST PLUGS

A. Manufacturers:
1. Peterson Products Co.
2. Texas Fairfax Company, Inc.
3. Watts Water Technologies
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Test Plug: 1/4 inch or 1/2 inch, lead free brass or stainless steel fitting and cap for receiving 1/8 inch outside diameter pressure or temperature probe with EDPM core for temperatures up to 275 or nordel core for temperaturres up to 350 degrees F and pressures up to 500 psig.

C. Test Kit: Carrying case, internally padded and fitted containing one 2-1/2 inch diameter pressure gauge, one gauge adapter with 1/8 inch probes, two 1-1/2 inch dial thermometers (one high-range and one low-range).

2.5. STATIC PRESSURE GAUGES

A. Manufacturers:
1. Dwyer Instruments, Inc: www.dwyer-inst.com/#sle.
2. Omega Engineering, Inc: www.omega.com/#sle.
3. Weksler Glass Thermometer Corp: www.wekslerglass.com/#sle.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. 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.

C. Inclined manometer, red liquid on white background with black figures, front recalibration adjustment, 3 percent of full scale accuracy.

D. Accessories: Static pressure tips with compression fittings for bulkhead mounting, 1/4 inch diameter tubing.

PART 3 EXECUTION

3.1. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install direct-mounted pressure gages in piping tees with pressure gage located on pipe at the most readable position.

C. Provide one pressure gauge per pump, installing taps before strainers and on suction and discharge of pump. Pipe to gauge.

D. Install pressure gages with pulsation dampers in piping for fluids. Provide gage cock to isolate each gage. Provide siphon on gages in steam systems. Extend nipples and siphons to allow clearance from insulation.

E. Install thermowells with socket extending a minimum 2 inches into fluid and in vertical position in piping tees or in short couplings (enlarge to pipes 2-1/2 inch diameter).

F. Install thermowells with extension on insulated piping.

G. Install thermowells of sizes required to match thermometer connectors. Include bushings if required to match sizes.

H. Fill thermowells with heat-transfer medium.

I. Install thermometers in air duct systems on mounting brackets in walls of duct, attached to duct with screws.

J. Install thermometer sockets adjacent to controls system thermostat, transmitter, or sensor sockets. Refer to Section 23 0943. Where thermometers are provided on local panels, duct or pipe mounted thermometers are not required.

K. Locate duct mounted thermometers minimum 10 feet downstream of mixing dampers, coils, or other devices causing air turbulence.

L. Provide instruments with scale ranges selected according to service with largest appropriate scale.

M. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical.

N. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

O. Locate test plugs adjacent thermometers and thermometer sockets.

3.2. SCHEDULE

A. Pressure Gauges, Location and Scale Range:

1. Pressure reducing valves, 0 to 100 psi.
2. Pumps, 0 to 100 psi.
3. Air handling unit coils, 0 to 100 psi.
4. Expansion tanks, 0 to 100 psi.
5. Heat exchangers - fluid, 0 to 100 psi.
6. Hot-water boiler, 0 to 100 psi.
7. Chiller - chilled-water inlet and outlet, 0 to 100 psi.

B. Pressure Gage Tappings (Test Plugs), Location:

1. Control valves 3/4 inch & larger - inlets and outlets.
2. Major coils - inlets and outlets.
3. Heat exchangers - inlets and outlets.
4. Chiller - inlets and outlets.
5. Boiler - inlets and outlets.
6. Duct mounted coils - inlet and outlet.
7. Terminal unit coils - inlet and outlet.

C. Stem Type Thermometers, Location and Scale Range:

1. Boilers - inlets and outlets, 0 to 240 degrees F.
2. Heat exchangers (hot) - fluid inlets and outlets, 30 to 240 degrees F.
3. Heat exchangers (cold) - fluid inlets and outlets, 0 to 150 degrees F.
4. Hot water boilers - inlet and outlet, 30 to 240 degrees F.
5. Chiller - chilled-water inlet and outlet, 0 to 100 degrees F.
6. Air handling unit coils (hot) - inlet(s) and outlet(s), 30 to 240 degrees F.
7. Air handling unit coils (cold) - inlet(s) and outlet(s), 0 to 100 degrees F.

D. Thermometer Sockets (Test Plugs), Location:

1. Control valves 1 inch & larger - inlets and outlets.

2. Reheat coils - inlets and outlets.
3. Unit heaters - inlets and outlets.
4. Air curtains - inlets and outlets.

E. Static Pressure and Filter Gauges, Location and Scale Range:

1. Built up filter banks, 0 to 8 inches W.C..
2. Unitary filter sections, 0 to 8 inches W.C..
3. Supply fan discharge, 0 to 8 inches W.C..

END OF SECTION

SECTION 23 0548 - SECTION 23 0548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC

PART 1 GENERAL

1.1. SUMMARY

A. Section Includes:

1. Elastomeric isolation pads.
2. Elastomeric isolation mounts.
3. Restrained elastomeric isolation mounts.
4. Open-spring isolators.
5. Housed-spring isolators.
6. Restrained-spring isolators.
7. Housed-restrained-spring isolators.
8. Pipe-riser resilient supports.
9. Resilient pipe guides.
10. Elastomeric hangers.
11. Spring hangers.
12. Snubbers.
13. Restraint channel bracings.
14. Restraint cables.
15. Seismic-restraint accessories.
16. Mechanical anchor bolts.

1.2. ACTION SUBMITTALS

A. Product Data: For each type of product.

B. Delegated-Design Submittal: For each vibration isolation and seismic-restraint device.

1. Include design calculations and details for selecting vibration isolators and seismic restraints complying with performance requirements, design criteria, and analysis data signed and sealed by the qualified professional engineer responsible for their preparation.

1.3. INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.4. QUALITY ASSURANCE

A. Comply with seismic-restraint requirements in the IBC unless requirements in this Section are more stringent.

B. Welding Qualifications: Qualify procedures and personnel according to AWS D1.1/D1.1M, "Structural Welding Code - Steel."

C. Seismic-restraint devices shall have horizontal and vertical load testing and analysis and shall bear anchorage preapproval OPA number from OSHPD, preapproval by ICC-ES, or preapproval by another agency acceptable to authorities having jurisdiction, showing maximum seismic-restraint ratings. Ratings based on independent testing are preferred to ratings based on calculations. If preapproved ratings are unavailable, submittals based on independent testing are preferred. Calculations (including combining shear and tensile loads) to support seismic-restraint designs must be signed and sealed by a qualified professional engineer.

PART 2 PRODUCTS

2.1. PERFORMANCE REQUIREMENTS

A. Seismic-Restraint Loading:

1. Site Class as Defined in the IBC: C.
2. Assigned Seismic Use Group or Building Category as Defined in the IBC: IV.
    a. Component Importance Factor: See ASCE 7 and IBC 2012.
    b. Component Response Modification Factor: See ASCE 7 and IBC 2012.
    c. Component Amplification Factor: See ASCE 7 and IBC 2012.
3. Design Spectral Response Acceleration at Short Periods (0.2 Second): 11.9%.
4. Design Spectral Response Acceleration at 1.0-Second Period: 6.1%.

2.2. MANUFACTURERS

A. Manufacturers:

1. Kinetics Noise Control, Inc.
2. Mason Industries, Inc.
3. Vibration Mountings and Controls/Korfund
4. Vibro-Acoustics.

2.3. ELASTOMERIC ISOLATION PADS

A. Elastomeric Isolation Pads:

1. Fabrication: Single or multiple layers of sufficient durometer stiffness for uniform loading over pad area.
2. Size: Factory or field cut to match requirements of supported equipment.
3. Pad Material: Oil and water resistant with elastomeric properties.
4. Surface Pattern: Waffle pattern.
5. Infused nonwoven cotton or synthetic fibers.
6. Load-bearing metal plates adhered to pads.

2.4. ELASTOMERIC ISOLATION MOUNTS

A. Double-Deflection, Elastomeric Isolation Mounts:

1. Mounting Plates:
    a. Top Plate: Encapsulated steel load transfer top plates, factory drilled and threaded with threaded studs.
    b. Baseplate: Encapsulated steel bottom plates with holes provided for anchoring to support structure.
2. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.5. RESTRAINED ELASTOMERIC ISOLATION MOUNTS

A. Restrained Elastomeric Isolation Mounts:

1. Description: All-directional isolator with seismic restraints containing two separate and opposing elastomeric elements that prevent central threaded element and attachment hardware from contacting the housing during normal operation.
    a. Housing: Cast-ductile iron or welded steel.
    b. Elastomeric Material: Molded, oil-resistant rubber, neoprene, or other elastomeric material.

2.6. OPEN-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators:

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Baseplates: Factory-drilled steel plate for bolting to structure with an elastomeric isolator pad attached to the underside. Baseplates shall limit floor load to 500 psig.
6. Top Plate and Adjustment Bolt: Threaded top plate with adjustment bolt and cap screw to fasten and level equipment.

2.7. HOUSED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators in Two-Part Telescoping Housing:

1. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
2. Minimum Additional Travel: 50 percent of the required deflection at rated load.
3. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
4. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
5. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators.
    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Top housing with attachment and leveling bolt.

2.8. RESTRAINED-SPRING ISOLATORS

A. Freestanding, Laterally Stable, Open-Spring Isolators with Vertical-Limit Stop Restraint:

1. Housing: Steel housing with vertical-limit stops to prevent spring extension due to weight being removed.
    a. Base with holes for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Internal leveling bolt that acts as blocking during installation.
2. Restraint: Limit stop as required for equipment and authorities having jurisdiction.
3. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
4. Minimum Additional Travel: 50 percent of the required deflection at rated load.
5. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
6. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.9. HOUSED-RESTRAINED-SPRING ISOLATORS

A. Freestanding, Steel, Open-Spring Isolators with Vertical-Limit Stop Restraint in Two-Part Telescoping Housing:

1. Two-Part Telescoping Housing: A steel top and bottom frame separated by an elastomeric material and enclosing the spring isolators. Housings are equipped with adjustable snubbers to limit vertical movement.
    a. Drilled base housing for bolting to structure with an elastomeric isolator pad attached to the underside. Bases shall limit floor load to 500 psig.
    b. Threaded top housing with adjustment bolt and cap screw to fasten and level equipment.
2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.

2.10. PIPE-RISER RESILIENT SUPPORT

A. Description: All-directional, acoustical pipe anchor consisting of two steel tubes separated by a minimum 1/2-inch-thick neoprene
    1. Vertical-Limit Stops: Steel and neoprene vertical-limit stops arranged to prevent vertical travel in both directions.
    2. Maximum Load Per Support: 500 psig on isolation material providing equal isolation in all directions.

2.11. RESILIENT PIPE GUIDES

A. Description: Telescopic arrangement of two steel tubes or post and sleeve arrangement separated by a minimum 1/2-inch thick neoprene
    1. Factory-Set Height Guide with Shear Pin: Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of motion to meet location requirements.

2.12. ELASTOMERIC HANGERS

A. Elastomeric Mount in a Steel Frame with Upper and Lower Steel Hanger Rods:
    1. Frame: Steel, fabricated with a connection for an upper threaded hanger rod and an opening on the underside to allow for a maximum of 30 degrees of angular lower hanger-rod misalignment without binding or reducing isolation efficiency.
    2. Dampening Element: Molded, oil-resistant rubber, neoprene, or other elastomeric material with a projecting bushing for the underside opening preventing steel to steel contact.

2.13. SPRING HANGERS

A. Combination Coil-Spring and Elastomeric-Insert Hanger with Spring and Insert in Compression:
    1. Frame: Steel, fabricated for connection to threaded hanger rods and to allow for a maximum of 30 degrees of angular hanger-rod misalignment without binding or reducing isolation efficiency.
    2. Outside Spring Diameter: Not less than 80 percent of the compressed height of the spring at rated load.
    3. Minimum Additional Travel: 50 percent of the required deflection at rated load.
    4. Lateral Stiffness: More than 80 percent of rated vertical stiffness.
    5. Overload Capacity: Support 200 percent of rated load, fully compressed, without deformation or failure.
    6. Elastomeric Element: Molded, oil-resistant rubber or neoprene. Steel-washer-reinforced cup to support spring and bushing projecting through bottom of frame.

7. Adjustable Vertical Stop: Steel washer with neoprene washer "up-stop" on lower threaded rod.
8. Self-centering hanger-rod cap to ensure concentricity between hanger rod and support spring coil.

2.14. SNUBBERS

A. Description: Factory fabricated using welded structural-steel shapes and plates, anchor bolts, and replaceable resilient isolation washers and bushings.

1. Anchor bolts for attaching to concrete shall be seismic-rated, drill-in, and stud-wedge or female-wedge type.
2. Resilient Isolation Washers and Bushings: Oil- and water-resistant neoprene.
3. Maximum 1/4-inch air gap, and minimum 1/4-inch-thick resilient cushion.

2.15. RESTRAINT CHANNEL BRACINGS

A. Description: MFMA-4, shop- or field-fabricated bracing assembly made of slotted steel channels with accessories for attachment to braced component at one end and to building structure at the other end and other matching components and with corrosion-resistant coating; rated in tension, compression, and torsion forces.

2.16. RESTRAINT CABLES

A. Restraint Cables: ASTM A 603 galvanized steel cables. End connections made of steel assemblies with thimbles, brackets, swivel, and bolts designed for restraining cable service; with a minimum of two clamping bolts for cable engagement.

2.17. SEISMIC-RESTRAINT ACCESSORIES

A. Hanger-Rod Stiffener: Steel tube or steel slotted-support-system sleeve with internally bolted connections to hanger rod.

B. Bushings for Floor-Mounted Equipment Anchor Bolts: Neoprene bushings designed for rigid equipment mountings, and matched to type and size of anchor bolts and studs.

C. Bushing Assemblies for Wall-Mounted Equipment Anchorage: Assemblies of neoprene elements and steel sleeves designed for rigid equipment mountings, and matched to type and size of attachment devices used.

D. Resilient Isolation Washers and Bushings: One-piece, molded, oil- and water-resistant neoprene, with a flat washer face.

E. Mechanical Anchor Bolts: Drilled-in and stud-wedge or female-wedge type in zinc-coated steel for interior applications and stainless steel for exterior applications. Select anchor bolts with strength required for anchor and as tested according to ASTM E 488.

PART 3 EXECUTION

3.1. APPLICATIONS

A. Multiple Pipe Supports: Secure pipes to trapeze member with clamps approved for application by an agency acceptable to authorities having jurisdiction.

B. Hanger-Rod Stiffeners: Install hanger-rod stiffeners where indicated or scheduled on Drawings to receive them and where required to prevent buckling of hanger rods due to seismic forces.

C. Strength of Support and Seismic-Restraint Assemblies: Where not indicated, select sizes of components so strength is adequate to carry present and future static and seismic loads within specified loading limits.

3.2. VIBRATION CONTROL AND SEISMIC-RESTRAINT DEVICE INSTALLATION

A. Coordinate the location of embedded connection hardware with supported equipment attachment and mounting points and with requirements for concrete reinforcement and formwork specified in Section 033000 "Cast-in-Place Concrete."

B. Installation of vibration isolators must not cause any change of position of equipment, piping, or ductwork resulting in stresses or misalignment.

C. Comply with requirements in Section 077200 "Roof Accessories" for installation of roof curbs, equipment supports, and roof penetrations.

D. Equipment Restraints:

1. Install seismic snubbers on HVAC equipment mounted on vibration isolators. Locate snubbers as close as possible to vibration isolators and bolt to equipment base and supporting structure.

2. Install resilient bolt isolation washers on equipment anchor bolts where clearance between anchor and adjacent surface exceeds 0.125 inch .

3. Install seismic-restraint devices using methods approved by an agency acceptable to authorities having jurisdiction that provides required submittals for component.

E. Piping Restraints:

1. Comply with requirements in MSS SP-127.

2. Space lateral supports a maximum of 40 feet o.c., and longitudinal supports a maximum of 80 feet o.c.

3. Brace a change of direction longer than 12 feet.

F. Install cables so they do not bend across edges of adjacent equipment or building structure.

G. Install seismic-restraint devices using methods approved by agency acceptable to authorities having jurisdiction that provides required submittals for component.

H. Install bushing assemblies for anchor bolts for floor-mounted equipment, arranged to provide resilient media between anchor bolt and mounting hole in concrete base.

I. Install bushing assemblies for mounting bolts for wall-mounted equipment, arranged to provide resilient media where equipment or equipment-mounting channels are attached to wall.

J. Attachment to Structure: If specific attachment is not indicated, anchor bracing to structure at flanges of beams, at upper truss chords of bar joists, or at concrete members.

K. Drilled-in Anchors:

1. Identify position of reinforcing steel and other embedded items prior to drilling holes for anchors. Do not damage existing reinforcing or embedded items during coring or drilling. Notify the structural engineer if reinforcing steel or other embedded items are encountered during drilling. Locate and avoid prestressed tendons, electrical and telecommunications conduit, and gas lines.

2. Do not drill holes in concrete or masonry until concrete, mortar, or grout has achieved full design strength.

3. Wedge Anchors: Protect threads from damage during anchor installation. Heavy-duty sleeve anchors shall be installed with sleeve fully engaged in the structural element to which anchor is to be fastened.

4. Set anchors to manufacturer's recommended torque, using a torque wrench.

5. Install zinc-coated steel anchors for interior and stainless-steel anchors for exterior applications.

3.3. ACCOMMODATION OF DIFFERENTIAL SEISMIC MOTION

A. Install flexible connections in piping where they cross seismic joints, where adjacent sections or branches are supported by different structural elements, and where the connections terminate with connection to equipment that is anchored to a different structural element from the one supporting the connections as they approach equipment. Comply with requirements in Section 232113 "Hydronic Piping" for piping flexible connections.

3.4. FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Tests and Inspections:

1. Provide evidence of recent calibration of test equipment by a testing agency acceptable to authorities having jurisdiction.

2. Schedule test with Owner, through Architect, before connecting anchorage device to restrained component (unless postconnection testing has been approved), and with at least seven days' advance notice.

3. Obtain Architect's approval before transmitting test loads to structure. Provide temporary load-spreading members.

4. Test at least four of each type and size of installed anchors and fasteners selected by Architect.

5. Test to 90 percent of rated proof load of device.

6. Measure isolator restraint clearance.

7. Measure isolator deflection.

8. Verify snubber minimum clearances.

D. Remove and replace malfunctioning units and retest as specified above.

E. Prepare test and inspection reports.

3.5. ADJUSTING

A. Adjust isolators after piping system is at operating weight.

B. Adjust limit stops on restrained-spring isolators to mount equipment at normal operating height. After equipment installation is complete, adjust limit stops so they are out of contact during normal operation.

END OF SECTION

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Nameplates.

B. Equipment Labels.

C. Warning Signs and Labels.

D. Pipe Labels.

E. Duct Labels.

F. Valve Tags.

G. Stencils.

H. Pipe markers.

I. Ceiling tacks.

1.2. RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Identification painting.

1.3. REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2015.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Valve numbering scheme.

C. Valve 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. Project Record Documents: Record actual locations of tagged valves.

F. Operation and Maintenance Manual: Include valve schedule in Operation and Maintenance Manual submission.

PART 2 PRODUCTS

2.1. 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. Heat Transfer Equipment: Nameplates.

H. Instrumentation: Tags.

I. Piping: Tags.

J. Pumps: Nameplates.

K. Small-sized Equipment: Tags.

L. Tanks: Nameplates.

M. Thermostats: Nameplates.

N. Valves: Tags and ceiling tacks where located above lay-in ceiling.

2.2. EQUIPMENT LABELS AND NAMEPLATES

A. Manufacturers:

1. Advanced Graphic Engraving, LLC.
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers.
4. Kolbi Pipe Marker Co.
5. Seton Identification Products, a Tricor Direct Company.

B. Letter Color: White.

C. Background Color: Black.

D. Labels:

1. Material and Thickness: Multi-layer plastic; 1/16 inch.
2. Maximum Temperature: Able to withstand temperatures up to 160 degrees F continuous.
3. Pre-drilled or stamped holes for attachment hardware.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 x 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1 inch for viewing distances up to 72 inches and proprtionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the isze of principal lettering.
6. Fasteners: Stainless steel rivets or self-tapping screws.

2.3. WARNING SIGNS AND LABELS

A. Manufacturers:

1. Seton Identification Products.

B. Letter Color: Black.

C. Background Color: Safety-yellow.

D. Signs and Labels:

1. Material and Thickness: Multi-layer plastic; 1/16 inch.
2. Maximum Temperature: Able to withstand temperatures up to 160 degrees F continuous.
3. Pre-drilled or stamped holes for attachment hardware.
4. Minimum Label Size: Length and width vary for required label content, but not less than 3 x 5-1/4 inches.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1/2 inch for viewing distances up to 72 inches and proprtionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the isze of principal lettering.
6. Nomenclature: Large size primary caption such as "DANGER," "CAUTION," or "DO NOT OPERATE."
7. Fasteners: Brass grommet and wire or Reinforced grommet and wire.
8. Content: Include caution and warning information plus emergency notification instructions.

2.4. DUCT LABELS

A. Manufacturers:

1. Advanced Graphic Engraving.

2. Brimar Industries, Inc..
3. Kolbi Pipe Marker Co..
4. Seton Identification Products.

B. Letter Color: White.

C. Background Color: Black.

D. Labels:

1. Material and Thickness: Multi-layer plastic; 1/16 inch.
2. Maximum Temperature: Able to withstand temperatures up to 160 degrees F continuous.
3. Pre-drilled or stamped holes for attachment hardware.
4. Minimum Label Size: Length and width vary for required label content, but not less than 2-1/2 x 3/4 inch.
5. Minimum Letter Size: 1/4 inch for name of units if viewing distance is less than 24 inches, 1 inch for viewing distances up to 72 inches and proprtionately larger lettering for greater viewing distances. Include secondary lettering two-thirds to three-quarters the isze of principal lettering.
6. Fasteners: Stainless steel rivets or self-tapping screws.
7. Content: Include identifiaction of duct service using same designations or abbreviations as used on Drawings; also include duct size and an arrow indicating flow direction.
    a. Flow-Direction Arrows: Integral with duct system service lettering to accommodate both directions or as separate unit on each duct label to indicate flow direction.

2.5. VALVE TAGS

A. Manufacturers:

1. Advanced Graphic Engraving.
2. Brimar Industries, Inc.
3. Craftmark Pipe Markers.
4. Kolbi Pipe Marker Co.
5. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Metal Tags: Brass with stamped or engraved letters; tag size minimum 1-1/2 inch diameter with smooth edges and pre-drilled or stamped holes for attachment hardware.

C. Number Height: 1/2 inch.

D. Letter Height for piping system abbreviation: 1/4 inch.

E. Fasteners: Brass S-hook.

F. Valve Tag Schedule: Typewritten letter size list in anodized aluminum frame for each piping system, on 8-1/2 x 11 inch bond paper. Tabulate valve number, piping system, system abbreviation (as shown on valve tag), location of valve (room or space), normal-operating position (open, closed, or modulating), and variations for identification.

1. Mark valves for emergency shut-off and similar special uses.
2. Valve-tag schedule shall be included in operation and maintenance data.

2.6. STENCILS

A. Manufacturers:

1. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Stencils: With clean cut symbols and letters of following size:

1. Clean cut symbols.
2. Stencil Material: Aluminum.

C. Pipe Lettering:

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.

D. Ductwork and Equipment Lettering: 2-1/2 inch high letters.

E. Stencil Paint: As specified in Section 09 9123, exterior, gloss, alkyd enamel colors conforming to ASME A13.1.

2.7. PIPE LABELS

A. Manufacturers:

1. Craftmark Pipe Markers: www.craftmarkid.com/#sle.
2. Kolbi Pipe Marker Co: www.kolbipipemarkers.com/#sle.
3. MIFAB, Inc: www.mifab.com/#sle.
4. Seton Identification Products, a Tricor Company: www.seton.com/#sle.

B. Color: Comply with ASME A13.1.

C. Plastic Pipe Markers: Factory fabricated, pre-printed, color-coded, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.

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. Heating-water: Orange.
2. Chilled-water Supply: Blue.
3. Chilled-water return: Light blue.

F. Flow Direction Arrows: Integral with piping system service lettering to accommodate both directions or as separate unit on each pipe label to indicate flow direction.

G. Lettering 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.

2.8. CEILING TACKS

A. Description: Steel with 3/4 inch diameter color coded head.

B. Color code as follows:

1. HVAC Equipment: Yellow.
2. Fire Dampers and Smoke Dampers: Red.

3. Heating/Cooling Valves: Blue.

PART 3 EXECUTION

3.1. PREPARATION

A. Clean piping and equipment surfaces of substances that could impair bond onf identification devices, including dirt, oil, grease, release agents, and incompatible primers, paints, and encapsulants.

B. Prepare surfaces in accordance with Section 09 9123 for stencil painting.

3.2. EQUIPMENT LABEL INSTALLATION

A. Install or permanently fasten labels on each major item of mechanical equipment.

B. Locate equipment labels where accessible and visible.

3.3. PIPE LABEL INSTALLATION

A. Apply stencil painting in accordance with Section 09 9123.

B. Locate pipe labels wheere piping is exposed or above accessible ceilings in finished spaces; machine rooms; accessible maintenance spaces such as shafts, tunnels, and plenums; and exterior exposed locations as follows:

1. Near each valve and control device.

2. Near each branch connection, excluding short take-offs for terminal units. Where flow pattern is not obvious, mark each pipe at branch.

3. Near penetrations through walls, floors, ceilings, and inaccessible enclosures.

4. At access doors, manholes, and similar access points that permit view of concealed piping.

5. Near major equipment items and other points of origination and termination.

6. Spaced at maximum inteval of 50 feet along each run. reduce intevals to 25 feet in areas of congested piping and equipment.

7. Directional Flow Arrows: Arrows shall be used to indicate direction of flow in pipes, including pipes where flow is allowed in both directions.

3.4. DUCT LABEL INSTALLATION

A. Stenciled labels, showing service and flow direction, may be provided intead of plastic-laminated duct labels, at Installer's option, if lettering larger than 1-inch high is needed for proper identification because of distance.

B. Locate labels near points where ducts enter into concealed spaces and at maximum intervals of 50 feet in each space where ducts are exposed or are concealed by a removable ceiling system.

3.5. VALVE TAG INSTALLATION

A. Install tags on valves andf control devices in piping systems, except check valves; valves within factory-fabricated equipment enclosures; shut-off valves; and HVAC termianl devices and similar roughing-in connnections of end-use units. List tagged valves in valve schedule.

B. Valve-Tag Application Schedule: Tag valves according to size, shape, and color, scheme and with captions similar to those indicated in the following subparagraphs:

1. Valve-Tag Shape:

a. Chilled Water: Square.

b. Heating Water: Square.

c. Gas: Round.

2. Valve-Tag / Letter Color:

a. Chilled Water: Black letters on natural background.

b. Heating Water: Black letters on natural background.

c. Gas: Black letters on safety-yellow background.

3.6. WARNING-TAG INSTALLATION

A. Write required message on, and attach warning tags to, equipment and other items where required.

3.7. INSTALLATION

A. Apply stencil painting in accordance with Section 09 9123.

B. Install plastic pipe markers in accordance with manufacturer's instructions.

C. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.

D. Install underground plastic pipe markers 6 to 8 inches below finished grade, directly above buried pipe.

E. 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 23 0593 - TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Testing, adjustment, and balancing of air systems.

B. Testing, adjustment, and balancing of hydronic systems.

1.2. RELATED REQUIREMENTS

A. Section 23 0800 - Commissioning of HVAC.

1.3. 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 (Reaffirmed 2017).

C. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. 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 the Commissioning Authority.

2. Include at least the following in the plan:

a. List of all air flow, water flow, sound level, 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. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

d. Final test report forms to be used.

e. Procedures for formal deficiency reports, including scope, frequency and distribution.

C. 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.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1. GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. 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. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

2. 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.

D. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.2. 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.

3.3. 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.

C. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.4. RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.5. AIR SYSTEM PROCEDURE

A. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

B. Measure air quantities at air inlets and outlets.

C. 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.

D. Vary total system air quantities by adjustment of fan speeds. Provide drive changes required. Vary branch air quantities by damper regulation.

E. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

F. 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.

G. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions.

H. 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.

3.6. WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. 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.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. 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.

3.7. SCOPE

A. Test, adjust, and balance the following:

1. HVAC Pumps.
2. Boilers.
3. Air Cooled Water Chillers.
4. Packaged Roof Top Heating/Cooling Units.
5. Air Coils.
6. Terminal Heat Transfer Units.
7. Air Handling Units.

8. Fans.
9. Air Terminal Units.
10. Air Inlets and Outlets.

END OF SECTION

SECTION 23 0713 - DUCT INSULATION

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Duct insulation.

B. Duct liner.

C. Insulation jackets.

1.2. RELATED REQUIREMENTS

A. Section 01 6116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 07 8400 - Firestopping.

1.3. REFERENCE STANDARDS

A. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

C. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2020.

D. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

E. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

F. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2020.

G. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2019.

H. ASTM C1290 - Standard Specification for Flexible Fibrous Glass Blanket Insulation Used to Externally Insulate HVAC Ducts; 2016.

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

K. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

L. NAIMA-AH124 - North American Insulation Manufacturers Association, Fibrous Glass Duct Liner Standard, 2002.

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, water-vapor permeance, list of materials and thickness for each service, and locations.

C. Shop Drawings: Include plans, elevations, sections, details, and attachments to other work.

1. Detail application of protective shields, saddles, and inserts at hangers for each type of insulation and hanger.

2. Detail insulation application at elbows, fittings, dampers, specialties and flanges for each type of insulation.

3. Detail application of field-applied jackets.

4. Detail application at linkages of control devices.

D. Manufacturer's Instructions: Indicate installation procedures necessary to ensure acceptable workmanship and that installation standards will be achieved.

1.5. 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.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section .

C. Surface-Burning Characteristics: For insulation and related materials, as determined by testing identical products according to ASTM E 84, by a testing agency acceptable to authorities having jurisdiction. Factory label insulation and jacket materials and adhesive, mastic, tapes, and cement material containers, with appropriate markings of applicable testing agency.

1. Insulation Installed Indoors: Flame-spread index of 25 or less, and smoke-developed index of 50 or less.

2. Insulation Installed Outdoors: Flame-spread index of 75 or less, and smoke-developed index of 150 or less.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labelled with manufacturer's identification, including product density and thickness, ASTM standard designation, type and grade, and maximum use temperature.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.7. COORDINATION

A. Coordiante sizes and locations of supports, hangers, and insulation shields specified in Section 230529 "Hangers and Supports for HVAC Piping and Equipment."

B. Coordinate clearance requirements with duct Installer for duct insulation application. Before preparing ductwork Shop Drawings, establish and maintain clearance requirements for installation of insulation and field-applied jackets and finishes and for space required for maintenance.

1.8. SCHEDULING

A. Schedule insulation application after pressure testing systems and, where required, after installing and testing heat tracing. Insulation application may begin on segments that have satisfactory test results.

B. Complete installation and concealment of plastic materials as rapidly as possible in each area of construction.

1.9. 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

2.1. 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.

B. Products shall not contain asbestos, lead, mercury, or mercury compounds.

C. Products that come in contact with stainless steel shall have a leachable chloride content of less than 50 ppm when tested according to ASTM C 871.

D. Insulation materials for use on austenitic stainless steel shall be qualified as acceptable according to ASTM C 795.

2.2. GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. Knauf Insulation; Friendy Feel Duct Wrap: www.knaufusa.com.
2. Johns Manville; Microlite: www.jm.com.
3. Owens Corning Corporation; SOFTR All-Service Duct Wrap: www.ocbuildingspec.com.
4. CertainTeed Corporation; SoftTouch Duct Wrap: www.certainteed.com.

B. Insulation: Mineral or glass fibers bonded with a thermosetting resin; ASTM C553, Type II and ASTM C 1290, Type III with factory-applied FSP jacket; flexible, noncombustible blanket.

1. 'K' value: 0.26 at 75 degrees F, when tested in accordance with ASTM C518.
2. Maximum Service Temperature: 250 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket:

1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.
2. Secure with pressure sensitive tape.
3. ASJ (All Service Jacket): White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
4. ASJ-SSL (Self-Sealing Lap):White, kraft-paper, fiberglass-reinforced scrim with aluminum-foil backing; complying with ASTM C 1136, Type I.
5. FSK (Foil-Scrim-Kraft) Jacket: Aluminum-foil, fiberglass-reinforced scrim with kraft-paper backing; complying with ASTM C 1136, Type II.
6. FSP (Foil-Scrim-Polyethylene) Jacket: Aluminum-foil, fiberglass-reinforced scrim with polyethylene backing; complying with ASTM C 1136, Type II.
7. Vynil Jacket: White vinyl with a permeance of 1.3 perms when tested according to ASTM E 96/E 96M, Procedure A, and complying with NFPA 90A and NFPA 90B.

D. Vapor Barrier Tape:

1. Manufacturers:
   a. ABI, Ideal Tape Division; 491 AWF FSK.
   b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
   c. Compac Corporation; 110 and 111.
   d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
2. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire: Annealed steel, 16 gage, 0.0508 inch diameter.

2.3. GLASS FIBER, RIGID

A. Manufacturer:

1. Knauf Insulation; Insulation Board: www.knaufusa.com.
2. Johns Manville; 800 Series Spin-Glas: www.jm.com.
3. Owens Corning Corporation; 700 Series FIBERGLAS Insulation: www.ocbuildingspec.com/#sle.
4. CertainTeed Corporation; Commercial Board: www.certainteed.com.

B. Insulation: ASTM C612; rigid, noncombustible blanket.
   1. Maximum Service Temperature: 450 degrees F.
   2. Maximum Water Vapor Absorption: 5.0 percent.
   3. Maximum Density: 8.0 lb/cu ft.

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. Manufacturers:
      a. ABI, Ideal Tape Division; 491 AWF FSK.
      b. Avery Dennison Corporation, Specialty Tapes Division; Fasson 0827.
      c. Compac Corporation; 110 and 111.
      d. Venture Tape; 1525 CW NT, 1528 CW, and 1528 CW/SQ.
   2. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

2.4. FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturers:
   1. Aeroflex USA, Inc; Aerocel Sheet and Roll with PSA: www.aeroflexusa.com/#sle.
   2. Armacell LLC; ArmaFlex Ultra with FlameDefense: www.armacell.us/#sle.
   3. K-Flex USA LLC; Insul-Sheet: www.kflexusa.com/#sle.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
   1. Minimum Service Temperature: Minus 40 degrees F.
   2. Maximum Service Temperature: 180 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.5. JACKETS

A. FSK Jacket: Aluminum-foil-face, fiberglass-reinforced scrim with kraft-paper backing.

B. Aluminum Jacket: ASTM B209 (ASTM B209M); Alloy 3003, Temper H-14.
   1. Joining: Longitudinal slip joints and 2 inch laps.
   2. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   3. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.
   4. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.
   5. Moisture Barrier for Indoor Applications: 3-mil thick, heat-bonded polyethylene and kraft paper.
   6. Moisture Barrier for Indoor Application: 3-mil thick, heat-bonded polyethylene and kraft paper.

C. Stainless-Steel Jacket: ASTM A 167 or ASTM A 240/A 240M; Type 304 or Type 316.
   1. Joining: Longitudinal slip joints and 2 inch laps.
   2. Fittings: 0.024 inch inch thick die shaped fitting covers with factory attached protective liner.

3. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.
4. Moisture Barrier for Indoor Applications: 3-mil thick, heat-bonded polyethylene and kraft paper.
5. Moisture Barrier for Indoor Application: 3-mil thick, heat-bonded polyethylene and kraft paper.

2.6. DUCT LINER

A. Manufacturers:
1. Johns Manville: www.jm.com/#sle.
2. Knauf Insulation: www.knaufinsulation.com/#sle.
3. Owens Corning Corporation: www.ocbuildingspec.com/#sle.

B. Elastomeric Foam Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.
1. Minimum Service Temperature: Minus 40 degrees F.
2. Maximum Service Temperature: 180 degrees F.
3. Fungal Resistance: No growth when tested according to ASTM G21.
4. Apparent Thermal Conductivity: Maximum of 0.28 at 75 degrees F.
5. Minimum Noise Reduction Coefficients:
a. 1 inch Thickness: 0.40.
6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation. Comply with ASTM C916.

D. Liner Fasteners: Galvanized steel, self-adhesive pad with integral head.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

3.3. PENETRATIONS

A. Insulation Installation at Roof and Exterior Wall Penetrations: Install insulation continuously through roof penetrations.
1. Seal penetrations with flashing sealant.
2. For applications requiring only indoor insulation, terminate insulation above roof or inside wall surface and seal with joint sealant. For applications requiring indoor and outdoor insulation, install insulation for outdoor applications tightly joined to indoor insulation ends. Seal joint with joint sealant.
3. Extend jacket of outdoor insulation outside flashing at least 2 inches below top of roof flashing or additionally overlap wall flashing at least 2 inches.
4. Seal jacket to flashing with flashing sealant.

B. Insulation Installation at Interior Wall and Partition Penetrations (That Are Not Fire Rated): Install insulation continuously through walls and partitions.

C. Insulation Installation at Fire-Rated Wall and Partition Penetrations: Terminate insulation at fire damper sleeves for fire-rated wall and partition penetrations. Externally insulate damper sleeves to match adjacent insulation and overlap duct insulation at least 2 inches.

1. Comply with requirements in Section 078413 "Penetration Firestopping" for firestopping and fire-resistive joint sealers.

D. Insulation Installation at Floor Penetrations:

1. Duct: For penetrations through fire-rated assemblies, terminate insulation at fire damper sleeves and externally insulate damper sleeve beyond floor to match adjacent duct insulation. Overlap damper sleeve and duct insulation at least 2 inches.

2. Seal penetrations through fire-rated assemblies. Comply with requirements in Section 078413 "Penetration Firestopping."

3.4. INSTALLATION OF MINERAL-FIBER INSULATION

A. Blanket and Board Insulation Installation on Ducts and Plenums: Secure with adhesive and insulation pins.

1. Apply adhesives according to manufacturer's recommended coverage rates per unit area, for 100 percent coverage of duct and plenum surfaces.

2. Apply adhesive to entire circumference of ducts and to all surfaces of fittings and transitions.

3. Install either capacitor-discharge-weld pins and speed washers or cupped-head, capacitor-discharge-weld pins on sides and bottom of horizontal ducts and sides of vertical ducts as follows:

a. On duct sides with dimensions 18 inches and smaller, place pins along longitudinal centerline of duct. Space 3 inches maximum from insulation end joints, and 16 inches o.c.

b. On duct sides with dimensions larger than 18 inches, place pins 16 inches o.c. each way, and 3 inches maximum from insulation joints. Install additional pins to hold insulation tightly against surface at cross bracing.

c. Pins may be omitted from top surface of horizontal, rectangular ducts and plenums.

d. Do not overcompress insulation during installation.

e. Cut excess portion of pins extending beyond speed washers or bend parallel with insulation surface. Cover exposed pins and washers with tape matching insulation facing.

4. For ducts and plenums with surface temperatures below ambient, install a continuous unbroken vapor barrier. Create a facing lap for longitudinal seams and end joints with insulation by removing 2 inches from one edge and one end of insulation segment. Secure laps to adjacent insulation section with 1/2-inch outward-clinching staples, 1 inch o.c. Install vapor barrier consisting of factory- or field-applied jacket, adhesive, vapor-barrier mastic, and sealant at joints, seams, and protrusions.

a. Repair punctures, tears, and penetrations with tape or mastic to maintain vapor-barrier seal.

b. Install vapor stops for ductwork and plenums operating below 50 deg F at 18-foot intervals. Vapor stops shall consist of vapor-barrier mastic applied in a Z-shaped pattern over insulation face, along butt end of insulation, and over the surface. Cover insulation face and surface to be insulated a width equal to two times the insulation thickness, but not less than 3 inches.

5. Install insulation on rectangular duct elbows and transitions with a full insulation section for each surface. Install insulation on round and flat-oval duct elbows with individually mitered gores cut to fit the elbow.

6. Insulate duct stiffeners, hangers, and flanges that protrude beyond insulation surface with 6-inch wide strips of same material used to insulate duct. Secure on alternating sides of stiffener, hanger, and flange with pins spaced 6 inches o.c.

3.5. FIELD-APPLIED JACKET INSULATION

A. Where glass-cloth jackets are indicated, install directly over bare insulation or insulation with factory-applied jackets.

1. Draw jacket smooth and tight to surface with 2-inch overlap at seams and joints.
2. Embed glass cloth between two 0.062-inch- thick coats of lagging adhesive.
3. Completely encapsulate insulation with coating, leaving no exposed insulation.

B. Where FSK jackets are indicated, install as follows:

1. Draw jacket material smooth and tight.
2. Install lap or joint strips with same material as jacket.
3. Secure jacket to insulation with manufacturer's recommended adhesive.
4. Install jacket with 1-1/2-inch laps at longitudinal seams and 3-inch wide joint strips at end joints.
5. Seal openings, punctures, and breaks in vapor-retarder jackets and exposed insulation with vapor-barrier mastic.

C. Where metal jackets are indicated, install with 2-inch overlap at longitudinal seams and end joints. Overlap longitudinal seams arranged to shed water. Seal end joints with weatherproof sealant recommended by insulation manufacturer. Secure jacket with stainless-steel bands 12 inches o.c. and at end joints.

3.6. FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Perform tests and inspections.

C. Test and Inspections:

1. Inspect ductwork, randomly selected by Architect, by removing field-applied jacket and insulation in layers in reverse order of their installation. Extent of inspection shall be limited to one location(s) for each duct system defined in the "Duct Insulation Schedule, General" Article.

D. All insulation applications will be considered defective Work if sample inspection reveals noncompliance with requirements.

3.7. INDOOR DUCT INSULATION SCHEDULE

A. Items Not Insulated:

1. Factory insulated flexible ducts.
2. Flexible connectors.
3. Vibration control devices.
4. Factory insulated access doors and panels.

B. Concealed, Supply Air Duct and Plenum Insulation shall be the following:

1. Glass Fiber, Flexible: 2 inches thick and 1.0-lb/cu.ft. nominal density.

C. Concealed, Return Air Duct and Plenum Insulation shall be the following:

1. Glass Fiber, Flexible: 2 inches thick and 1.0-lb/cu.ft. nominal density.

D. Concealed, Outdoor Air Duct and Plenum Insulation shall be the following:

1. Glass Fiber, Flexible: 2 inches thick and 1.0-lb/cu.ft. nominal density.

E. Concealed, Exhaust Air Duct and Plenum Insulation between isolation damper and penetration of building exterior shall be the following:

1. Glass-Fiber, Flexible: 2 inches thick and 1.0-lb/cu.ft. nominal density.

F. Exposed (in equipment rooms, unfinished spaces, and unconditioned spaces), Supply Air Duct and Plenum Insulation shall be the following:

1. Glass Fiber, Rigid: 2 inches thick and 3.0-lb/cu.ft. nominal density.

G. Exposed (in equipment rooms, unfinished spaces, and unconditioned spaces), Return Air Duct and Plenum Insulation shall be the following:

1. Glass Fiber, Rigid: 2 inches thick and 3.0-lb/cu.ft. nominal density.

H. Exposed, Outdoor Air Duct and Plenum Insulation shall be the following:

1. Glass Fiber, Rigid: 2 inches thick and 3.0-lb/cu.ft. nominal density.

I. Exposed, Exhaust Air Duct and Plenum Insulation between isolation damper and penetration of building exterior shall be the following:

1. Glass Fiber, Rigid: 2 inches thick and 3.0-lb/cu.ft. nominal density.

END OF SECTION

SECTION 23 0716 - HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Equipment insulation.

B. Covering.

1.2. RELATED REQUIREMENTS

A. Section 23 0553 - Identification for HVAC Piping and Equipment.

B. Section 23 2114 - Hydronic Specialties.

1.3. REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.

E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

F. ASTM C449 - Standard Specification for Mineral Fiber Hydraulic-Setting Thermal Insulating and Finishing Cement; 2007 (Reapproved 2013).

G. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.

H. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2020.

I. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

J. ASTM C612 - Standard Specification for Mineral Fiber Block and Board Thermal Insulation; 2014.

K. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

L. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

M. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4. 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 equipment scheduled.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5. DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled 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.

1.6. 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

2.1. 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.

2.2. GLASS FIBER, FLEXIBLE PIPE AND TANK INSULATION

A. Manufacturers:

1. CertainTeed Corporation; Crimp Wrap..
2. Johns Manville Corporation; MicroFlex..
3. Knauf Insulation; Pipe and Tank Insulation..
4. Owens Corning Corp; Owens Corning; Fiberglas Pipe and Tank Insulation..
5. Manson Insulation, Inc.; AK Flex..

B. Insulation: ASTM C553; flexible, noncombustible.

1. 'K' Value: 0.36 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
2. Maximum Service Temperature: 450 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.

C. Vapor Barrier Jacket: Kraft paper reinforced with glass fiber yarn and bonded to aluminized film.

1. Moisture Vapor Permeability: 0.02 perm inch, when tested in accordance with ASTM E96/E96M.

D. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.

E. Vapor Barrier Lap Adhesive: Compatible with insulation. Comply with MIL-A-3316C, Class 2, Grade A for bonding insulation jacket lap seams and joints.

1. Manufacturers:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.

F. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

1. Manufacturers:
   a. Ramco Insulation, Inc.; Super-Stik.

2.3. GLASS FIBER, RIGID

A. Manufacturer:

1. CertainTeed Corporation; CertaPro Commercial Board: www.certainteed.com.
2. Johns Manville Corporation; 800 Series Spin-Glas: www.jm.com.
3. Knauf Insulation; Insulation Board: www.knaufusa.com.
4. Owens Corning Corp; Fiberglas 700 Series: www.owenscorning.com.
5. Fibrex Insulations, Inc.; FBX.

B. Insulation: ASTM C612 ; rigid, noncombustible.

1. 'K' Value: 0.25 at 75 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
2. Maximum Service Temperature: 850 degrees F.
3. Maximum Water Vapor Absorption: 5.0 percent by weight.
4. Maximum Density: 8.0 lb/cu ft.

C. Vapor Barrier Jacket:

1. Kraft paper reinforced 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.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

1. Manufacturers:
   a. Childers Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; CP-82.
   b. Eagle Bridges - Marathon Industries; 225.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-50.
   d. Mon-Eco Industries, Inc.; 22-25.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

1. Manufacturers:
   a. Ramco Insulation, Inc.; Super-Stik.

2.4. FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Aeroflex USA, Inc; Aerocel.: www.aeroflexusa.com.
2. Armacell LLC; AP Armaflex.: www.armacell.us.
3. K-Flex USA LLC; Insul-Sheet and K-FLEX LS.: www.kflexusa.com.

B. Insulation: Preformed flexible elastomeric cellular rubber insulation complying with ASTM C534/C534M Grade 1, in sheet form.

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.

1. Manufacturers:
   a. Aeroflex USA, Inc.; Aeroseal.
   b. Armacell LLC; Armaflex 520 Adhesive.
   c. Foster Brand, Specialty Construction Brands, Inc., a business of H. B. Fuller Company; 85-75.
   d. K-Flex USA; R-373 Contact Adhesive

2.5. JACKETS

A. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.

1. Thickness: 0.025 inch sheet.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

B. Stainless Steel Jacket: ASTM A666, Type 304 stainless steel.

1. Thickness: 0.010 inch.
2. Finish: Smooth.
3. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that equipment has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2. PREPARATION

A. Prior to insulating apply a corrosion coating to insulated surfaces as follows:

1. Stainless Steel: Coat 300 series stainless steel with an epoxy primer 5 mils thick and an epoxy finish 5 mils thick if operating in a temperature range between 140 to 300 deg. F. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.
2. Carbon Steel: Coat carbon steel operating at a service temperature between 32 to 300 deg. F with an epoxy coating. Consult coating manufacturer for appropriate coating materials and application methods for operating temperature range.

B. Coordinate insulation installation with the trade installing heat tracing. Comply with requirements for heat tracing that apply to insulation.

C. Mix insulating cements with clean potable water; if insulating cements are to be in contact with stainless-steel surfaces, use demineralized water.

3.3. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Factory Insulated Equipment: Do not insulate.

C. Exposed Equipment: Locate insulation and cover seams in least visible locations.

D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.

E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.

F. Insulated equipment containing fluids below ambient temperature; insulate entire system.

G. Fiber glass insulated equipment containing fluids below ambient temperature; provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.

H. For hot equipment containing fluids 140 degrees F or less, do not insulate flanges and unions, but bevel and seal ends of insulation.

I. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.

J. Fiber glass insulated equipment containing fluids above ambient temperature; provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Finish with glass cloth and adhesive.

K. Equipment in Mechanical Equipment Rooms or Finished Spaces: Finish with aluminum jacket.

L. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.

M. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.4. SCHEDULE: Refer to the Insulation Schedule on the drawings

A. Heating Systems:

1. Pump Bodies: Insulation shall be the following:
    a. Mineral-Fiber Board: 3 inches thick and 3.0-lb/cu.ft. nominal density.
2. Heat Exchangers/Converters: Insulation shall be the following:
    a. Mineral-Fiber Board: 3 inches thick and 3.0-lb/cu.ft. nominal density.
    b. Mineral-Fiber Pipe and Tank: 2 inches thick.
3. Air Separators: Insulation shall be the following:
    a. Mineral-Fiber Board: 2 inches thick and 3.0-lb/cu.ft. nominal density.
    b. Mineral-Fiber Pipe and Tank: 2 inches thick.
4. Expansion Tanks:
    a. Mineral-Fiber Board: 2 inches thick and 1.5-lb/cu.ft. nominal density.
    b. Mineral-Fiber Pipe and Tank: 2 inches thick.
5. Hot Thermal Storage Tanks: Insulation shall be the following:
    a. Mineral-Fiber Board: 3 inches thick and 3.0-lb/cu.ft. nominal density.

B. Cooling Systems:

1. Pump Bodies: Insulation shall be the following:
    a. Flexible Elastomeric: 1 inch thick.
2. Air Separators: Insulation shall be the following:
    a. Flexible Elastomeric: 1 inch thick.
3. Expansion Tanks: Insulation shall be the following:
    a. Flexible Elastomeric: 1 inch thick.

END OF SECTION

SECTION 23 0719 - HVAC PIPING INSULATION

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Piping insulation.

B. Flexible removable and reusable blanket insulation.

C. Jackets and accessories.

1.2. RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

1.3. REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.

B. ASTM B209 - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate; 2014.

C. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate (Metric); 2014.

D. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.

E. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).

F. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2020.

G. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2019.

H. ASTM C795 - Standard Specification for Thermal Insulation for Use in Contact with Austenitic Stainless Steel; 2008 (Reapproved 2018).

I. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

J. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.

K. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4. 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.

PART 2 PRODUCTS

2.1. 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.

2.2. GLASS FIBER, RIGID

A. Manufacturers:

1. CertainTeed Corporation.
2. Johns Manville Corporation.
3. Knauf Insulation.
4. Owens Corning Corporation.

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. 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. Vapor Barrier Lap Adhesive: Compatible with insulation.

E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.

2.3. FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:
   1. Aeroflex USA, Inc; Aerocel ULP: www.aeroflexusa.com/#sle.
   2. Armacell LLC; AP Armaflex: www.armacell.us/#sle.
   3. K-Flex USA LLC; K-Flex Titan: www.kflexusa.com/#sle.

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: 180 degrees F.
   3. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.
   1. Manufacturers:
      a. Aeroflex USA, Inc; Aeroseal: www.aeroflexusa.com/#sle.

2.4. JACKETS

A. PVC Plastic.
   1. Manufacturers:
      a. Johns Manville Corporation: www.jm.com/#sle.
   2. 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. 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.
   5. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

C. Stainless Steel Jacket: ASTM A666, Type 304 stainless steel.
   1. Thickness: 0.010 inch.

2. Finish: Smooth.
3. Metal Jacket Bands: 3/8 inch wide; 0.010 inch thick stainless steel.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2. PIPING INSULATION SCHEDULE

A. Heating hot-water:

1. Up to 1-1/4" pipe size, insulation shall be the following:
   a. Glass-Fiber, 1-1/2" thick.
2. 1-1/2" pipe size and greater, insulation shall be the following:
   a. Glass-Fiber, 2" thick.

B. Chilled water:

1. Up to 1-1/4" pipe size, insulation shall be the following:
   a. Flexible Elastomeric, 1/2" thick.
2. 1-1/2" pipe size and greater, insulation shall be the following:
   a. Flexible Elastomeric, 1" thick.

C. Indoor, Refrigerant Suction, Liquid, and Hot gas:

1. All sizes, insulation shall be the following:
   a. Flexible Elastomeric, 1" thick.

3.3. FIELD APPLIED JACKET SCHEDULE

A. Exterior Chilled Water Piping:

1. All pipe sizes, field applied insulation jacket shall be the following:
   a. Aluminum Jacket: 0.02 inch sheet.
   b. Finish: Stucco embossed.
   c. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
   d. Metal Jacket Bands: 3/8 inch wide, 0.015 inch thick aluminum.

3.4. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with 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, pump bodies, and expansion joints.

E. 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.

F. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.

G. 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.

H. 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.

I. 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.

J. 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 or stainless steel jacket with seams located on bottom side of horizontal piping. Provide two coats of UV resistant finish for flexible elastomeric cellular insulation without jacketing.

END OF SECTION

SECTION 23 0913 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Control panels.

B. Control Valves:

1. Globe pattern.
2. Butterfly pattern.
3. Electronic operators.

C. Dampers.

D. Damper Operators:

1. Electric operators.

E. Input/Output Sensors:

1. Temperature sensors.
2. Humidity sensors.
3. Static pressure (air pressure) sensors.
4. Equipment operation (current) sensors.
5. Digital to pneumatic transducers.
6. Damper position indicators.
7. Carbon dioxide sensors.

F. Thermostats:

1. Electric room thermostats.
2. Room thermostat accessories.
3. Outdoor reset thermostats.
4. Airstream thermostats.
5. Electric low limit duct thermostats.
6. Electric high limit duct thermostats.

G. Transmitters:

1. Building static pressure transmitters.
2. Pressure transmitters.
3. Air pressure transmitters.
4. Water pressure transmitters (liquid differential pressure transmitters).
5. Temperature transmitters.
6. Humidity transmitters.

H. Transducers:

1. Electropneumatic transducers.

I. Flow Sensors:

1. Airflow measurement array (AFMA).

1.2. RELATED REQUIREMENTS

A. Section 23 2113 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, and gauge taps.

1.3. REFERENCE STANDARDS

A. AMCA 500-D - Laboratory Methods of Testing Dampers for Rating; 2018.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

C. NEMA DC 3 - Residential Controls - Electrical Wall-Mounted Room Thermostats; 2013.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Manufacturer's Instructions: Provide for all manufactured components.

E. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

F. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.

1. Revise shop drawings to reflect actual installation and operating sequences.

G. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

PART 2 PRODUCTS

2.1. EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.2. CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with enameled finished face panel.

C. Provide common keying for all panels.

2.3. CONTROL VALVES

A. Globe Pattern:

1. Up to 2 inches: Bronze body, bronze trim, rising stem, renewable composition disc, screwed ends with backseating capacity repackable under pressure.

2. Over 2 inches: Iron body, bronze trim, rising stem, plug-type disc, flanged ends, renewable seat and disc.

3. Hydronic Systems:

a. Rate for service pressure of 125 psig at 250 degrees F.

b. Replaceable plugs and seats of stainless steel.

c. Size for 3 psig maximum pressure drop at design flow rate.

d. two-way valves shall have equal percentage characteristics, three way valves linear characteristics. Size two-way valve operators to close valves against pump shut off head.

4. Steam Systems:

a. Rate for service pressure of 125 psig at 250 degrees F.

b. Replaceable plugs and seats of stainless steel. Pressure drop across any steam valve at maximum flow; as indicated on drawings.

c. Size for 10 psig inlet pressure and 5 psig pressure drop.

d. Valves shall have modified linear characteristics.

B. Butterfly Pattern:

1. Iron body, bronze disc, resilient replaceable seat for service to 180 degrees F wafer or lug ends, extended neck.

2. Hydronic Systems:

a. Rate for service pressure of 125 psig at 250 degrees F.

b. Size for 1 psig maximum pressure drop at design flow rate.

C. Electronic Operators:

1. Valves shall spring return to normal position as indicated on freeze, fire, or temperature protection.

2. Select operator for full shut off at maximum pump differential pressure.

2.4. DAMPERS

A. Performance: Test in accordance with AMCA 500-D.

B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 12 gage, 0.1046 inch.

C. Blades: Galvanized steel, maximum blade size 8 inches wide, 48 inches long, minimum 22 gage, 0.0299 inch, attached to minimum 1/2 inch shafts with set screws.

D. Blade Seals: Synthetic elastomeric, mechanically attached, field replaceable.

E. Jamb Seals: Spring stainless steel.

F. Shaft Bearings: Oil impregnated sintered bronze.

G. Linkage Bearings: Oil impregnated sintered bronze.

H. Leakage: Less than one percent based on approach velocity of 2000 ft per min and 4 inches wg.

I. Maximum Pressure Differential: 6 inches wg.

J. Temperature Limits: Minus 40 to 200 degrees F.

2.5. DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.

1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.

2. Provide one operator for maximum 36 sq ft damper section.

B. Electric Operators:

1. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch and and 24 V dc, 24 va transformer.

2.6. INPUT/OUTPUT SENSORS

A. Temperature Sensors:

1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
3. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
4. Temperature Sensing Device: Compatible with project DDC controllers.
5. Performance Characteristics:
    a. RTD:
        1) Room Sensor Accuracy: Plus/minus 0.50 degrees F minimum.
        2) Duct Averaging Accuracy: Plus/minus 0.50 degrees F minimum.
        3) Chilled Water Accuracy: Plus/minus 0.50 degrees F minimum.
        4) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
        5) Range: Minus 40 degrees F through 220 degrees F minimum.
    b. Thermistor:
        1) Accuracy (All): Plus/minus 0.36 degrees F minimum.
        2) Range: Minus 25 degrees F through 122 degrees F minimum.
        3) Heat Dissipation Constant: 2.7 mW per degree C.
    c. Temperature Transmitter:
        1) Accuracy: 0.10 degree F minimum or plus/minus 0.20 percent of span.
        2) Output: 4 to 20 mA.
    d. Sensing Range:
        1) Provide extended range sensors if required to sense the range expected for a respective point.
        2) Use RTD type sensors for extended ranges beyond minus 30 degrees F to 230 degrees F.
        3) Use temperature transmitters in conjunction with RTD's when RTD's are incompatible with DDC controller direct temperature input.
    e. Wire Resistance:
        1) Use appropriate wire size to limit temperature offset due to wire resistance to 1.0 degree F or use temperature transmitter when offset is greater than 1.0 degree F due to wire resistance.
        2) Compensate for wire resistance in software input definition when feature is available in the DDC controller.
    f. Room Sensors: Locking cover matching the pneumatic thermostats used.
    g. Outside Air Sensors: Watertight inlet fitting shielded from direct rays of the sun.
    h. Immersion Temperature Sensors: A sensor encased in a corrosion-resistant probe with a threaded-enclosure service entry body.
    i. Room Temperature Sensors with Integral Digital Display:
        1) Construct for surface or wall box.

2) Provide a four button keypad with the following capabilities:

(a) Indication of space and outdoor temperatures.

(b) Setpoint adjustment to accommodate room setpoint, DDC Input/Output Points List, and Sequence of Operation.

(c) Manual occupancy override and indication of occupancy status.

(d) Controller mode status.

j. Temperature Averaging Elements:

1) Use on duct sensors for ductwork 10 sq ft or larger.

2) Provide for all mixed air and heating coil discharge sensors regardless of duct size.

k. Insertion Elements:

1) Use in ducts not affected by temperature stratification or smaller than 11 sq inches.

2) Provide dry type, insertion elements for liquids, installed in immersion wells, with minimum insertion length of 2.5 inches.

B. Humidity Sensors:

1. Duct Mounted Sensor: Voltage type encased in a die-cast metal, weather-proof housing.

a. Input Power, Voltage Type: Class 2; 12-30 VDC/24 VAC, 15mA max., 24 VAC plus/minus 10 percent 50/60 Hz, or as required for compatibility with the DDC system.

b. Input Power, mA Type: Class 2; Loop powered 12-30 VDC only, 30 mA max.

c. Output Voltage Type: 0-10 V observed polarity or 0-5 V observed polarity.

d. Output mA Type: 2-wire, not polarity sensitive (clipped and capped).

e. Humidity:

1) HS Element: Replaceable digitally profiled thin-film capacitive.

2) Accuracy 1 percent at 10 to 80 percent relative humidity at 77 degrees F, multi-point calibration, NIST traceable.

(a) Plus/minus 1 percent at 20 to 40 percent RH in mA output mode; (multi-point calibration, NIST traceable).

3) Scaling: 0 to 100 percent RH.

f. Temperature Effect:

1) Duct Mounted: Plus/minus 0.18 percent per degree F.

2) Outdoor Mounted: 4 to 20mA version: (0.0013x%RHx(TdegreeC-25)).

g. Hysteresis: 1.5 percent typical.

h. Linearity: Included in accuracy specification.

i. Reset Rate: 24 hours.

j. Stability: Plus/minus 1 percent at 68 degrees F (20 degrees C) annually, for two years.

k. Temperature Monitoring:

1) Temperature Transmitter Output: Digital, 4 to 20mA (clipped and capped) or 0-5V/0-10V output.

l. Operating Environment:

1) Operating Humidity Range: 0 to 100 percent RH noncondensing.

2) Operating Temperature Range: Minus 40 degrees F to 122 degrees F.

2. Wall Mounted Sensor: Voltage type encased in a High impact ABS plastic housing.

C. Static Pressure (Air Pressure) Sensors:

1. Unidirectional with ranges not exceeding 150 percent of maximum expected input.
2. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.
3. Accuracy: One percent of full scale with repeatability 0.3 percent.
4. Output: 0 to 5 vdc with power at 12 to 28 vdc.

D. Equipment Operation (Current) Sensors:

1. Status Inputs for Fans: Differential pressure switch with adjustable range of 0 to 5 inches wg.
2. Status Inputs for Pumps: Differential pressure switch piped across pump with adjustable pressure differential range of 8 to 60 psi.
3. Status Inputs for Electric Motors: Current sensing relay with current transformers, adjustable and set to 175 percent of rated motor current.

E. Carbon Dioxide Sensors, Duct and Wall:

1. General: Provide non-dispersive infrared (NDIR), diffusion sampling CO2 sensors with integral transducers and linear output.
2. Air Temperature: Range of 32 to 122 degrees F.
3. Relative Humidity: Range of 0 to 95 percent (non-condensing).
4. Power Input: Class 2; 12 to 30VDC or 24VAC 50/60 Hz; 100mA max.
5. Calibration Characteristics:
    a. Automatically compensating algorithm for sensor drift due to sensor degradation.
    b. Maximum Drift: 2 percent.
    c. User calibratable with a minimum calibration interval of 5 years.
6. Construction:
    a. Sensor Chamber: Non-corrosive material for neutral effect on carbon dioxide sample.
    b. Provide duct mounted sensors with duct probe designed to protect sensing element from dust accumulation and mechanical damage.
    c. Housing: High impact plastic, UL 94 VO.

2.7. THERMOSTATS

A. Electric Room Thermostats:

1. Type: NEMA DC 3, 24 volts, with setback/setup temperature control.
2. Service: Cooling and heating.
3. Covers: Locking with set point adjustment and setpoint indication, with thermometer.

B. Room Thermostat Accessories:

1. Insulating Bases: For thermostats located on exterior walls.
2. Thermostat Guards: Metal mounted on separate base.
3. Adjusting Key: As required for device.
4. Aspirating Boxes: Where indicated for thermostats requiring flush installation.

C. Outdoor Reset Thermostats:

1. Remote bulb or bimetal rod and tube type, proportioning action with adjustable throttling range, adjustable setpoint.
2. Scale range: Minus 10 to 70 degrees F.

D. Airstream Thermostats:

1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint in middle of range and adjustable throttling range.
2. Averaging service remote bulb element: 7.5 feet.

E. Electric Low Limit Duct Thermostats:

1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint,
2. Bulb length: Minimum 20 feet.
3. Provide one thermostat for every 20 sq ft of coil surface.

F. Electric High Limit Duct Thermostats:

1. Snap acting, single pole, single throw, manual reset switch that trips if temperature sensed across any 12 inches of bulb length is equal to or above setpoint,
2. Bulb length: Minimum 20 feet.
3. Provide one thermostat for every 20 sq ft of coil surface.

2.8. TRANSMITTERS

A. Building Static Pressure Transmitters:

1. One pipe, differential type with temperature compensation, scale range 0.01 to 6.0 inch wg positive or negative, and sensitivity of 0.0005 inch wg. Transmit electronic signal to receiver with matching scale range.

B. Pressure Transmitters:

1. One pipe direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.

C. Air Pressure Transmitters:

1. General: Provide dry media differential pressure transducers to monitor duct, room, and ____ pressure.
    a. Media Compatibility: Dry air.
    b. Input Power: Class 2; 12 to 30 VDC; 2-wire: 20 mA max.
    c. Output: Field selectable, 2-wire, loop-powered 4 to 20 mA (DC only, clipped and capped).
    d. Pressure Ranges: 4 and 7, field selectable.
    e. Response Time:
        1) Standard: T95 in 20 seconds.
    f. Proof Pressure (pressure differential): 3 psid.
    g. Accuracy: Plus/minus 1 percent f.s. (full scale) of selected range (combined linearity & hysteresis).
    h. Temperature Effect (per transmitter size):
        1) 1 inch w.c.: 2.0 percent per degree C.
        2) 10 inch w.c.: 0.01 percent per degree C.; (Relative to 25 degrees C) 32 degrees F to 122 degrees F.
    i. Zero Drift (1-year) (per transmitter size):
        1) 1 inch w.c.: 2 percent maximum.
        2) 10 inch: 0.05 percent maximum.

j. Zero adjust: Pushbutton auto-zero and digital input (2-pos terminal block).

k. Operating Environment:

1) 32 degrees F to 140 degrees F.

2) 0 to 90 percent RH noncondensing.

l. Fittings:

1) Brass barb.

2) 0.24 inches outer diameter.

D. Water Pressure Transmitters (Liquid Differential Pressure Transmitters):

1. General: Provide wet media differential pressure transducers with 6 ft (1.83 m) armored cable, to allow remote pressure sensing capability using existing plumbing runs.

a. Input Power: Class 2; 15 to 30 VDC, 24VAC nominal, 50/60 Hz.

b. Maximum Current Draw:

1) DC: 125 mA.

2) AC: 280 mA.

c. Output: 3-wire transmitter; user-selectable, 4 to 20 mA (0 to 5V/0 to 10V).

d. Sensor:

1) Media Compatibility: 17 to 4 PH stainless steel.

2) Status Indication: Dual color LED.

3) Proof Pressure: 2x max. F.S. range.

4) Burst Pressure: 5x max. F.S. range.

5) Accuracy at 77 degrees F for less than or equal 20 ft:

(a) Ranges A and B: Plus/minus 1 percent F.S. typical.

6) Surge Damping: Electronic; 1 second averaging.

7) Long Term Stability: Plus/minus 0.25 percent.

e. Pressure Ranges:

1) 0 psi to 50 psi (Gauge): 5 psid/10 psid/25 psid/50 psid (pressure differential).

2) 0 psi to 100 psi (Gauge): 10 psid/20 psid/50 psid/100 psid (pressure differential).

3) 0 psi to 250 psi (Gauge): 25 psid/50 psid/125 psid/250 psid (pressure differential).

f. Operating Conditions:

1) Temperature Compensated Range:

(a) TC Span less than 1.5 percent of product F.S. (full scale) per sensor.

2) Sensor Operating Range: Minus 4 degrees F to 185 degrees F.

3) Operating Environment: 14 degrees F to 122 degrees F; 10 to 90 percent RH noncondensing.

g. Enclosure: NEMA 250, Type 4.

E. Temperature Transmitters:

1. One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 200 degrees F span and plus or minus 1 percent for 50 degrees F span, with 50 degrees F. temperature range, compensated bulb, averaging capillary, or rod and tube operation on 20 psig input pressure and 3 to 15 psig output.

F. Humidity Transmitters:

1. One pipe, directly proportioned output signal to measured variable, linearity within plus or minus 1 percent for 70 percent relative humidity span, capable of withstanding 95 percent relative humidity without loss of calibration.

2.9. TRANSDUCERS

A. Electropneumatic Transducers:

1. General: Provide electropneumatic pressure transducer utilizing micro-controlled poppet valve technology for pressure sensing in multiple applications.
   a. Input Power: Class 2; 24 VAC/DC nominal, 30 VAC max; 150 mA max.
   b. Control Input: Class 2; 4 to 20 mA/0 to 5 V/0 to 10 VDC, jumper-selectable.
   c. Accuracy: 1 percent.
   d. Operating Environment: 10 to 90 percent RH noncondensing.
   e. Air Capacity:
   f. Supply Pressure: 45 psi.
   g. Control Range: 0 to 20 psi, or 3 to 15 psi.
   h. Pressure Differential: 0.1 psi (supply to branch).
   i. Minimum Tubing Length: 15 ft.
   j. Port Connection: 1/8 inch poly tubing.
   k. Media Connection:
      1) Clean, dry air, or inert gas.
      2) Use with oxygen service is prohibited.

2.10. FLOW SENSORS

A. Airflow Measurement Array (AFMA):

1. Outdoor Air Temperature: In outside air measurement or in low-temperature air delivery applications, provide an AFMA certified by the manufacturer to be accurate as specified over a temperature range of minus 20 degrees F to 120 degrees F.
2. Airflow Resistance:
   a. Resistance to Airflow Through the AFMA and the Airflow Straightener: Not to exceed 0.085 inches at an airflow velocity of 2000 fpm.
   b. AFMA Construction: Suitable for operation at air flows of up to 5000 fpm over a temperature range of 40 degrees F to 120 degrees F.
3. Pitot Tube:
   a. Furnish each pitot tube AFMA with an array of velocity sensing elements.
   b. Velocity Sensing Elements: Multiple pitot tube type with averaging manifolds.
   c. Distribute the sensing elements across the duct section in the pattern and quantity specified or as recommended by the installation instructions of the AMFA manufacturer.
      1) Pitot Tube AFMA's in Air Flows Over 600 fpm: Accuracy of plus/minus 5 percent over a range of 500 fpm to 2500 fpm.
      2) Pitot Tube AFMA's in Air Flows Under 600 fpm: Accuracy of plus/minus 5 percent over a range of 125 fpm to 2500 fpm.
4. Electronic:

a. Each electronic AFMA to consist of an array of velocity sensing elements of the resistance temperature detector (RTD) or thermistor type.

b. Sensing Elements: Distributed across the duct cross section in the quantity and pattern specified or recommended by the published application data of the manufacturer.

c. Electronic AFMA's: Accuracy of plus/minus 5 percent over a range of 125 fpm to 5,000 fpm and temperature compensated output over a range of 32 degrees F to 212 degrees F.

d. Fan Inlet Measurement Devices: Refer to drawings and/or equipment schedules.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.2. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Check and verify location of thermostats with plans and room details before installation. Locate 60 inches above floor. Align with lighting switches and humidistats. Refer to Section 26 2726.

C. Mount freeze protection thermostats using flanges and element holders.

D. Mount outdoor reset thermostats and outdoor sensors indoors, with sensing elements outdoors with sun shield.

E. Provide separable sockets for liquids and flanges for air bulb elements.

F. Provide thermostats in aspirating boxes in front entrances.

G. Provide guards on thermostats in entrances, public areas, and where indicated.

H. Provide valves with position indicators and with pilot positioners where sequenced with other controls.

I. Provide separate steam valves for each bank of coils. Provide two valves in parallel where steam load exceeds 1500 lb per hr with 1/3 to 2/3 load capacities sequenced with smaller valve opening first.

J. Provide mixing dampers of opposed blade construction arranged to mix streams. Provide pilot positioners on mixed air damper motors. _____.

K. Provide isolation (two position) dampers of parallel blade construction.

L. Provide pilot positioners on pneumatic damper operators sequenced with other controls.

M. Install damper motors on outside of duct in warm areas. Do not install motors in locations at outdoor temperatures.

N. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.

O. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.

P. Provide conduit and electrical wiring in accordance with Section 26 0583. Electrical material and installation shall be in accordance with appropriate requirements of .

END OF SECTION

SECTION 23 0923 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1. SECTION INCLUDES

A. System description.

B. Operator interface.

C. Controllers.

D. Power supplies and line filtering.

E. System software.

F. Controller software.

G. HVAC control programs.

1.2. RELATED REQUIREMENTS

A. Section 23 0913 - Instrumentation and Control Devices for HVAC.

B. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3. REFERENCE STANDARDS

A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020.

B. ASHRAE Std 147 - Reducing the Release of Halogenated Refrigerants From Refrigerating and Air-Conditioning Equipment and Systems; 2019.

C. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; 2019h.

D. ASHRAE Std 147 - Reducing the Release of Halogenated Refrigerants From Refrigerating and Air-Conditioning Equipment and Systems; 2019.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL (DIR) - Online Certifications Directory; Current Edition.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Conduct a preinstallation meeting at least one week prior to the start of the work of this section; require attendance by all affected installers.

1.5. 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. List connected data points, including connected control unit and input device.

3. Indicate system graphics indicating monitored systems, data (connected and calculated) point addresses, and operator notations. Provide demonstration digital media containing graphics.

4. Show system configuration with peripheral devices, batteries, power supplies, diagrams, modems, and interconnections.

5. 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.

H. Maintenance Materials:

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.6. QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for purpose specified and indicated.

1.7. WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a one year period after Substantial Completion.

C. Provide five year manufacturer's warranty for field programmable micro-processor based units.

1.8. PROTECTION OF SOFTWARE RIGHTS

A. Prior to delivery of software, the Owner and the party providing the software will enter into a software license agreement with provisions for the following:

1. Limiting use of software to equipment provided under these specifications.

2. Limiting copying.

3. Preserving confidentiality.

4. Prohibiting transfer to a third party.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Trane Corporation, Tracer SC+ and Tracer Ensemble.

B. Substitutions: See Section 01 6000 - Product Requirements.

2.2. SYSTEM DESCRIPTION

A. Integrates owner's existing legacy Trane Building Automation Systems with new building control system under a single log in interface.

B. Automatic temperature control field monitoring and control system using field programmable micro-processor based units.

C. 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.

D. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

E. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units. Individual terminal unit control is specified in Section 23 0913.

F. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

G. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

2.3. OPERATOR INTERFACE

A. PC Based Work Station:

1. Resides on high speed network with building controllers.
2. Connected to server for full access to all system information.

B. Workstation, controllers, and control backbone to communicate using BACnet protocol and addressing.

C. BACnet protocol to comply with ASHRAE Std 135.

D. Hardware:

1. Desktop:
   a. Computer(s) and display(s) to be provided by DDC controls manufacturer.
   b. Quantity: Provide allowance for one computer(s).
   c. Minimum RAM: as determined by the system designer.
   d. Minimum Processing Speed: as determined by the system designer.
   e. Minimum Hard Drive Memory: as determined by the system designer.
   f. Drives: as determined by the system designer.
   g. Ports: as determined by the system designer.
   h. Monitor: minimum 21 inch, and with features as determined by the system designer.
   i. Location(s): As directed by the Owner.
   j. Network Connection:
      1) Ethernet interface card.
      2) Minimum Speed: as determined by the system designer.
   k. System Printer:
      1) Printer(s) to be provided by DDC controls manufacturer.
      2) Quantity: As indicated on the drawings.
      3) Type: Color Laser.
      4) Resolution: 600 dpi or greater.
      5) Minimum Print Speed: 10 page per minute or greater.
      6) Locations(s): As directed by the Owner.

2.4. 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. 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. Local Keypad and Display for each Controller:

a. Use for interrogating and editing data.

b. System security password prevents unauthorized use.

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 CONTROLLERS

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:
      1) VAV terminal units.
      2) CAV Terminal Units.
   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.

2.5. 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 workstations and 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.

2.6. LOCAL AREA NETWORK (LAN)

A. Provide communication between control units over local area network (LAN).

B. LAN Capacity: Not less than 60 stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 19.2 Kb.

E. Communication Techniques: Allow interface into network by multiple operation stations and by auto-answer/auto-dial modems. Support communication over telephone lines utilizing modems.

F. Transmission Median: Fiber optic or single pair of solid 24 gage twisted, shielded copper cable.

G. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.7. SYSTEM SOFTWARE

A. Operating System:

1. Concurrent, multi-tasking capability.

a. Common Software Applications Supported: Microsoft Excel, WordPerfect, and Microsoft Access.

b. Acceptable Operating Systems: Windows 10 or later.

2. System Graphics:

a. Allow up to 10 graphic screens, simultaneously displayed for comparison and monitoring of system status.

b. Animation displayed by shifting image files based on object status.

c. Provide method for operator with password to perform the following:

1) Move between, change size, and change location of graphic displays.

2) Modify on-line.

3) Add, delete, or change dynamic objects consisting of:

(a) Analog and binary values.

(b) Dynamic text.

(c) Static text.

(d) Animation files.

3. Custom Graphics Generation Package:

a. Create, modify, and save graphic files and visio format graphics in PCX, TIFF, GEM, and .dwg formats.

b. HTML graphics to support web browser compatible formats.

c. Capture or convert graphics from AutoCAD and Designer.

4. Standard HVAC Graphics Library:

a. HVAC Equipment:

1) Chillers.

2) Boilers.

3) Air Handlers.
4) Terminal HVAC Units.
5) Fan Coil Units.

b. Ancillary Equipment:
1) Fans.
2) Pumps.
3) Coils.
4) Dampers.

c. File Format Compatible with Graphics Generation Package Program.

B. Workstation System Applications:

1. Automatic System Database Save and Restore Functions:
a. Current database copy of each Building Controller is automatically stored on hard disk.
b. Automatic update occurs upon change in any system panel.
c. In the event of database loss in any system panel, the first workstation to detect the loss automatically restores the database for that panel unless disabled by the operator.

2. Manual System Database Save and Restore Functions by Operator with Password Clearance:
a. Save database from any system panel.
b. Clear a panel database.
c. Initiate a download of a specified database to any system panel.

3. Software provided allows system configuration and future changes or additions by operators under proper password protection.

4. On-line Help:
a. Context-sensitive system assists operator in operation and editing.
b. Available for all applications.
c. Relevant screen data provided for particular screen display.
d. Additional help available via hypertext.

5. Security:
a. Operator log-on requires user name and password to view, edit, add, or delete data.
b. System security selectable for each operator.
c. System supervisor sets passwords and security levels for all other operators.
d. Operator passwords to restrict functions accessible to viewing and/or changing system applications, editor, and object.
e. Automatic, operator log-off results from keyboard or mouse inactivity during user-adjustable, time period.
f. All system security data stored in encrypted format.

6. System Diagnostics:
a. Operations Automatically Monitored:
1) Workstations.
2) Printers.
3) Modems.

4) Network connections.
5) Building management panels.
6) Controllers.

b. Device failure is annunciated to the operator.

7. Alarm Processing:
   a. All system objects are configurable to "alarm in" and "alarm out" of normal state.
   b. Configurable Objects:
      1) Alarm limits.
      2) Alarm limit differentials.
      3) States.
      4) Reactions for each object.
8. Alarm Messages:
   a. Descriptor: English language.
   b. Recognizable Features:
      1) Source.
      2) Location.
      3) Nature.
9. Configurable Alarm Reactions by Workstation and Time of Day:
   a. Logging.
   b. Printing.
   c. Starting programs.
   d. Displaying messages.
   e. Dialing out to remote locations.
   f. Paging.
   g. Providing audible annunciation.
   h. Displaying specific system graphics.
10. Custom Trend Logs:
    a. Definable for any data object in the system including interval, start time, and stop time.
    b. Trend Data:
       1) Sampled and stored on the building controller panel.
       2) Archivable on hard disk.
       3) Retrievable for use in reports, spreadsheets and standard database programs.
       4) Archival on LAN accessible storage media including hard disk, tape, Raid array drive, and virtual cloud environment.
       5) Protected and encrypted format to prevent manipulation, or editing of historical data and event logs.
11. Alarm and Event Log:
    a. View all system alarms and change of states from any system location.
    b. Events listed chronologically.

c. Operator with proper security acknowledges and clears alarms.

d. Alarms not cleared by operator are archived to the workstation hard disk.

12. Object, Property Status and Control:

a. Provide a method to view, edit if applicable, the status of any object and property in the system.

b. Status Available by the Following Methods:

1) Menu.

2) Graphics.

3) Custom Programs.

13. Reports and Logs:

a. Reporting Package:

1) Allows operator to select, modify, or create reports.

2) Definable as to data content, format, interval, and date.

3) Archivable to hard disk.

b. Real-time logs available by type or status such as alarm, lockout, normal, etc.

c. Stored on hard disk and readily accessible by standard software applications, including spreadsheets and word processing.

d. Set to be printed on operator command or specific time(s).

14. Reports:

a. Standard:

1) Objects with current values.

2) Current alarms not locked out.

3) Disabled and overridden objects, points and SNVTs.

4) Objects in manual or automatic alarm lockout.

5) Objects in alarm lockout currently in alarm.

6) Logs:

(a) Alarm History.

(b) System messages.

(c) System events.

(d) Trends.

b. Custom:

1) Daily.

2) Weekly.

3) Monthly.

4) Annual.

5) Time and date stamped.

6) Title.

7) Facility name.

c. Tenant Override:

1) Monthly report showing total, requested, after-hours HVAC and lighting services on a daily basis for each tenant.
2) Annual report showing override usage on a monthly basis.

d. Electrical, Fuel, and Weather:
1) Weather:
(a) Monthly showing minimum, maximum, average outdoor air temperature and heating/cooling degree-days for the month.

e. Daily Operating Condition of Chiller(s) Based on ASHRAE Std 147:
1) Chilled water inlet and outlet temperature.
2) Chilled water flow.
3) Chilled water inlet and outlet pressure.
4) Evaporator refrigerant pressure and temperature.
5) Condenser refrigerant pressure and temperature.
6) Condenser refrigerant pressure and liquid temperature.
7) Condenser water flow.
8) Refrigerant levels.
9) Oil pressure and temperature.
10) Oil level.
11) Compressor refrigerant discharge temperature.
12) Refrigerant suction temperature.
13) Addition of refrigerant.
14) Addition of oil.
15) Motor amperes per phase.
16) Motor volts per phase.
17) Ambient temperature (dry-bulb and wet-bulb).
18) Date and time logged.

C. Workstation Applications Editors:
1. Provide editing software for each system application at PC workstation.
2. Downloaded application is executed at controller panel.
3. Full screen editor for each application allows operator to view and change:
a. Configuration.
b. Name.
c. Control parameters.
d. Set-points.
4. Scheduling:
a. Monthly calendar indicates schedules, holidays, and exceptions.
b. Allows several related objects to be scheduled and copied to other objects or dates.
c. Start and stop times adjustable from master schedule.
5. Custom Application Programming:

a. Create, modify, debug, edit, compile, and download custom application programming during operation and without disruption of all other system applications.

b. Programming Features:

1) English oriented language, based on BASIC, FORTRAN, C, or PASCAL syntax allowing for free form programming.

2) Alternative language graphically based using appropriate function blocks suitable for all required functions and amenable to customizing or compounding.

3) Insert, add, modify, and delete custom programming code that incorporates word processing features such as cut/paste and find/replace.

4) Allows the development of independently, executing, program modules designed to enable and disable other modules.

5) Debugging/simulation capability that displays intermediate values and/or results including syntax/execution error messages.

6) Support for conditional statements (IF/THEN/ELSE/ELSE-F) using compound Boolean (AND, OR, and NOT) and/or relations (EQUAL, LESS THAN, GREATER THAN, NOT EQUAL) comparisons.

7) Support for floating-point arithmetic utilizing plus, minus, divide, times, square root operators; including absolute value; minimum/maximum value from a list of values for mathematical functions.

8) Language consisting of resettable, predefined, variables representing time of day, day of the week, month of the year, date; and elapsed time in seconds, minutes, hours, and days where the variable values cab be used in IF/THEN comparisons, calculations, programming statement logic, etc.

9) Language having predefined variables representing status and results of the system software enables, disables, and changes the set points of the controller software.

2.8. CONTROLLER SOFTWARE

A. All applications reside and operate in the system controllers and editing of all applications occurs at the operator workstation.

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.

3. User Log On/Log Off attempts are recorded.

4. Automatic Log Off occurs following the last keystroke after a user defined delay time.

C. Object or Object Group Scheduling:

1. Weekly Schedules Based on Separate, Daily Schedules:

a. Include start, stop, optimal stop, and night economizer.

b. 10 events maximum per schedule.

c. Start/stop times adjustable for each group object.

2. Holiday or Special Schedules:

a. Capability to define up to 99 schedules.

b. Repeated annually.

c. Length of each period is operator defined.

D. Provide standard application for equipment coordination and grouping based on function and location to be used for scheduling and other applications.

E. 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.
    c. Reporting Options:
        1) Start programs.
        2) Logged.
        3) Custom messaging.
        4) Graphical displays.
        5) Dial out to workstation receivers via system protocol.

F. Maintenance Management: System monitors equipment status and generates maintenance messages based upon user-designated run-time limits.

G. Sequencing: Application software based upon specified sequences of operation in Section 23 0993.

H. PID Control Characteristics:

1. Direct or reverse action.
2. Anti-windup.
3. Calculated, time-varying, analog value, positions an output or stages a series of outputs.
4. User selectable controlled variable, set-point, and PED gains.

I. Staggered Start Application:

1. Prevents all controlled equipment from simultaneously restarting after power outage.
2. Order of equipment startup is user selectable.

J. Anti-Short Cycling:

1. All binary output objects protected from short-cycling.
2. Allows minimum on-time and off-time to be selected.

K. On-Off Control with Differential:

1. Algorithm allows binary output to be cycled based on a controlled variable and set-point.
2. Algorithm to be direct-acting or reverse-acting incorporating an adjustable differential.

L. Run-Time Totalization:

1. Totalize run-times for all binary input objects.
2. Provides operator with capability to assign high run-time alarm.

2.9. HVAC CONTROL PROGRAMS

A. Optimal Run Time:

1. Control start-up and shutdown times of HVAC equipment for both heating and cooling.
2. Base on occupancy schedules, outside air temperature, seasonal requirements, and interior room mass temperature.

3. Start-up systems by using outside air temperature, room mass temperatures, and adaptive model prediction for how long building takes to warm up or cool down under different conditions.
4. Use outside air temperature to determine early shut down with ventilation override.
5. Analyze multiple building mass sensors to determine seasonal mode and worse case condition for each day.
6. Operator commands:
    a. Define term schedule.
    b. Add/delete fan status point.
    c. Add/delete outside air temperature point.
    d. Add/delete mass temperature point.
    e. Define heating/cooling parameters.
    f. Define mass sensor heating/cooling parameters.
    g. Lock/unlock program.
    h. Request optimal run time control summary.
    i. Request optimal run time mass temperature summary.
    j. Request HVAC point summary.
    k. Request HVAC saving profile summary.
7. Control Summary:
    a. HVAC Control system begin/end status.
    b. Optimal run time lock/unlock control status.
    c. Heating/cooling mode status.
    d. Optimal run time schedule.
    e. Start/Stop times.
    f. Selected mass temperature point ID.
    g. Optimal run time system normal start times.
    h. Occupancy and vacancy times.
    i. Optimal run time system heating/cooling mode parameters.
8. HVAC point summary:
    a. Control system identifier and status.
    b. Point ID and status.
    c. Outside air temperature point ID and status.
    d. Mass temperature point ID and point.
    e. Calculated optimal start and stop times.
    f. Period start.

B. Supply Air Reset:

1. Monitor heating and cooling loads in building spaces, terminal reheat systems, both hot deck and cold deck temperatures on dual duct and multizone systems, single zone unit discharge temperatures.
2. Adjust discharge temperatures to most energy efficient levels satisfying measured load by:
    a. Raising cooling temperatures to highest possible value.

b. Reducing heating temperatures to lowest possible level.

3. Operator commands:
   a. Add/delete fan status point.
   b. Lock/unlock program.
   c. Request HVAC point summary.
   d. Add/Delete discharge controller point.
   e. Define discharge controller parameters.
   f. Add/delete air flow rate.
   g. Define space load and load parameters.
   h. Request space load summary.
4. Control summary:
   a. HVAC control system status (begin/end).
   b. Supply air reset system status.
   c. Optimal run time system status.
   d. Heating and cooling loop.
   e. High/low limits.
   f. Deadband.
   g. Response timer.
   h. Reset times.

C. Enthalpy Switchover:
1. Calculate outside and return air enthalpy using measured temperature and relative humidity; determine energy expended and control outside and return air dampers.
2. Operator commands:
   a. Add/delete fan status point.
   b. Add/delete outside air temperature point.
   c. Add/delete discharge controller point.
   d. Define discharge controller parameters.
   e. Add/delete return air temperature point.
   f. Add/delete outside air dew point/humidity point.
   g. Add/delete return air dew point/humidity point.
   h. Add/delete damper switch.
   i. Add/delete minimum outside air.
   j. Add/delete atmospheric pressure.
   k. Add/delete heating override switch.
   l. Add/delete evaporative cooling switch.
   m. Add/delete air flow rate.
   n. Define enthalpy deadband.
   o. Lock/unlock program.
   p. Request control summary.

q. Request HVAC point summary.

3. Control summary:

a. HVAC control system begin/end status.

b. Enthalpy switchover optimal system status.

c. Optimal return time system status.

d. Current outside air enthalpy.

e. Calculated mixed air enthalpy.

f. Calculated cooling cool enthalpy using outside air.

g. Calculated cooling cool enthalpy using mixed air.

h. Calculated enthalpy difference.

i. Enthalpy switchover deadband.

j. Status of damper mode switch.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.2. 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 and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. 23 0993.

C. Provide with 120v AC, 15 amp dedicated emergency power circuit to each programmable control unit.

D. Provide conduit and electrical wiring in accordance with Section 26 0583. Electrical material and installation shall be in accordance with appropriate requirements.

E. Integrate owners existing legacy Trane Building Automation System with new building control system under a single log in interface.

3.3. 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.

B. Provide service engineer to instruct Owner's representative in operation of systems plant and equipment for 3 day period.

C. Provide basic operator training for 4 persons on data display, alarm and status descriptors, requesting data, execution of commands and request of logs. Include a minimum of 40 hours dedicated instructor time. Provide training on site.

3.4. DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate complete and operating system to Owner.

END OF SECTION

SECTION 23 2113 - HYDRONIC PIPING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Hydronic system requirements.

B. Heating water piping, above grade.

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.

H. Flow controls.

1.2. RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 08 3100 - Access Doors and Panels.

C. Section 09 9123 - Interior Painting.

D. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.

E. Section 22 0719 - Plumbing Piping Insulation.

F. Section 23 0516 - Expansion Fittings and Loops for HVAC Piping.

G. Section 23 0548 - Vibration and Seismic Controls for HVAC.

H. Section 23 0553 - Identification for HVAC Piping and Equipment.

I. Section 23 0719 - HVAC Piping Insulation.

J. Section 23 2114 - Hydronic Specialties.

K. Section 23 2500 - HVAC Water Treatment: Pipe cleaning.

1.3. 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; 2016.

C. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2018.

D. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2018.

E. ASME B31.9 - Building Services Piping; 2017.

F. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.

G. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

H. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts; 2014 (Reapproved 2020).

I. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.

J. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

K. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2020.

L. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2020.

M. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992, with Editorial Revision (2018).

N. AWS A5.8M/A5.8 - Specification for Filler Metals for Brazing and Braze Welding; 2011 (Amended 2012).

O. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015, with Errata (2016).

P. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2009.

1.4. 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 catalogue information.
3. Indicate valve data and ratings.

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.

1.5. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with documented experience.

C. Provide all pressed joint couplings, fittings, valves, specialties, and crimping tools from a single manufacturer.

D. Welder Qualifications: Certify in accordance with ASME BPVC-IX.

1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Covers shall stay in place from manufacturer to delivery on site and be maintained in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system

D. Prepare valves for shipping and storage by protecting internal valve parts against rust and corrosion, protecting threads, flange faces, grooves, and weld ends and setting angle and globe valves closed to prevent rattling

E. Store valves indoors and maintain at higher-than-ambient dew point temperature. If outdoor storage is necessary, store valves off the ground in watertight enclosures.

PART 2 PRODUCTS

2.1. 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. 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 or unions to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.

D. Valves: Provide valves where indicated:

1. Isolate equipment using butterfly valves with lug end flanges or grooved mechanical couplings.

2. For throttling, bypass, or manual flow control services, use globe valves.

3. For shut-off and to isolate parts of systems or vertical risers, use gate, ball, or butterfly valves per sizes noted in valve specification.

2.2. HEATING WATER PIPING, ABOVE GRADE, NPS 2 AND SMALLER

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:

1. Threaded Joints: ASME B16.3, malleable iron fittings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), 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.

b. Braze: AWS A5.8M/A5.8 BCuP copper/silver alloy.

C. HEATING WATER PIPING, ABOVE GRADE, NPS 2-1/2 AND LARGER

1. Steel Pipe: ASTM A53/A53M, Schedule 40, black, using one of the following joint types:

a. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.

2.3. CHILLED WATER PIPING, ABOVE GRADE, NPS 2 AND SMALLER

A. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:

1. Threaded Joints: ASME B16.3, malleable iron fittings.

B. Copper Tube: ASTM B88 (ASTM B88M), Type L (B), 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.

C. CHILLED WATER PIPING, ABOVE GRADE, NPS 2-1/2 AND LARGER

1. Steel Pipe: ASTM A53/A53M, Schedule 40, black; using one of the following joint types:

a. Welded Joints: ASTM A234/A234M, wrought steel welding type fittings; AWS D1.1/D1.1M welded.

2.4. 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.

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.

2.5. 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. 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:

1. Bases: High density polypropylene.

2. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.

3. Steel Components: Stainless steel, or carbon steel hot-dip galvanized after fabrication in accordance with ASTM A123/A123M.

4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports; corrosion resistant material.

5. Height: Provide minimum clearance of 6 inches under pipe to top of roofing.

6. Manufacturers:

2.6. UNIONS, FLANGES, MECHANICAL COUPLINGS, AND DIELECTRIC CONNECTIONS

A. Unions for Pipe 2 Inches and Less:

1. Ferrous Piping: 150 psig malleable iron, threaded.

2. Copper Pipe: Bronze, soldered joints.

B. Flanges for Pipe 2 Inches and Greater:

1. Ferrous Piping: 150 psig forged steel, slip-on.

2. Copper Piping: Bronze.

C. 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.

2.7. BALL VALVES

A. Manufacturers:

1. Conbraco Industries: www.apollovalves.com.

2. Grinnell Products, a Tyco Business: www.grinnell.com.

3. Shurjoint Piping Products, Inc., a Tyco Business: www.shurjoint.com.

4. Milwaukee Valve Company: www.milwaukeevalve.com.

5. Nibco, Inc: www.nibco.com.

6. Victaulic Company: www.victaulic.com.

B. Up To and Including 2 Inches:

1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, threaded ends .

2.8. BUTTERFLY VALVES

A. Manufacturers:

1. Crane Co.: www.cranevalve.com.
2. Grinnell Products, a Tyco Business: www.grinnell.com.
3. Shurjoint Piping Products, Inc., a Tyco Business: www.shurjoint.com.
4. Hammond Valve: www.hammondvalve.com.
5. Milwaukee Valve Company: www.milwaukeevalve.com.
6. Victaulic Company: www.victaulic.com.

B. Body: Cast or ductile iron with resilient replaceable EPDM seat, lug ends, extended neck.

C. Disc: Construct of aluminum bronze or stainless steel.

D. Stem: Stainless steel with stem offset from the centerline to provide full 360 degree circumferential setting.

E. Operator: Infinite position lever handle with memory stop.

2.9. SWING CHECK VALVES

A. Manufacturers:

1. Grinnell Products, a Tyco Business: www.grinnell.com.
2. Shurjoint Piping Products, Inc., a Tyco Business: www.shurjoint.com.
3. Hammond Valve: www.hammondvalve.com.
4. Milwaukee Valve Company: www.milwaukeevalve.com.
5. Nibco, Inc: www.nibco.com.
6. Victaulic Company: www.victaulic.com.

B. Up To and Including 2 Inches:

1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder or threaded ends.

C. Over 2 Inches:

1. Iron body, bronze trim, bronze swing disc, renewable disc and seat, flanged ends.

2.10. FLOW CONTROLS

A. Manufacturers:

1. Griswold Controls: www.griswoldcontrols.com.
2. ITT Bell & Gossett: www.bellgossett.com.
3. Taco, Inc: www.taco-hvac.com.
4. Victaulic Company: www.victaulic.com.
5. Armstrong Pumps, Inc.

B. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet.

C. 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.

PART 3 EXECUTION

3.1. PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt on inside and outside before assembly.

C. Prepare piping connections to equipment using jointing system specified.

D. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

E. After completion, fill, clean, and treat systems. Refer to Section 23 2500 for additional requirements.

3.2. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route piping in orderly manner, parallel to building structure, and maintain gradient.

C. Install piping to conserve building space and to avoid interfere with use of space.

D. Group piping whenever practical at common elevations.

E. Sleeve pipe passing through partitions, walls and floors.

F. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

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. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.

2. Support horizontal piping as scheduled.

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. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

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.

J. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 22 0719.

K. Provide access where valves and fittings are not exposed. Coordinate size and location of access doors with Section 08 3100.

L. Use eccentric reducers to maintain top of pipe level.

M. Prepare unfinished pipe, fittings, supports, and accessories, ready for finish painting. Refer to Section 09 9123.

N. Install valves with stems upright or horizontal, above mid point of pipe, not inverted.

O. Use sling to handle large valves; rig sling to avoid damage to exposed parts. Do not use handwheels or stems as lifting or rigging points.

3.3. SCHEDULES

A. Hanger Spacing for Copper Tubing.

1. 1/2 inch and 3/4 inch: Maximum span, 5 feet; minimum rod size, 1/4 inch.

2. 1 inch: Maximum span, 6 feet; minimum rod size, 1/4 inch.
3. 1-1/2 inch and 2 inch: Maximum span, 8 feet; minimum rod size, 3/8 inch.
4. 2-1/2 inch: Maximum span, 9 feet; minimum rod size, 3/8 inch.
5. 3 inch: Maximum span, 10 feet; minimum rod size, 3/8 inch.
6. 4 inch: Maximum span, 12 feet; minimum rod size, 1/2 inch.

B. Hanger Spacing for Steel Piping.

1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
9. 8 inches: Maximum span, 19 feet; minimum rod size, 5/8 inch.

END OF SECTION

SECTION 23 2114 - HYDRONIC SPECIALTIES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Expansion tanks.

B. Air vents.

C. Air separators.

D. Strainers.

E. Suction diffusers.

F. Pump connectors.

G. Combination pump discharge valves.

H. Pressure-temperature test plugs.

I. Glycol system.

1.2. REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2019.

1.3. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.

1.4. DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.1. EXPANSION TANKS

A. Manufacturers:

1. Amtrol Inc: www.amtrol.com.

2. ITT Bell & Gossett: www.bellgossett.com.

3. Taco, Inc: www.taco-hvac.com.

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psi, with flexible butyl diaphragm or bladder sealed into tank, and steel support stand.

C. Accessories: Pressure gauge and air-charging fitting, tank drain; precharge to 12 psi or as indicated in Expansion Tank Schedule.

D. Automatic Cold Water Fill Assembly: Pressure reducing valve, reduced pressure double check back flow preventer, test cocks, strainer, vacuum breaker, and valved by-pass.

2.2. AIR VENTS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com/#sle.

2. ITT Bell & Gossett: www.bellgossett.com/#sle.
3. Taco, Inc: www.taco-hvac.com/#sle.

B. 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.

C. 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.

D. Washer Type:

1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.

2.3. AIR SEPARATORS

A. Coalescing Air/Dirt Separators:

1. Manufacturers:
   a. Armstrong International, Inc: www.armstronginternational.com/#sle.
   b. ITT Bell & Gossett: www.bellgossett.com/#sle.
   c. Spirotherm, Inc: www.spirotherm.com/#sle.
2. Tank: Fabricated steel tank; tested and stamped in accordance with ASME BPVC-VIII-1; for 150 psi operating pressure and 270 degrees F maximum operating temperature; subject to the requirements of the application and the manufacturer's standard maximum operating conditions.
3. Coalescing Medium: Provide structured copper or stainless steel medium filling the entire vessel to suppress turbulence and provide air elimination efficiency of 100 percent free air, 100 percent entrained air, and 99.6 percent dissolved air at the installed location.
4. Air Vent: Integral float actuated air vent at top fitting of tank rated at 150 psi, threaded to the top of the separator.
5. Inlet and Outlet Connections: Threaded for 2 NPS and smaller; Class 150 flanged connections for 2-1/2 NPS and larger.
6. Blowdown Connection: Threaded.
7. Size: Match system flow capacity.

2.4. STRAINERS

A. Manufacturers:

1. Armstrong International, Inc: www.armstronginternational.com/#sle.
2. Flexicraft Industries: www.flexicraft.com/#sle.
3. Grinnell Products, a Tyco Business: www.grinnell.com/#sle.

B. Size 2 inch and Under:

1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.

C. Size 2-1/2 inch to 4 inch:

1. Provide flanged iron body for 175 psi working pressure, Y pattern with 1/16 inch stainless steel perforated screen.

D. Size 5 inch and Larger:

1. Provide flanged iron body for 175 psi working pressure, basket pattern with 1/8 inch stainless steel perforated screen.

2.5. SUCTION DIFFUSERS

A. Manufacturers:

1. Anvil International, Inc: www.anvilintl.com.
2. Grinnell Products, a Tyco Business: www.grinnell.com.
3. Shurjoint Piping Products, Inc., a Tyco Business: www.shurjoint.com.
4. ITT Bell & Gossett: www.bellgossett.com.
5. Victaulic Company of America: www.victaulic.com.

B. Fitting: Angle pattern, cast-iron body, threaded for 2 inch and smaller, flanged for 2-1/2 inch and larger, rated for 175 psi working pressure, with bronze or stainless-steel straightening vanes, bronze or stainless-steel cylinder strainer with 3/16 inch diameter openings, disposable 5/32 inch mesh strainer to fit over cylinder strainer, 20 mesh and bronze start up screen.

C. Accessories: Factory-fabricated adjustable foot support, blowdown tapping in bottom, gage tapping in side, and drain plug.

2.6. PUMP CONNECTORS

A. Manufacturers:

1. American Wheatley, a company of Global Flow Products, LLC.
2. Anvil International; AnviFlex.
3. The Metraflex Company; Vane Flex.

B. Flexible Connectors: Flanged, braided type with wetted components of stainless steel, sized to match piping.

1. Maximum Allowable Working Pressure: 150 psig at 120 degrees F.
2. End Connections: Same as specified for pipe jointing.
3. Provide pump connector with integral vanes to reduce turbulent flow.
4. Provide necessary accessories including, but not limited to, swivel joints.

2.7. COMBINATION PUMP DISCHARGE VALVES

A. Manufacturers:

1. Crane Co.: www.cranevalve.com.
2. Taco, Inc: www.taco-hvac.com.
3. Victaulic Company of America: www.victaulic.com.
4. ITT Bell & Gossett: www.bellgossett.com.

B. Valves: Straight or angle pattern, flanged cast-iron valve body with bolt-on bonnet for 175 psi operating pressure, non-slam check valve with spring-loaded bronze disc and seat, stainless steel stem, and calibrated adjustment permitting flow regulation.

2.8. PRESSURE-TEMPERATURE TEST PLUGS

A. Manufacturers:

1. Peterson Equipment Company Inc.
2. Sisco Manufacturing Company Inc.
3. Ferguson Enterprises Inc.

B. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and EPDM insert rated for minimum 200 degrees F.

C. Application: Use extended length plugs to clear insulated piping.

2.9. GLYCOL SYSTEM

A. Pump System:

1. Storage: 55 gal polypropylene tank with bolt-removable hinged solid cover and enamel coated carbon steel tank-stand.
2. Pump:
   a. Thermally protected 1/4 hp motor at 115 to 120 VAC, single phase rated for indoor service.
   b. Maximum Service Operation: 100 psi at 85 degrees F.
3. Mechanical Accessories: System isolation valves, strainer, and pressure gauges.
4. Control Panel:
   a. Fused single-point system connection rated at 115 to 120 VAC, single phase.
   b. Interface: Hand switches with indicating lights for ON, FAULT, and LOW LEVEL.
   c. Pressure Switch: Panel-mounted and prewired for 10 psi cut-in and 40 psi cut-out, adjustable.
   d. Low Level Cut-Off Switch: Prewired to shut-down unit upon activation. Tank-side mounted.
5. Pressure Relief Valve: System-mounted brass valve tubed from pump discharge side into tank with adjustable setpoint between 20 psi and 150 psi.

B. Glycol Solution:

1. Water-based solution mix containing 30 percent ethylene glycol by volume required for cooling or heating system operating temperature range.
2. Cooling or heating System Operating Temperature Range: Between freezing and boiling points of 3 and 220 degees F at 14.7 psia.

C. Glycol Solution:

PART 3 EXECUTION

3.1. INSTALLATION

A. Install specialties in accordance with manufacturer's instructions.

B. Provide manual air vents at system high points and as indicated.

C. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

D. Provide valved drain and hose connection on strainer blowdown connection.

E. Provide pump suction fitting on suction side of base-mounted centrifugal pumps where indicated. Remove temporary strainers after cleaning systems.

F. Support pump fittings with floor-mounted pipe and flange supports.

G. Perform tests determining strength of glycol and water solution and submit written test results.

END OF SECTION

SECTION 23 2123 - HYDRONIC PUMPS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. In-line circulators.

B. Vertical in-line pumps.

C. Base-mounted pumps.

D. Automatic condensate pump units.

1.2. RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 23 0513 - Common Motor Requirements for HVAC Equipment.

C. Section 23 0548 - Vibration and Seismic Controls for HVAC.

D. Section 23 0716 - HVAC EQUIPMENT INSULATION.

E. Section 23 0719 - HVAC Piping Insulation.

F. Section 23 2113 - Hydronic Piping.

G. Section 23 2114 - Hydronic Specialties.

H. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3. REFERENCE STANDARDS

A. NEMA MG 1 - Motors and Generators; 2018.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 778 - Standard for Motor-Operated Water Pumps; Current Edition, Including All Revisions.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide certified pump curves showing performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable. Include electrical characteristics and connection requirements.

C. Shop Drawings: For each pump.

1. Show pump layout and connections.

2. Include setting drawings with templates for installing foundation and anchor bolts and other anchorages.

3. Include diagrams for power, signal, and control wiring.

D. Millwright's Certificate: Certify that base mounted pumps have been aligned.

E. Manufacturer's Installation Instructions: Indicate hanging and support requirements and recommendations.

F. Source quality-control reports.

G. Factory testing reports.

H. Start-up report for each pump.

I. Operation and Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.

J. 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 Pump Seals: One set for each type and size of pump.
3. Extra Cartridges for Side-Stream Filters: One set for each filter.

1.5. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacture, assembly, and field performance of pumps, with minimum three years of documented experience.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Armstrong Fluid Technology, Inc.
B. Aurora Pump; Division of Pentair Pump Group.
C. Bell & Gossett, a Xylem Inc. brand.
D. Peerless Pump Company.
E. Taco, Inc.

2.2. HVAC PUMPS - GENERAL

A. Provide pumps that operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.
B. Minimum Quality Standard: UL 778.
C. Base Mounted Pumps: Aligned by qualified millwright.
D. Products Requiring Electrical Connection: Listed and classified by UL or testing agency acceptable to Authority Having Jurisdiction as suitable for the purpose specified and indicated.

2.3. IN-LINE CIRCULATORS

A. Type: Factory-assembled and tested, centrifugal, overhung-impeller, single stage, horizontal pump and motor shafts, separately coupled, in-line pump as defined in HI 1.1-1.2 anmd HI 1.3.
B. Casing: Radially-split, cast iron, with threaded companion-flange pump connections, and threaded gauge tappings at inlet and outlet.
C. Impeller: Cast bronze keyed to shaft.
    1. ASTM B 584.
    2. Statically and dynamically balanced.
D. Bearings: Permanently-lubricated ball bearings.
E. Shaft: Alloy steel with copper alloy sleeve, integral thrust collar.
F. Seal: Carbon rotating against a stationary ceramic seat held by a stainless steel spring, and Buna-N bellows and gasket. Include water slinger on shaft between motor and seal. 225 degrees F maximum continuous operating temperature.
G. Drive: Flexible coupling, Molded-rubber insert with interlocking spider capable of absorbing vibration.
H. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
I. Motor: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 0513.
    1. Single speed and resiliently mounted to pump csasing.
    2. Enclosure: Open, dripproof.
    3. Enclosue Materials: Cast iron.

4. Motor Bearings: Permanently lubricated ball bearings.
5. Refer to Section 26 0583.
6. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

2.4. VERTICAL IN-LINE PUMPS

A. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, in-line pump as defined in HI 1.1-1.2 and HI 1.3; designed for installation with pump and motor shafts mounted vertically.

B. Type: Vertical, single stage, close coupled, radially or horizontally split casing, for in-line mounting, for 175 psi working pressure.

C. Casing: Cast iron, with suction and discharge gauge port, casing wear ring, seal flush connection, drain plug, flanged suction and discharge.

D. Impeller: Bronze, fully enclosed, keyed directly to motor shaft or extension.
1. ASTM B 584.
2. Statically and dynamically balanced.

E. Pump Bearings: Permanently lubricated ball bearings.

F. Shaft: Carbon steel with stainless steel impeller cap screw or nut and bronze sleeve.

G. Seal: Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and EPT bellows and gasket. Include water slinger on shaft between motor and seal.

H. Shaft Coupling: Axially split spacer coupling.

I. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

J. Motor: Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 0513.
1. Single speed and resiliently mounted to pump csasing.
2. Enclosure: Open, dripproof.
3. Enclosue Materials: Cast-iron.
4. Motor Bearings: Permanently lubricated ball bearings.
5. Refer to Section 26 2717.
6. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

2.5. BASE-MOUNTED, END-SUCTION PUMPS

A. Description: Factory-assembled and -tested, centrifugal, overhung-impeller, separately coupled, end-suction pump as defined in HI 1.1-1.2 and HI 1.3; designed for base mounting, with pump and motor shafts horizontal.

B. Type: Single stage, radially or vertically split casing, for 125 psi maximum working pressure.

C. Casing: Cast iron, with suction and discharge gauge ports, renewable bronze casing wearing rings, seal flush connection, drain plug, flanged suction and discharge.

D. Impeller: Bronze, fully enclosed, keyed to shaft.
1. ASTM B 584.
2. Statically and dynamically balanced.
3. Secured with a locking cap screw.
4. For pumps not frequency-drive controlled, trim impeller to match specified performance.

E. Bearings: Oil lubricated roller or ball bearings.

F. Shaft: Alloy steel with copper, bronze, or stainless steel shaft sleeve.

G. Seal: Mechanical seal, 225 degrees F maximum continuous operating temperature.

1. Mechanical seal consisting of carbon rotating ring against a ceramic seat held by a stainless-steel spring, and Buna-N bellows and gasket.

H. Drive: Flexible coupling with coupling guard.

1. Shaft Coupling: Molded-rubber insert and interlocking spider capable of absorbing vibration. EDPM coupling sleeve for variable speed applications.

2. Coupling Guard: Dual rated; ANSI B15.1, Section 8; OSHA 1910.219 approved; steel; removable; attached to mounting frame.

I. Baseplate: Cast iron or fabricated steel with integral drain rim.

J. Mounting Frame: Welded-steel frame and cross members, factory fabricated from ASTM A 36/A 36M channels and angles. Fabricate to mount pump casing, coupling guard, and motor.

K. Motor: Single speed, secured to mounting frame, with adjustable alignment.

1. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2. Comply with NEMA designation, temperature rating, service factor, and efficiency requirements for motors specified in Section 23 0513.

a. Enclosure: Open, dripproof.

b. Enclosure Materials: Cast-iron or Rolled steel.

c. Motor Bearings: Grease lubricated ball bearings.

d. Efficiency: Premium efficient.

e. NEMA Design: Design B, medium induction motor.

f. Service Factor: 1.15.

2.6. AUTOMATIC CONDENSATE PUMP UNITS

A. Manufacturers:

1. Beckett Corporation.

2. Hartell Pumps Div.; Milton Roy Co.

3. Little Giant Pump Co.

4. Mepco, LLC.

B. Description: Packaged units with corrosion-resistant pump, plastic tank with cover, and automatic controls. Include factory- or field-installed check valve and a 72-inch- minimum, electrical power cord with plug.

PART 3 EXECUTION

3.1. PREPARATION

A. Verify that electric power is available and of the correct characteristics.

B. Examine equipment foundations and anchor-bolt locations for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

C. Examine foundations and inertia bases or suitable conditions where pumps are to be installed.

D. Examine roughing-in for piping systems to verify actual locations of piping connections before pump installation.

E. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. INSTALLATION

A. Comply with HI 1.4.

B. Install in accordance with manufacturer's instructions.

C. Provide access space around pumps for service including removing motors, impellers, couplings, and accessories.. Provide no less than minimum space recommended by manufacturer.

D. Decrease from line size with long radius reducing elbows or reducers. Support pump independently of piping such that pump is not supported by piping. Support piping adjacent to pump such that no weight is carried on pump casings. For close coupled or base mounted pumps, provide supports under elbows on pump suction and discharge line sizes 4 inches and over. Refer to Section 23 0548.

E. Install close-coupled and base-mounted pumps on concrete housekeeping base, with anchor bolts, set and level, and grout in place. Refer to Section 03 3000.

F. Install in-line pumps with continuous-thread hanger rods and spring hangers of size required to support weight of in-line pumps.

G. Comply with requirements for vibration isolation control devices specified in Section 23 0548.

H. Automatic Condensate Pump Units: Install units for collecting condensate and extend to open drain.

3.3. ALIGNMENT

A. Engage a factory-authorized service representative to perform alignment service.

B. Comply with requirements in Hydronics Institute standards for alignment of pump and motor shaft. Add shims to the motor feet and bolt motor to base frame. Do not use grout between motor feet and base frame.

C. Comply with pump and coupling manufacturers' written instructions.

D. After alignment is correct, tighten foundation bolts evenly but not too firmly. Completely fill baseplate with nonshrink, nonmetallic grout while metal blocks and shims or wedges are in place. After grout has cured, fully tighten foundation bolts.

E. Check, align, and certify alignment of base-mounted pumps prior to start-up.

3.4. CONNECTIONS

A. Where installing piping adjacent to pump, allow space for service and maintenance.

B. Connect piping to pumps. Install valves that are same size as piping connected to pumps.

C. Install suction and discharge pipe sizes equal to or greater than diameter of pump nozzles.

D. Install soft seated check, shutoff, and balancing valves on discharge side of pumps.

E. Install Y-type strainer and shutoff valve on suction side of pumps.

F. Install flexible connectors on suction and discharge sides of base-mounted pumps between pump casing and valves.

G. Install pressure gages on pump suction and discharge or at integral pressure-gage tapping, or install single gauge with multiple-input selector valve.

H. Provide air cock and drain connection on horizontal pump casings.

I. Provide drains for bases and seals, piped to and discharging into floor drains.

J. Install check valve and ball valve on each condensate pump unit discharge.

K. Ground equipment according to Section 26 0526.

L. Connect wiring according to Section 26 0519.

3.5. STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.
2. Check piping connections for tightness.
3. Clean strainers on suction piping.
4. Perform the following startup checks for each pump before starting:
    a. Verify bearing lubrication.
    b. Verify that pump is free to rotate by hand and that pump for handling hot liquid is free to rotate with pump hot and cold. If pump is bound or drags, do not operate until cause of trouble is determined and corrected.
    c. Verify that pump is rotating in the correct direction.
5. Prime pump by opening suction valves and closing drains, and prepare pump for operation.
6. Start motor.
7. Open discharge valve slowly.

3.6. DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain hydronic pumps. Video record the training sessions. Provide in accordance with Section 01 7900.
    1. Provide training in two identical sessions; one morning session and one afternoon session to allow participation of all relevant staff personnel.

END OF SECTION

SECTION 23 2500 - HVAC WATER TREATMENT

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Materials.

1. System cleaner.
2. Closed system treatment (water).

B. By-pass (pot) feeder.

C. Water meter.

1.2. RELATED REQUIREMENTS

A. Section 01 6000 - Product Requirements: Owner furnished treatment equipment.

B. Section 23 2113 - Hydronic Piping.

1.3. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide chemical treatment materials, chemicals, and equipment including electrical characteristics and connection requirements.

C. Manufacturer's Installation Instructions: Indicate placement of equipment in systems, piping configuration, and connection requirements.

D. Water Analysis: Illustrate water quality available at Project site.

1. Water Analysis Provider Qualifications: Verification of experience and capability of HVAC water-treatment service provider.

E. Water-Treatment Program: Written sequence of operation on an annual basis for the application equipment required to achieve water quality defined in "Performance Requirements" Article.

F. Manufacturer's Field Reports: Indicate start-up of treatment systems when completed and operating properly. Indicate analysis of system water after cleaning and after treatment.

G. Certificate: Submit certificate of compliance from Authority Having Jurisdiction indicating approval of chemicals and their proposed disposal.

H. Project Record Documents: Record actual locations of equipment and piping, including sampling points and location of chemical injectors.

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. Sufficient chemicals for treatment and testing during required maintenance period.

1.4. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience. Company shall have local representatives with water analysis laboratories and full time service personnel.

PART 2 PRODUCTS

2.1. PERFORMANCE REQUIREMENTS

A. Water quality for HVAC systems shall minimize corrosion, scale buildup, and biological growth for optimum efficiency of HVAC equipment without creating a hazard to operating personnel or to the environment.

B. Base HVAC water treatment on quality of water available at Project site, HVAC system equipment material characteristics and functional performance characteristics, operating personnel capabilities, and requirements and guidelines of authorities having jurisdiction.

C. Closed hydronic systems, including heating-water and chilled-water, shall have the following water qualities:

1. pH: Maintain a value within 9.0 to 10.5.
2. "P" Alkalinity: Maintain a value within 100 to 500 ppm.
3. Boron: Maintain a value within 100 to 200 ppm.
4. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
5. Soluble Copper: Maintain a maximum value of 0.20 ppm.
6. TSS: Maintain a maximum value of 10 ppm.
7. Ammonia: Maintain a maximum value of 20 ppm.
8. Free Caustic Alkalinity: Maintain a maximum value of 20 ppm.
9. Microbiological Limits:
    a. Total Aerobic Plate Count: Maintain a maximum value of 1,000 organisms/ml.
    b. Total Anaerobic Plate Count: Maintain a maximum value of 100 organisms/ml.
    c. Nitrate Reducers: Maintain a maximum value of 100 orgqanisms/ml.
    d. Sulfate Reducers: Maintain a maximum value of zero (0) organisms/ml.
    e. Iron Bacteria: Maintain a maximum value of zero (0) organisms/ml.

D. Open hydronic systems, including condenser-water, shall have the following water qualities:

1. pH: Maintain a value within 8.0 to 9.1.
2. "P" Alkalinity: Maintain a value within 100 ppm.
3. Chemical Oxygen Demand: Maintain a maximum value of 100 ppm.
4. Soluble Copper: Maintain a maximum value of 0.20 ppm.
5. TSS: Maintain a maximum value of 10 ppm.
6. Ammonia: Maintain a maximum value of 20 ppm.
7. Free "OH" Alkalinity: Maintain a maximum value of zero (0) ppm.
8. Microbiological Limits:
    a. Total Aerobic Plate Count: Maintain a maximum value of 10,000 organisms/ml.
    b. Total Anaerobic Plate Count: Maintain a maximum value of 1,000 organisms/ml.
    c. Nitrate Reducers: Maintain a maximum value of 100 orgqanisms/ml.
    d. Sulfate Reducers: Maintain a maximum value of zero (0) organisms/ml.
    e. Iron Bacteria: Maintain a maximum value of zero (0) organisms/ml.
9. Polymer Testable: Maintain a minimum value within 10 to 40.

E. Passivation for Galvanized Steel: For first 60 days of operation.

1. pH: Maintain minimum value within 7 to 8.
2. Calcuim Carbonate Hardness: Maintain a value within 100 to 300 ppm.
3. Calcuim Carbonate Alkalinity: Maintain a value within 100 to 300 ppm.

2.2. MANUFACTURERS

A. AmSolv-Amrep, Inc.

B. GE Water & Process Technologies.

C. Nalco, an Ecolab Company.

2.3. MATERIALS

A. System Cleaner:

1. Manufacturers:

a. AmSolv-Amrep, Inc: www.amsolv.com/#sle.

b. GE Water & Process Technologies; _____: www.gewater.com/#sle.

c. Nalco, an Ecolab Company; _____: www.nalco.com/#sle.

2. Liquid alkaline compound with emulsifying agents and detergents to remove grease and petroleum products; sodiumtripoly phosphate and sodium molybdate.

B. Closed System Treatment (Water):

1. Manufacturers:

a. AmSolv-Amrep, Inc.

b. GE Water & Process Technologies.

c. Nalco, an Ecolab Company.

2. Corrosion inhibitors; boron-nitrite, sodium nitrite and borax, sodium totyltriazole, low molecular weight polymers, phosphonates, sodium molybdate, or sulphites.

3. Conductivity enhancers; phosphates or phosphonates.

2.4. BY-PASS (POT) FEEDER

A. Manufacturers:

1. Griswold Controls.

2. J. L. Wingert Company.

3. Neptune, a brand of the Dover Company.

B. By-pass Feeder: Steel, with corrosion-resistant exterior coating, minimum 3-1/2-inch fill opening in the top, and NPS 3/4 bottom inlet and top side outlet. Quarter turn or threaded fill cap with gasket seal and diaphragm to lock the top on the feeder when exposed to system pressure in the vessel.

1. Capacity: 2 gallon.

2. Minimum Working Pressure: 175 psig.

2.5. WATER METER

A. Manufacturers:

B. AWWA C700, Oscillating-piston, magnetic-drive, totalization meter.

1. Body: Bronze.

2. Minimum Working Pressure Rating: 150 psig.

3. Maximum Pressure Loss at Design Flow: 3 psig.

4. Registration: Gallons or Cubic Feet.

5. End Connections: Threaded.

6. Controls: Flow-controlled switch with normally open contacts, rated for a maximum 10A, 250 V AC, and close at adjustable increments of total flow.

a. Inface with Building Automation System (BAS).

7. Electrical Components, Devices, and Accessories: Listed and labelled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

2.6. CHEMICALS

A. Chemicals shall be as recommended by water-treatment system manufacturer that are compatible with piping system components and connected equipment and that can attain water quality specified in "Performance Requirements" Article.

PART 3 EXECUTION

3.1. PREPARATION

A. Systems shall be operational, flushed, filled, started, and vented prior to cleaning. Use water meter to record capacity in each system.

B. Place terminal control valves in open position during cleaning.

C. Perform an analysis of supply water to determine quality of water available at Project site.

3.2. CLEANING SEQUENCE

A. Concentration:

1. As recommended by manufacturer.

B. Hot Water Heating Systems:

1. Apply heat while circulating, slowly raising temperature to 160 degrees F and maintain for 12 hours minimum.
2. Remove heat and circulate to 100 degrees F or less; drain systems as quickly as possible and refill with clean water.
3. Circulate for 6 hours at design temperatures, then drain.
4. Refill with clean water and repeat until system cleaner is removed.

C. Chilled Water Systems:

1. Circulate for 48 hours, then drain systems as quickly as possible.
2. Refill with clean water, circulate for 24 hours, then drain.
3. Refill with clean water and repeat until system cleaner is removed.

D. Flush open systems and glycol filled closed systems with clean water for one hour minimum. Drain completely and refill.

E. Remove, clean, and replace strainer screens.

F. Inspect, remove sludge, and flush low points with clean water after cleaning process is completed. Include disassembly of components as required.

3.3. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install lines and fittings furnished by equipment manufacturer but not factory installed.

C. Install water-testing equipment on wall near water-chemical-application equipment.

3.4. CLOSED SYSTEM TREATMENT

A. Introduce closed system treatment through bypass feeder when required or indicated by test.

B. Provide 3/4 inch water coupon rack around circulating pumps with space for 4 test specimens.

C. Install by-pass feeder on each closed hydronic system with full-port ball valve on inlet and outlet.

1. Provide drain with full-port ball valve and terminate over nearest floor drain/sink.
2. Provide manual air vent for feeder.
3. Install around system circulating pump(s).
4. Install around throttling valve downstream of system circulating pump(s).

3.5. FIELD QUALITY CONTROL

A. Perform the following tests and inspections.

1. Inspect field-assembled components and equipment installation, including piping and electrical connections.

2. Inspect piping and equipment to determine that systems and equipment have been cleaned, flushed, and filled with water, and are fully operational before introducing chemicals for water-treatment system.

3. Place HVAC water-treatment system into operation and calibrate controls during the preliminary phase of HVAC system's startup procedures.

4. Do not enclose, cover, or put piping into operation until it is tested and satisfactory test results are achieved.

5. Test for leaks and defects. If testing is performed in segments, submit separate report for each test, complete with diagram of portion of piping tested.

6. Leave uncovered and unconcealed new, altered, extended, and replaced water piping until it has been tested and approved. Expose work that has been covered or concealed before it has been tested and approved.

7. Cap and subject piping to static water pressure of 50 psig above operating pressure, without exceeding pressure rating of piping system materials. Isolate test source and allow test pressure to stand for four hours. Leaks and loss in test pressure constitute defects.

8. Repair leaks and defects with new materials and retest piping until no leaks exist.

B. Equipment will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

D. Sample boiler water at one-week intervals after boiler startup for a period of five weeks, and prepare test report advising Owner of changes necessary to adhere to "Performance Requirements" Article for each required characteristic. Sample boiler water at four-week intervals following the testing noted above to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section.

E. At four-week intervals following Substantial Completion, perform separate water analyses on hydronic systems to show that automatic chemical-feed systems are maintaining water quality within performance requirements specified in this Section. Submit written reports of water analysis advising Owner of changes necessary to adhere to "Performance Requirements" Article.

3.6. CLOSEOUT ACTIVITIES

A. Training: Train Owner's personnel on operation and maintenance of chemical treatment system.

1. Provide minimum of two hours of instruction for two people.

2. Have operation and maintenance data prepared and available for review during training.

3. Conduct training using actual equipment after treated system has been put into full operation.

3.7. MAINTENANCE

A. Perform maintenance work using competent and qualified personnel under the supervision and in the direct employ of the equipment manufacturer or original installer.

B. Provide service and maintenance of treatment systems for one year from Date of Substantial Completion.

C. Provide monthly technical service visits to perform field inspections and make water analysis on-site. Detail findings in writing on proper practices, chemical treating requirements, and corrective actions needed. Submit two copies of field service report after each visit.

D. Provide laboratory and technical assistance services during this maintenance period.

E. Provide on-site inspections of equipment during scheduled or emergency shutdown to properly evaluate success of water treatment program, and make recommendations in writing based upon these inspections.

END OF SECTION

SECTION 23 3100 - SECTION 23 3100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section Includes:

1. Single-wall rectangular ducts and fittings.
2. Single-wall round ducts and fittings.
3. Type I Kitchen Hood Exhaust Duct.
4. Sheet metal materials.
5. Sealants and gaskets.
6. Hangers and supports.

B. Related Sections:

1. Section 230593 "Testing, Adjusting, and Balancing for HVAC" for testing, adjusting, and balancing requirements for metal ducts.
2. Section 233300 "Air Duct Accessories" for dampers, sound-control devices, duct-mounting access doors and panels, turning vanes, and flexible ducts.

1.3. PERFORMANCE REQUIREMENTS

A. Structural Performance: Duct hangers and supports shall withstand the effects of gravity loads and stresses within limits and under conditions described in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible"

B. Airstream Surfaces: Surfaces in contact with the airstream shall comply with requirements in ASHRAE 62.1.

1.4. ACTION SUBMITTALS

A. Product Data: For each type of the following products:

1. Liners and adhesives.
2. Sealants and gaskets.
3. Seismic-restraint devices.

B. Shop Drawings:

1. Factory- and shop-fabricated ducts and fittings.
2. Reinforcement and spacing.
3. Seam and joint construction.
4. Penetrations through fire-rated and other partitions.
5. Hangers and supports, including methods for duct and building attachment and vibration isolation.

C. Delegated-Design Submittal:

1. Sheet metal thicknesses.
2. Joint and seam construction and sealing.
3. Reinforcement details and spacing.
4. Materials, fabrication, assembly, and spacing of hangers and supports.

1.5. INFORMATIONAL SUBMITTALS

A. Welding certificates.

B. Field quality-control reports.

1.6. QUALITY ASSURANCE

A. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel," for hangers and supports.

2. AWS D1.2/D1.2M, "Structural Welding Code - Aluminum," for aluminum supports.

3. AWS D9.1M/D9.1, "Sheet Metal Welding Code," for duct joint and seam welding.

B. ASHRAE Compliance: Applicable requirements in ASHRAE 62.1, Section 5 - "Systems and Equipment" and Section 7 - "Construction and System Start-up."

C. ASHRAE/IESNA Compliance: Applicable requirements in ASHRAE/IESNA 90.1, Section 6.4.4 - "HVAC System Construction and Insulation."

PART 2 PRODUCTS

2.1. SINGLE-WALL RECTANGULAR DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" based on indicated static-pressure class unless otherwise indicated.

B. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-1, "Rectangular Duct/Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

C. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 2-2, "Rectangular Duct/Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

D. Elbows, Transitions, Offsets, Branch Connections, and Other Duct Construction: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 4, "Fittings and Other Construction," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.2. SINGLE-WALL ROUND DUCTS AND FITTINGS

A. General Fabrication Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 3, "Round, Oval, and Flexible Duct," based on indicated static-pressure class unless otherwise indicated.

B. Retain subparagraph below to require factory-fabricated, single-wall round and flat-oval ducts and fittings; delete to allow shop-fabricated ducts and fittings.

C. Manufacturers: Subject to compliance with requirements, available manufacturers offering products that may be incorporated into the Work include, but are not limited to the following:

1. Ductmate Industries, Inc.

2. Lindab Inc.

3. McGill AirFlow LLC.

D. Transverse Joints: Select joint types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-1, "Round Duct Transverse Joints," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

E. Longitudinal Seams: Select seam types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-2, "Round Duct Longitudinal Seams," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

F. Tees and Laterals: Select types and fabricate according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees," for static-pressure class, applicable sealing requirements, materials involved, duct-support intervals, and other provisions in SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

2.3. SHEET METAL MATERIALS

A. General Material Requirements: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for acceptable materials, material thicknesses, and duct construction methods unless otherwise indicated. Sheet metal materials shall be free of pitting, seam marks, roller marks, stains, discolorations, and other imperfections.

B. Galvanized Sheet Steel: Comply with ASTM A 653/A 653M.

1. Galvanized Coating Designation: G90.

2. Finishes for Surfaces Exposed to View: Mill phosphatized.

C. Reinforcement Shapes and Plates: ASTM A 36/A 36M, steel plates, shapes, and bars; black and galvanized.

1. Where black- and galvanized-steel shapes and plates are used to reinforce aluminum ducts, isolate the different metals with butyl rubber, neoprene, or EPDM gasket materials.

D. Tie Rods: Galvanized steel, 1/4-inch minimum diameter for lengths 36 inches or less; 3/8-inch minimum diameter for lengths longer than 36 inches.

2.4. SEALANT AND GASKETS

A. General Sealant and Gasket Requirements: Surface-burning characteristics for sealants and gaskets shall be a maximum flame-spread index of 25 and a maximum smoke-developed index of 50 when tested according to UL 723; certified by an NRTL.

B. Two-Part Tape Sealing System:

1. Tape: Woven cotton fiber impregnated with mineral gypsum and modified acrylic/silicone activator to react exothermically with tape to form hard, durable, airtight seal.

2. Tape Width: 4 inches.

3. Sealant: Modified styrene acrylic.

4. Water resistant.

5. Mold and mildew resistant.

6. Maximum Static-Pressure Class: 10-inch wg, positive and negative.

7. Service: Indoor and outdoor.

8. Service Temperature: Minus 40 to plus 200 deg F.

9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum.

10. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

C. Water-Based Joint and Seam Sealant:

1. Application Method: Brush on.

2. Solids Content: Minimum 65 percent.

3. Shore A Hardness: Minimum 20.
4. Water resistant.
5. Mold and mildew resistant.
6. VOC: Maximum 75 g/L (less water).
7. Maximum Static-Pressure Class: 10-inch wg, positive and negative.
8. Service: Indoor or outdoor.
9. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

D. Solvent-Based Joint and Seam Sealant:

1. Application Method: Brush on.
2. Base: Synthetic rubber resin.
3. Solvent: Toluene and heptane.
4. Solids Content: Minimum 60 percent.
5. Shore A Hardness: Minimum 60.
6. Water resistant.
7. Mold and mildew resistant.
8. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).
9. VOC: Maximum 395 g/L.
10. Sealant shall comply with the testing and product requirements of the California Department of Health Services' "Standard Practice for the Testing of Volatile Organic Emissions from Various Sources Using Small-Scale Environmental Chambers."
11. Maximum Static-Pressure Class: 10-inch wg, positive or negative.
12. Service: Indoor or outdoor.
13. Substrate: Compatible with galvanized sheet steel (both PVC coated and bare), stainless steel, or aluminum sheets.

E. Flanged Joint Sealant: Comply with ASTM C 920.

1. General: Single-component, acid-curing, silicone, elastomeric.
2. Type: S.
3. Grade: NS.
4. Class: 25.
5. Use: O.
6. For indoor applications, sealant shall have a VOC content of 250 g/L or less when calculated according to 40 CFR 59, Subpart D (EPA Method 24).

F. Flange Gaskets: Butyl rubber, neoprene, or EPDM polymer with polyisobutylene plasticizer.

G. Round Duct Joint O-Ring Seals:

1. Seal shall provide maximum 3 cfm/100 sq. ft. at 1-inch wg and shall be rated for10-inch wg static-pressure class, positive or negative.
2. EPDM O-ring to seal in concave bead in coupling or fitting spigot.
3. Double-lipped, EPDM O-ring seal, mechanically fastened to factory-fabricated couplings and fitting spigots.

2.5. HANGERS AND SUPPORTS

A. Hanger Rods for Noncorrosive Environments: Cadmium-plated steel rods and nuts.

B. Hanger Rods for Corrosive Environments: Electrogalvanized, all-thread rods or galvanized rods with threads painted with zinc-chromate primer after installation.

C. Strap and Rod Sizes: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct."

D. Steel Cables for Galvanized-Steel Ducts: Galvanized steel complying with ASTM A 603.

E. Steel Cable End Connections: Cadmium-plated steel assemblies with brackets, swivel, and bolts designed for duct hanger service; with an automatic-locking and clamping device.

F. Duct Attachments: Sheet metal screws, blind rivets, or self-tapping metal screws; compatible with duct materials.

G. Trapeze and Riser Supports:

1. Supports for Galvanized-Steel Ducts: Galvanized-steel shapes and plates.

PART 3 EXECUTION

3.1. DUCT INSTALLATION

A. Drawing plans, schematics, and diagrams indicate general location and arrangement of duct system. Indicated duct locations, configurations, and arrangements were used to size ducts and calculate friction loss for air-handling equipment sizing and for other design considerations. Install duct systems as indicated unless deviations to layout are approved on Shop Drawings and Coordination Drawings.

B. Install ducts according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" unless otherwise indicated.

C. Install round ducts in maximum practical lengths.

D. Install ducts with fewest possible joints.

E. Install factory- or shop-fabricated fittings for changes in direction, size, and shape and for branch connections.

F. Unless otherwise indicated, install ducts vertically and horizontally, and parallel and perpendicular to building lines.

G. Install ducts close to walls, overhead construction, columns, and other structural and permanent enclosure elements of building.

H. Install ducts with a clearance of 1 inch, plus allowance for insulation thickness.

I. Route ducts to avoid passing through transformer vaults and electrical equipment rooms and enclosures.

J. Where ducts pass through non-fire-rated interior partitions and exterior walls and are exposed to view, cover the opening between the partition and duct or duct insulation with sheet metal flanges of same metal thickness as the duct. Overlap openings on four sides by at least 1-1/2 inches.

K. Where ducts pass through fire-rated interior partitions and exterior walls, install fire dampers. Comply with requirements in Section 233300 "Air Duct Accessories" for fire and smoke dampers.

L. Protect duct interiors from moisture, construction debris and dust, and other foreign materials.

M. Exceptions:

1. Grease duct shall be fabricated and installed in accordance with the requirements of the IMC.

3.2. INSTALLATION OF EXPOSED DUCTWORK

A. Protect ducts exposed in finished spaces from being dented, scratched, or damaged.

B. Trim duct sealants flush with metal. Create a smooth and uniform exposed bead. Do not use two-part tape sealing system.

C. Grind welds to provide smooth surface free of burrs, sharp edges, and weld splatter. When welding stainless steel with a No. 3 or 4 finish, grind the welds flush, polish the exposed welds, and treat the welds to remove discoloration caused by welding.

D. Maintain consistency, symmetry, and uniformity in the arrangement and fabrication of fittings, hangers and supports, duct accessories, and air outlets.

E. Repair or replace damaged sections and finished work that does not comply with these requirements.

3.3. DUCT SEALING

A. Seal ducts for duct static-pressure, seal classes, and leakage classes specified in "Duct Schedule" Article according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."

B. Seal ducts to the following seal classes according to SMACNA's "HVAC Duct Construction Standards - Metal and Flexible":

1. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible."
2. Unconditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class B.
3. Unconditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class A.
4. Unconditioned Space, Exhaust Ducts: Seal Class C.
5. Unconditioned Space, Return-Air Ducts: Seal Class B.
6. Conditioned Space, Supply-Air Ducts in Pressure Classes 2-Inch wg and Lower: Seal Class C.
7. Conditioned Space, Supply-Air Ducts in Pressure Classes Higher Than 2-Inch wg: Seal Class B.
8. Conditioned Space, Exhaust Ducts: Seal Class B.
9. Conditioned Space, Return-Air Ducts: Seal Class C.

3.4. HANGER AND SUPPORT INSTALLATION

A. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Chapter 5, "Hangers and Supports."

B. Hanger Spacing: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Table 5-1, "Rectangular Duct Hangers Minimum Size," and Table 5-2, "Minimum Hanger Sizes for Round Duct," for maximum hanger spacing; install hangers and supports within 24 inches of each elbow and within 48 inches of each branch intersection.

C. Hangers Exposed to View: Threaded rod and angle or channel supports.

D. Support vertical ducts with steel angles or channel secured to the sides of the duct with welds, bolts, sheet metal screws, or blind rivets; support at each floor and at a maximum intervals of 16 feet.

E. Install upper attachments to structures. Select and size upper attachments with pull-out, tension, and shear capacities appropriate for supported loads and building materials where used.

3.5. CONNECTIONS

A. Make connections to equipment with flexible connectors complying with Section 233300 "Air Duct Accessories."

B. Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible" for branch, outlet and inlet, and terminal unit connections.

3.6. PAINTING

A. Paint interior of metal ducts that are visible through registers and grilles and that do not have duct liner. Apply one coat of flat, black, latex paint over a compatible galvanized-steel primer. Paint

materials and application requirements are specified in Section 099113 "Exterior Painting" and Section 099123 "Interior Painting."

3.7. FIELD QUALITY CONTROL

A. Perform tests and inspections.

B. Duct System Cleanliness Tests:

1. Visually inspect duct system to ensure that no visible contaminants are present.

3.8. DUCT CLEANING

A. Clean the following components by removing surface contaminants and deposits:

1. Air outlets and inlets (registers, grilles, and diffusers).
2. Supply, return, and exhaust fans including fan housings, plenums (except ceiling supply and return plenums), scrolls, blades or vanes, shafts, baffles, dampers, and drive assemblies.
3. Air-handling unit internal surfaces and components including mixing box, coil section, air wash systems, spray eliminators, condensate drain pans, humidifiers and dehumidifiers, filters and filter sections, and condensate collectors and drains.
4. Coils and related components.
5. Return-air ducts, dampers, actuators, and turning vanes except in ceiling plenums and mechanical equipment rooms.
6. Supply-air ducts, dampers, actuators, and turning vanes.
7. Dedicated exhaust and ventilation components and makeup air systems.

3.9. START UP

A. Air Balance: Comply with requirements in Section 230593 "Testing, Adjusting, and Balancing for HVAC."

3.10. DUCT SCHEDULE

A. Supply Ducts:

1. Ducts downstream of Terminal Units:
   a. Pressure Class: Positive 2-inch wg.
   b. Minimum SMACNA Seal Class: B.
2. Ducts Connected to Air-Handling Units:
   a. Pressure Class: Positive 4-inch wg.
   b. Minimum SMACNA Seal Class: B.

B. Return Ducts:

1. Ducts Connected to Air-Handling Units:
   a. Pressure Class: Positive or negative 4-inch wg.
   b. Minimum SMACNA Seal Class: B.

C. Exhaust Ducts:

1. Ducts Connected to Fans Exhausting (ASHRAE 62.1, Class 1 and 2) Air:
   a. Pressure Class: Negative 2-inch wg.
   b. Minimum SMACNA Seal Class: B if negative pressure, and A if positive pressure.

D. Intermediate Reinforcement:

1. Galvanized-Steel Ducts: Galvanized steel.

E. Branch Configuration:

1. Rectangular Duct: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 4-6, "Branch Connection."
    a. Rectangular Main to Rectangular Branch: 45-degree entry.
    b. Rectangular Main to Round Branch: Spin in.
2. Round and Flat Oval: Comply with SMACNA's "HVAC Duct Construction Standards - Metal and Flexible," Figure 3-5, "90 Degree Tees and Laterals," and Figure 3-6, "Conical Tees." Saddle taps are permitted in existing duct.
    a. Velocity 1000 fpm or Lower: 90-degree tap.
    b. Velocity 1000 to 1500 fpm: Conical tap.
    c. Velocity 1500 fpm or Higher: 45-degree lateral.

END OF SECTION

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Air turning devices/extractors.

B. Backdraft dampers - metal.

C. Combination fire and smoke dampers.

D. Duct access doors.

E. Duct test holes.

F. Fire dampers.

G. Flexible duct connections.

H. Smoke dampers.

I. Volume control dampers.

J. Miscellaneous products:

1. Duct opening closure film.

1.2. RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 23 0548 - Vibration and Seismic Controls for HVAC.

C. Section 23 3100 - HVAC Ducts and Casings.

D. Section 23 3600 - Air Terminal Units: Pressure regulating damper assemblies.

1.3. REFERENCE STANDARDS

A. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

B. NFPA 92 - Standard for Smoke Control Systems; 2018.

C. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005 (Revised 2009).

D. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

E. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

F. UL 555C - Standard for Safety Ceiling Dampers; 2014 (Revised 2017).

G. UL 555S - Standard for Smoke Dampers; Current Edition, Including All Revisions.

1.4. 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. Manufacturer's Installation Instructions: Provide instructions for fire dampers, combination fire and smoke dampers, and smoke dampers.

D. Project Record Drawings: Record actual locations of access doors, test holes, and rated dampers.

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 Fusible Links: One of each type and size.

1.5. 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.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1. AIR TURNING DEVICES/EXTRACTORS

A. Manufacturers:

1. Carlisle HVAC Products: www.carlislehvac.com.
2. Elgen Manufacturing: www.elgenmfg.com.
3. Krueger: www.krueger-hvac.com.
4. Ruskin Company: www.ruskin.com.
5. Titus: www.titus-hvac.com.
6. Ward Industries, a brand of Hart and Cooley, Inc: www.wardind.com/#sle.

B. Multi-blade device with airfoil blades aligned in short dimension; steel construction; with individually adjustable blades, mounting straps. Similar to Carlisle Dynair Hollow Vane and Rail (Double Wall Vane)

2.2. BACKDRAFT DAMPERS - METAL

A. Manufacturers:

1. Greenheck; : www.greenheck.com
2. Louvers & Dampers, Inc: www.louvers-dampers.com.
3. Nailor Industries Inc: www.nailor.com.
4. Ruskin Company: www.ruskin.com.

B. Gravity Backdraft Dampers, Size 18 by 18 inches or Smaller, Furnished with Air Moving Equipment: Air moving equipment manufacturer's standard construction.

C. Multi-Blade, Parallel Action Gravity Balanced Backdraft Dampers: Galvanized steel, with center pivoted blades of maximum 6 inch width, with felt or flexible vinyl sealed edges, linked together in rattle-free manner with 90 degree stop, steel ball bearings, and plated steel pivot pin; adjustment device to permit setting for varying differential static pressure.

2.3. COMBINATION FIRE AND SMOKE DAMPERS

A. Manufacturers:

1. Greenheck; : www.greenheck.com
2. Louvers & Dampers, Inc: www.louvers-dampers.com.
3. Nailor Industries Inc: www.nailor.com.
4. Pottorff: www.pottorff.com/#sle.
5. Ruskin Company: www.ruskin.com.

B. Fabricate in accordance with NFPA 90A, UL 555, UL 555S, and as indicated.

C. Provide factory sleeve and collar for each damper.

D. Sleeves for combination fire and smoke dampers shall be the rigid type of construction recommended in SMACNA Publication for "Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems".

Unless otherwise required by the authority having jurisdiction, use 16 gauge for ducts 24" or less in diameter or either rectangular dimension and 14 gauge for ducts over 24". Provide minimum 18" long sleeves. Coordinate required length with wall thicknesses.

E. Multiple Blade Dampers: Fabricate with 16 gage, 0.0598 inch galvanized steel frame and 16 gauge airfoil blades, stainless steel permanently lubricated sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

F. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.

G. All dampers used in smoke control systems shall have reopenable operation from remote location.

H. Provide local damper test switch to cycle damper for testing.

I. Damper shall have class I leakage rating in accordance with UL 555S.

J. Damper to have dynamic rating of 4000 fpm velocity at 8" w.g. static pressure for duct systems over 2" w.g. pressure classification and 2000 fpm velocity at 4" w.g. static pressure for duct systems 2" w.g. pressure classification and under. Maximum pressure drop for duct systems over 2" w.g. pressure classification shall be 0.25" w.g. at 2500 fpm velocity. Maximum pressure drop for duct systems 2" w.g. pressure classification and under shall be 0.15" w.g. at 1500 fpm velocity. Damper size shall be increased and duct transistioned to damper as required to meet maximum pressure drop listed.

2.4. DUCT ACCESS DOORS

A. Manufacturers:

1. Acudor Products Inc, a Division of Nelson Industrial Inc: www.acudor.com/#sle.
2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
3. Elgen Manufacturing: www.elgenmfg.com.
4. Flexmaster; Model The Inspector Series:http://www.flexmasterusa.com/
5. Nailor Industries Inc: www.nailor.com.
6. Ruskin Company: www.ruskin.com.
7. SEMCO Incorporated: www.semcohvac.com.
8. Ward Industries, a brand of Hart and Cooley, Inc: www.wardind.com/#sle.

B. Fabrication: Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices. For insulated ducts, install minimum 1 inch thick insulation with sheet metal cover. Frame shall be minimum 22 gauge galvanized steel.

1. Less Than 12 inches Square: Secure with sash locks.
2. Up to 18 inches Square: Provide two hinges and two sash locks.
3. Up to 24 x 48 inches: Continuous piano hinge and two compression latches with outside and inside handles.
4. Larger Sizes: Provide continuous piano hinge.

2.5. 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.

B. Permanent Test Holes: Factory fabricated, air tight flanged fittings with screw cap. Provide extended neck fittings to clear insulation.

1. Manufacturers:

a. Carlisle HVAC Products; Dynair Test Port with Red Cap with O-Ring Seal: www.carlislehvac.com/#sle.

b. Ventfabrics; Ventlok #699-2: www.ventfabrics.com/

c. Substitutions: See Section 01 6000 - Product Requirements.

2.6. FIRE DAMPERS

A. Manufacturers:

1. Greenheck; : www.greenheck.com
2. Louvers & Dampers, Inc: www.louvers-dampers.com.
3. Nailor Industries Inc: www.nailor.com.
4. Ruskin Company: www.ruskin.com.
5. Ward Industries by Commercial Products Group of Hart & Cooley, Inc: www.wardind.com.

B. Fabricate in accordance with NFPA 90A and UL 555, and as indicated.

C. Ceiling (Radiation) Dampers: Galvanized steel, 22 gage, 0.0299 inch frame and 16 gage, 0.0598 inch flap, two layers 0.125 inch ceramic fiber on top side and one layer on bottom side for round flaps, with locking clip.

1. Rated for three hour service in compliance with UL 555C.

D. Horizontal Dampers: Galvanized steel, 22 gage, 0.0299 inch frame, stainless steel closure spring, and lightweight, heat retardant non-asbestos fabric blanket.

E. Multiple Blade Dampers: 16 gage, 0.0598 inch galvanized steel frame and blades, stainless steel sleeve bearings and plated steel axles, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock.

F. Fusible Links: UL 33, separate at 160 degrees F with adjustable link straps for combination fire/balancing dampers.

G. All blades shall be located out of airstream.

H. All fire dampers shall have dynamic rating of 4000 fpm velocity at 8" w.g. static pressure for duct systems over 2" w.g. pressure classification and 2000 fpm velocity at 4" w.g. static pressure for duct systems 2" w.g. pressure classification and under. Maximum pressure drop for duct systems over 2" w.g. pressure classification shall be 0.25" w.g. at 2500 fpm velocity. Maximum pressure drop for duct systems 2" w.g. pressure classification and under shall be 0.15" w.g. at 1500 fpm velocity. Damper size shall be increased and duct transistioned to damper as required to meet maximum pressure drop listed.

I. Sleeves for fire dampers shall be the rigid type of construction recommended in SMACNA Publication for "Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems". Unless otherwise required by the authority having jurisdiction, use 16 gauge for ducts 24" or less in diameter or either rectangular dimension and 14 gauge for ducts over 24". Provide minimum 18" long sleeves. Coordinate required length with wall thicknesses.

2.7. FLEXIBLE DUCT CONNECTIONS

A. Manufacturers:

1. Carlisle HVAC Products: www.carlislehvac.com.
2. Ductmate Industries, Inc, a DMI Company: www.ductmate.com/#sle.
3. Elgen Manufacturing: www.elgenmfg.com.
4. Ventfabrics :www.ventfabrics.com/

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Flexible Duct Connections: Fabric crimped into metal edging strip.

1. Inside applications other than corrosive environments, fume hood exhaust, or kitchen exhaust.

a. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric compliant with NFPA 90A, minimum density 30 oz per sq yd. Net Fabric Width: Approximately 3 inches wide. Similar to Ventfabric Ventglas.

b. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

c. Suitable for temperatures between -20° F and 200° F.

d. Suitable for +/- 10" w.g. static pressure while being airtight and waterproof.

2. Outside applications other than corrosive environments, fume hood exhaust, or kitchen exhaust.

a. Fabric: UL listed fire-retardant woven glass fabric double coated with Hypalon compliant with NFPA 90A, minimum density 26 oz per sq yd. Net Fabric Width: Approximately 3 inches wide. Similar to Ventfabric Ventlon.

b. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

c. Suitable for temperatures between -10° F and 200° F.

d. Suitable for +/- 10" w.g. static pressure while being airtight and waterproof.

3. Indoor or outdoor application for corrosive environments or fume hoods.

a. Fabric: UL listed fire-retardant woven glass fabric coated with Teflon compliant with NFPA 90A, minimum density 14 oz per sq yd. Net Fabric Width: Approximately 3 inches wide. Similar to Ventfabric Ventlel.

b. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

c. Suitable for temperatures between -20° F and 200° F.

d. Suitable for +/- 10" w.g. static pressure while being airtight and waterproof.

D. Leaded Vinyl Sheet: Minimum 0.55 inch thick, 0.87 lbs per sq ft, 10 dB attenuation in 10 to 10,000 Hz range.

E. Maximum Installed Length: 14 inch.

2.8. SMOKE DAMPERS

A. Manufacturers:

1. Louvers & Dampers, Inc: www.louvers-dampers.com.

2. Nailor Industries Inc: www.nailor.com.

3. Ruskin Company: www.ruskin.com.

4. Greenheck; : www.greenheck.com

B. Fabricate in accordance with NFPA 90A and UL 555S, and as indicated.

C. Multiple Blade Dampers: Fabricate with 16 gage, 0.0598 inch galvanized steel frame and 16 gauge airfoil blades, stainless steel permanently lubricated sleeve bearings and plated steel axles, stainless steel jamb seals, 1/8 x 1/2 inch plated steel concealed linkage, stainless steel closure spring, blade stops, and lock, and 1/2 inch actuator shaft.

D. Operators: UL listed and labelled spring return electric type suitable for 120 volts, single phase, 60 Hz. Provide end switches to indicate damper position. Locate damper operator on exterior of duct and link to damper operating shaft.

E. Sleeves for smoke dampers shall be the rigid type of construction recommended in SMACNA Publication for "Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems". Unless otherwise required by the authority having jurisdiction, use 16 gauge for ducts 24" or less in diameter

or either rectangular dimension and 14 gauge for ducts over 24". Provide minimum 18" long sleeves. Coordinate required length with wall thicknesses.

2.9. VOLUME CONTROL DAMPERS

A. Manufacturers:

1. Greenheck; : www.greenheck.com
2. Louvers & Dampers, Inc: www.louvers-dampers.com.
3. Nailor Industries Inc: www.nailor.com.
4. Ruskin Company: www.ruskin.com.

B. Fabricate in accordance with SMACNA (DCS) and as indicated.

C. Single Blade Dampers:

1. Blade: 24 gage, 0.0239 inch, minimum.
2. Shaft: 1/2" square rod operator with end bearings and gasket seal at duct penetrations. Terminate shaft in damper frame with bushings.

D. Multi-Blade Damper: Fabricate of 3V style opposed blade pattern with maximum blade sizes 8 x 72 inch. Assemble center and edge crimped blades in prime coated or galvanized channel frame with suitable hardware.

1. Blade: 18 gage, 0.0478 inch, minimum.
2. Shaft: 1/2" square rod operator with end bearings and gasket seal at duct penetrations. Terminate shaft in damper frame with bushings.

E. 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.

1. Manufacturers:
   a. Carlisle HVAC Products; Dynair End Bearing Leak Resistant Sets: www.carlislehvac.com/#sle.
   b. Elgen Manufacturing Company, Inc; Snap-in Bushing: www.elgenmfg.com/#sle.

F. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers. Minimum 12 gauge construction.
2. On externally insulated ducts, mount quadrant regulators on stand-off mounting brackets, bases, or adapters with height equivalent to insulation thickness.
3. Where rod lengths exceed 30 inches provide regulator at both ends.
4. Manufacturers:
   a. Carlisle HVAC Products; Dynair Double Shear Rattle Free Quadrants 1/2 inch: www.carlislehvac.com/#sle.
   b. DuroDyne Quadline Damper Quadrants; http://www.durodyne.com/.

2.10. MISCELLANEOUS PRODUCTS

A. 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.
5. Manufacturers:

a. Carlisle HVAC Products; Dynair Duct Protection Film: www.carlislehvac.com/#sle.

b. Elgin; Shrink Wrap with PSA: www.elgenmfg.com

PART 3 EXECUTION

3.1. PREPARATION

A. Verify that electric power is available and of the correct characteristics.

3.2. 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. Install duct opening closure film on open ductwork at end of day. All ductwork delivered to site shall have ends covered with closure film.

C. Provide backdraft dampers on exhaust fans or exhaust ducts nearest to outside and where indicated.

D. Provide insulated duct access doors for inspection and cleaning before and after filters, coils, fans, automatic dampers, at fire dampers, combination fire and smoke dampers, duct mounted airflow measuring stations and elsewhere as indicated. Provide access door at smoke detectors. Review locations prior to fabrication.

E. For ductwork under 12" in longest dimension, provide access door size to allow replacement of fusible link or as required for equipment service. For ductwork between 12" to 20" in longest dimension, provide minimum 12"x12" access door. For ductwork between 22" to 36" in longest dimension, provide minimum 18"x18" access door. For ductwork above 36" in longest dimension, provide minimum 24"x24" access door. Use angle iron bracing as required to make door frame a rigid assembly.

F. Check duct connections at access doors for air leakage or condensation. Correct conditions found.

G. Provide duct test holes where indicated and required for testing and balancing purposes.

H. Provide fire dampers, combination fire and smoke dampers, and smoke dampers at locations indicated, where ducts and outlets pass through fire rated components, and where required by authorities having jurisdiction. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

I. Attach multiple damper section assemblies together in accordance with manufacturer’s instructions. Install support mullions as reinforcement between assemblies as required. Provide and install bracing for multiple section assemblies to support assembly weight and to hold against system pressure.

J. Provide duct access door(s) for all rated dampers in accordance with NFPA 90A, identify each access door with 1/2" high stenciled letters as 'Fire Damper', 'Smoke Damper', and 'Combination Fire/Smoke Damper'.

K. Install smoke dampers and combination smoke and fire dampers in accordance with NFPA 92.

L. Demonstrate re-setting of fire dampers to Owner's representative.

M. Testing of Fire, Fire/Smoke, and Smoke dampers

1. Testing of Fire, Fire/Smoke, and Smoke dampers shall be by certified inspector in accordance with AHJ.

2. Test all fire dampers by manually disconnecting linkage and observing blades fall into position.

3. Test all Smoke and Combination Fire/Smoke dampers by observing damper operation during fire alarm system commissioning.

4. Install label on access door for each rated damper with equipment tag name, floor and number. Identify dampers on coordination drawing floor plans and deliver to Crawford Memorial Hospital with close-out documents. Provide label on access door with damper tag number, name of inspector, date of inspection and outcome of test.

5. Records of Testing: Maintain records of system testing and results thereof. Deliver results as part of project closing file and on an intermediate basis as requested by Architect/Engineer.
6. Provide a formal written inventory of all Fire, Fire/Smoke, and Smoke Dampers complete with an inventory system in spreadsheet format. Coordinate with Crawford Memorial Hospital/facilities director for required format of testing log. Provide sample for approval and revise as requested by Crawford Memorial Hospital/Engineer. Provide PDF and CAD file (based on coordination/record drawings) showing all damper locations with associated damper tags and evidence of their passing the tests.

N. At fans and motorized equipment associated with ducts, except kitchen grease exhuast fans, provide flexible duct connections immediately adjacent to the equipment.

O. At equipment supported by vibration isolators, except kitchen grease exhuast fans, provide flexible duct connections immediately adjacent to the equipment; see Section 22 0548.

P. For fans developing static pressures of 5.0 inches and over, cover flexible connections with leaded vinyl sheet, held in place with metal straps.

Q. 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. Locate dampers in accessable location.

R. Use splitter dampers only where indicated.

S. Provide balancing dampers on high velocity systems where indicated. Refer to Section 23 3600 - Air Terminal Units. Locate dampers in accessable location.

T. 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 3423 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Roof exhausters.

B. Roof ventilators.

1.2. 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.

D. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3. REFERENCE STANDARDS

A. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

B. AMCA 99 - Standards Handbook; 2016.

C. AMCA 204 - Balance Quality and Vibration Levels for Fans; 2005 (Reaffirmed 2012).

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. NEMA MG 1 - Motors and Generators; 2018.

H. NFPA 96 - Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations; 2021.

I. UL 705 - Power Ventilators; Current Edition, Including All Revisions.

J. UL 762 - Outline of Investigation for Power Roof Ventilators for Restaurant Exhaust Appliances; Current Edition, Including All Revisions.

1.4. 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.

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.

1.5. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6. FIELD CONDITIONS

A. Permanent ventilators may not be used for ventilation during construction.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Greenheck.

B. Loren Cook Company.

C. PennBarry.

D. Twin City Fans.

E. CaptiveAire.

2.2. 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. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

F. Kitchen Hood Exhaust Fans: Comply with requirements of NFPA 96 and UL 762.

2.3. ROOF **VENTILATORS**

A. Fan Unit: 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: 16 inch high self-flashing of galvanized steel with continuously welded seams, built-in cant strips.

C. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor.

D. Solid state speed controller.

E. Backdraft Damper: Electrically actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

PART 3 EXECUTION

3.1. 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.

D. Install units with clearances for service and maintenance.

E. Label fans according to requirements specified in Section 230553 "Identification for HVAC Piping and Equipment."

3.2. CONNECTIONS

A. Drawings indicate general arrangement of ducts and duct accessories. Make final duct connections with flexible connectors. Flexible connectors are specified in Section 233300 "Air Duct Accessories."

B. Install ducts adjacent to fans to allow service and maintenance.

C. Install piping from scroll drain connection, with trap with seal equal to 1.5 times specified static pressure, to nearest floor drain with pipe sizes matching the drain connection.

3.3. FIELD QUALITY CONTROL

A. Perform the following tests and inspections:

1. Verify that shipping, blocking, and bracing are removed.
2. Verify that unit is secure on mountings and supporting devices and that connections to ducts and electrical components are complete. Verify that proper thermal-overload protection is installed in motors, starters, and disconnect switches.
3. Verify that cleaning and adjusting are complete.
4. Verify lubrication for bearings and other moving parts.
5. Verify that manual and automatic volume control and fire and smoke dampers in connected ductwork systems are in fully open position.
6. See Section 230593 "Testing, Adjusting, and Balancing For HVAC" for testing, adjusting, and balancing procedures.
7. Remove and replace malfunctioning units and retest as specified above.

B. Test and adjust controls and safeties. Controls and equipment will be considered defective if they do not pass tests and inspections.

C. Prepare test and inspection reports.

END OF SECTION

SECTION 23 3433 - AIR CURTAINS

<<<< UPDATE NOTES

PART 1 GENERAL

2.1. SECTION INCLUDES

A. Air curtains with hot water heat.

2.2. REFERENCE STANDARDS

A. AMCA 220 - Laboratory Methods of Testing Air Curtains for Aerodynamic Performance Ratings; 2012.

2.3. SUBMITTALS

A. Product Data: Manufacturer's descriptive literature for products specified in this section; indicate options specified.

B. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

2.4. DELIVERY, STORAGE, AND HANDLING

A. Store products of this section in manufacturer's unopened packaging until installation.

B. Maintain dry, heated storage area for products of this section until installation of products.

PART 2 PRODUCTS

3.1. MANUFACTURERS

A. Berner International Corp.: www.berner.com/#sle.

B. MARS Air Systems: www.marsair.com/#sle.

3.2. AIR CURTAINS

A. Product Description: Self-contained, electrically-operated, air curtain for mounting at head of door openings.

1. Maximum Mounting Height: 8 feet.

B. Housing:

1. Material: Aluminum.
2. Factory-provided mounting brackets.
3. Finish: Painted epoxy or powder coated finish.
4. Color: Color as selected by architect. Provide physical color samples to architect for color selection..
5. Service Access: Removable screen and removable bottom access panel.

C. Blower Assembly: Forward curved cross flow tangential type, made of aluminum with flexible hubs and mounted in matched fan scroll made of aluminized steel.

D. Motor: Variable speed, open drip proof, direct driven, resilient mounted continuous duty with internal thermal-overload protection and permanently lubricated sealed ball bearing.

E. Discharge Nozzles:

1. Provide uniform velocity across width of air curtain.
2. Aperture: 2 in slot by width of air curtain.

F. Vanes: 0.875 in. minimum height; constructed of air-foil shaped aluminum extrusions, adjustable +/- 20 degrees.

G. Inlet: Front inlet with perforated aluminum screen with same finish as the cabinet.

H. Filter: Flat faced fire-rated cleanable aluminum filter with integral filter clips.

I. Performance: Tested in accordance with AMCA 220.

J. Control: ON/OFF control; air curtain turns on when door is opened and off when door is closed.

1. Factory mounted and wired digital programmable controller with minimum features:

a. 5 volt DC output for control circuit.

b. Lock and unlock for tamperproof operation.

c. 10 fan speed settings.

d. Programmable start, stop, and time delay.

e. Fan fail lockout.

f. Thermostat for heating control.

K. Operating Noise Level: 54 dBA.

1. Measured 10 feet from unit.

L. Heating: Hot-water heating coil. Certified in accordance with ARI 410.

1. Construction: 16-gauge galvanized steel casing, 5/8 inch copper tube with aluminum fins and seamless copper headers. Factory mount coil on air intake and protect with perforated metal screen.

2. Maximum Operating Temperature: 300 degree F hot water.

3. Maximum Operating Pressure: 250 psig.

PART 3 EXECUTION

4.1. EXAMINATION

A. Verify that required utilities are in correct location and are of correct capacities for specified products.

B. Verify that mounting surfaces have sufficient strength to support units.

C. Verify that space is ready for installation of units.

D. Verify clearances required to maintain the units.

4.2. INSTALLATION

A. Install air curtains in accordance with shop drawings and manufacturer's printed installation instructions.

B. Maintain clearances required to maintain the units.

C. Ensure proper connection to utilities.

END OF SECTION

SECTION 23 3600 - AIR TERMINAL UNITS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Single-duct terminal units.

1. Single-duct, variable-volume units.

1.2. RELATED REQUIREMENTS

A. Section 23 0548 - Vibration and Seismic Controls for HVAC.

B. Section 23 2113 - Hydronic Piping: Connections to heating coils.

C. Section 23 3100 - HVAC Ducts and Casings.

D. Section 23 3300 - AIR DUCT ACCESSORIES.

1.3. 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 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. ASTM A492 - Standard Specification for Stainless Steel Rope Wire; 1995 (Reapproved 2013).

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. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

H. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.4. 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. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5. 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

2.1. SINGLE-DUCT, **VARIABLE-VOLUME UNITS**

A. Manufacturers:

1. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp..

2. Titus.

3. Krueger-HVAC.

4. Metalaire, a brand of Metal Industries Inc.

5. Price Industries, Inc..
6. Trane, a brand of Ingersoll Rand.

B. 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.

C. Unit Casing:

1. Minimum 22 gage, 0.0299 inch galvanized steel.
2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.
3. Unit Discharge: Rectangular, with slip-and-drive connections.
4. Access Door: Premium Camlock access door in bottom of casing.
5. Acceptable Liners:
   a. Fibre Free. 1 inch thick lining complying with UL 181 erosion and mold growth requirements, ASTM C665, ASTM 1338, G21, G22, 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.

D. Sound Attenuator:

1. Provide if required to meet scheduled acoustical performance requirements.
2. Construction to consist of a continuous extension of the casing and liner as required to achieve required attenuation.
3. At 2000 fpm inlet velocity, the minimum operating pressure with attenuator added not to exceed 0.14 inch wg.

E. 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.

F. Hot Water Heating Coil:

1. Coil Casing: Minimum 22 gage, 0.0299 inch galvanized steel, factory-installed on terminal discharge with rectangular outlet, duct connection type.
   a. Access Door: Gasketed and insulated located on bottom.
2. Coil Fins: Aluminum or aluminum plated fins, mechanically-bonded to seamless copper tubes.
3. Coil leak tested to minimum 350 psig.
4. Base performance data on tests run in accordance with AHRI 410 and units to bear AHRI 410 label.

G. Controls:

1. DDC (Direct-Digital Controls):

a. Provide terminal unit compatible with field installed DDC controls.

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 Controls sheets for sequence of operations, control points, and other requirements.

PART 3 EXECUTION

3.1. 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. Provide ceiling access doors or locate units above easily removable ceiling components.

D. Support units individually from structure with wire rope complying with ASTM A492 and ASTM A603 in accordance with SMACNA (SRM). See Section 23 0548.

E. Do not support from ductwork.

F. Connect to ductwork in accordance with Section 23 3100.

3.2. ADJUSTING

A. Reset volume with damper operator attached to assembly allowing flow range modulation from 100 percent of design flow to 30 percent full flow.

3.3. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide manufacturer's field representative to test, instruct, and observe field-assembled components and equipment installation, including connections and to assist in field testing. Report results in writing.

1. Leak Test:

a. After installation, fill water coils and test for leaks.

b. Repair leaks and retest until no leaks exist.

2. Operational Test:

a. After electrical circuitry has been energized, start units to confirm proper motor rotation and unit operation.

b. Test and adjust controls and safeties.

c. Replace damaged and malfunctioning controls and other equipment.

d. Remove and replace malfunctioning units and retest as specified above.

3.4. CLEANING

A. Vacuum clean coils and inside of units.

B. Install new filters.

END OF SECTION

SECTION 23 5216 - CONDENSING BOILERS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Manufactured units.

B. Boiler construction.

C. Boiler trim.

D. Fuel burning system.

E. Factory installed controls.

1.2. RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete.

B. Section 23 0913 - Instrumentation and Control Devices for HVAC.

C. Section 23 2114 - Hydronic Specialties.

D. Section 23 2123 - Hydronic Pumps.

E. Section 23 2500 - HVAC Water Treatment.

F. Section 23 5100 - Breechings, Chimneys, and Stacks.

G. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3. REFERENCE STANDARDS

A. ANSI Z21.13 - American National Standard for Gas-Fired Low-Pressure Steam and Hot Water Boilers; 2017.

B. 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.

C. ASHRAE Std 103 - Methods of Testing for Annual Fuel Utilization Efficiency of Residential Central Furnaces and Boilers; 2017, with Errata (2019).

D. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2019.

E. ASME CSD-1 - Controls and Safety Devices for Automatically Fired Boilers; The American Society of Mechanical Engineers; 2012.

F. HI BTS-2000 - Testing Standard, Method to Determine Heating Efficiency of Commercial Space Heating Boilers; The Hydronics Institute of AHRI; 2007.

G. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); Current Edition.

H. NFPA 54 - National Fuel Gas Code; 2018.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittals procedures.

B. Product Data: Provide data indicating general assembly, components, controls, safety controls, and wiring diagrams with electrical characteristics and connection requirements, and service connections.

C. Manufacturer's Installation Instructions: Indicate assembly, support details, connection requirements, and include start up instructions.

D. Manufacturer's Factory Inspection Report: Submit boiler inspection prior to shipment.

E. Manufacturer's Field Reports: Burner manifold gas pressure, percent carbon monoxide (CO), percent oxygen (O), percent excess air, flue gas temperature at outlet, ambient temperature, net stack temperature, percent stack loss, percent combustion efficiency, and heat output.
   1. Indicate compliance with specified performance and efficiency.
   2. Provide results of the following combustion tests:
      a. Boiler firing rate.
      b. Over fire draft.
      c. Gas flow rate.
      d. Heat input.
      e. Burner manifold gas pressure.
      f. Percent carbon monoxide.
      g. Percent oxides of nitrogen.
      h. Percent oxygen.
      i. Percent excess air.
      j. Flue gas temperature at outlet.
      k. Ambient temperature.
      l. Net stack temperature.
      m. Percent stack loss.
      n. Percent combustion efficiency.
      o. Heat output.

F. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.

G. Sumbit copies of permits and certificates of acceptance from applicable local, state and national authorities having jurisdiction for installation, operating and air quality prior to final acceptance by the Engineer.

H. Provide ASME and National Board of Pressure Vessels Inspector cetrtificates for boiler prior to final acceptance by the Engineer.

I. Provide certificate of acceptance from insuring agency prior to final acceptance by the Engineer.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5. DELIVERY, STORAGE, AND HANDLING

A. Protect boilers from damage by leaving factory inspection openings and shipping packaging in place until final installation.

1.6. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide a five year warranty for heat exchanger.

C. Provide a ten year warranty against corrosion for flue condensate collection chamber.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Natural Gas, Propane, or Combination Natural Gas/Propane for Indoor Applications:
   1. Aerco; Model Benchmark: www.aerco.com.

2.2. MANUFACTURED UNITS

A. Factory assembled, factory fire-tested, self-contained, readily transported unit ready for automatic operation except for connection of water, fuel, electrical, and vent services.

B. Unit: Metal membrane wall, water or fire tube, condensing boiler on integral structural steel frame base with integral fuel burning system, firing controls, boiler trim, insulation, and removable jacket, suitable for indoor application.

C. Annual Fuel Utilization Efficiency (AFUE) in accordance with ASHRAE 103: 0.82.

2.3. BOILER CONSTRUCTION

A. Conform to the minimum requirements of ASME BPVC-IV, ASME CSD-1, and ANSI Z21.13 for construction of boilers.

B. Assembly to bear the ASME "H" stamp and comply with the efficiency requirements of the latest edition of ASHRAE Std 90.1 I-P I-P.

C. Required Directory Listings:

1. NBBI Manufacturer and Repair Directory - The National Board of Boiler and Pressure Vessel Inspectors (NBBI); current edition at www.nationalboard.org.

D. Heat Exchanger: Construct with stainless steel materials that are impervious to corrosion where subject to contact with corrosive condensables.

E. Boiler shall be capable of handling return water temperatures down to 40 degrees F without failure due to thermal shock or fireside condensation.

F. Provide adequate tappings, observation ports, removable panels, and access doors for entry, cleaning, and inspection. Access to the tubesheets and heat exchangers shall be available by burner and exhaust manifold removal. Minimum access opening shall be no less than 10 in. diameter.

G. Insulate casing with insulation material, protected and covered by heavy gauge, metal jacket.

H. Factory apply boiler base and other components, that are subject to corrosion, with durable, acrylic, powder coated, painted, or weather-proofed finish.

I. Ignition: Ignition shall be via spark ignition with 100 percent main-valve shutoff and electronic flame supervision.

2.4. BOILER TRIM

A. ASME rated pressure relief valve.

B. Flow switch.

C. Electronic Low Water Cut-off: Complete with test light and manual reset button to automatically prevent firing operation whenever boiler water falls below safe level.

D. Temperature and pressure gauge.

E. Pressure Switches:

1. High gas pressure.
2. Low gas pressure.
3. Air pressure.

F. Manual reset high limit.

G. Boiler Pump (where required by boiler design):

1. Primary pump, factory supplied and sized for field installation to ensure minimum, continuous circulation through boiler.
2. Where pump is not provided by boiler manufacturer, provide pump in accordance with boiler manufacturer's recommendations.

3. Pump time delay.

2.5. FUEL BURNING SYSTEM

A. Provide forced draft automatic burner or pulse combustion, integral to boiler, designed to burn natural gas and propane, and maintain fuel-air ratios automatically.

1. Blower Design: Statically and dynamically balanced to supply combustion air; direct connected to motor.

2. Forced Draft Design: Mixes combustion air and gas to achieve 90 percent combustion efficiency.

3. Pulse Combustion Design: Self-aspirating, not requiring blower for combustion.

4. Combustion Air Filter: Protects fuel burning system from debris.

B. Gas Train: Plug valve, safety gas valve, gas-air ratio control valve, pressure regulator controls air and gas mixture and high and low gas pressure switches. Each boiler shall utilize an electric single seated combination safety shutoff valve/regulator with proof of closure switch in its gas train and incorporate dual over-temperature protection with manual reset in accordance with ASME Section IV and CSD-1.

C. Combustion Air Proving Switch shall be furnished to ensure sufficient combustion airflow is present for burner ignition firing.

D. Emissions: The equipment shall be guaranteed to limit NOx emissions to 20 PPM, or less as required by authorities having jurisdiction.

E. Intakes: Combustion air intake capable of accepting free mechanical room air or direct outside air through a sealed intake pipe

F. The boiler manufacturer shall have the capability of providing a dual fuel gas train with natural gas and propane.

2.6. FACTORY INSTALLED CONTROLS

A. Option for internal or external (0-10) VDC control.

B. Temperature Controls:

1. Automatic reset type to control fuel burning system on-off and firing rate to maintain temperature.

2. Manual reset type to control fuel burning system to prevent boiler water temperature from exceeding safe system water temperature.

3. Low-fire start time delay relay.

C. Electronic PI setpoint/modulation control system.

D. Microprocessor-based, fuel/air mixing controls.

2.7. SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide factory tests to check construction, controls, and operation of unit.

C. Manufacturer to conduct boiler inspection prior to shipment; submit copy of inspection report to Architect.

D. Non-Conforming Work: See Section 01 4000.

PART 3 EXECUTION

3.1. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install boiler and provide connection of natural gas service in accordance with requirements of NFPA 54 and applicable codes.

C. Install equipment in strict compliance with state and local codes, applicable ASME and NFPA standards and insuring agency requirements. Contractor shall obtain all state and or national air quality permits and provide all required testing and test data for permits. Contractor shall obtain all state or city boiler installation and operating permits. Contractor shall provide all corrections to installation as required to satisfy inspector requirements for all permitting.

D. Install boiler on concrete housekeeping base, sized minimum of 4 inches larger than boiler base in accordance with Section 03 3000.

E. Maintain manufacturer's recommended clearances around sides and over top of equipment.

F. Install components that were removed from equipment for shipping purposes.

G. Install components that were furnished loose with equipment for field installation.

H. Provide all interconnecting electrical control and power wiring.

I. Boiler factory authorized representative to provide jobsite assistance to inspect boilers and other equipment upon arrival, verifying completeness of equipment supplied and potential damages. All shipped loose components, such as casing, to be mounted on boiler by boiler provider after contractor has set boiler in building.

J. Coordinate provisions for water treatment in accordance with Section 23 2500.

K. Pipe relief valves to nearest floor drain.

L. Pipe cooled condensate produced by the combustion process from the boiler condensate connection and/or flue stack with suitable piping material to neutralizer prior to discharging into nearest floor drain.

M. Provide piping connection and accessories in accordance with Section 23 2114.

N. Provide for connection to electrical service in accordance with Section 26 0583.

O. Vent combustion fumes in accordance with manufacturer's recommendations. Refer to Section 23 5100.

3.2. START UP

A. Start-up shall be conducted by experienced and factory authorized technician in the regular employment of the authorized service organization, and shall include:

1. The boiler supplier's factory authorized service organization shall be responsible for performance of inspections, start up and testing of the package boiler, and accessory equipment and materials furnished under this contract. A detailed written record of the start up performance, including burner setting data over the entire load range shall be furnished to the Engineer before final acceptance. All labor, equipment, and test apparatus shall be furnished by the factory authorized service organization. All equipment defects discovered by the tests shall be rectified either by the service organization or boiler manufacturer.

2. Verify that boiler, burner, controls, and accessories comply with requirements of the constuction documents and the boiler and accessories supplier's installation instructions.

3. Pre-test all items prior to scheduling the final testing that will be witnessed by the Engineer.

4. Minimum startup and testing requirements:

a. The manufacturer's representative shall test all boiler and burner interlocks, actuators, valves, controllers, gauges, thermometers, pilot lights, switches, etc. Any malfunctioning component shall be replaced at the time of initial start-up if found to be inoperative.

b. All adjustments to boiler, burner, and boiler control system shall be performed by the manufacturer's authorized service representative.

c. Fireside inspection

d. Set up fuel train and combustion air system

e. Set up operating set points

f. Check all safeties, including Flame safeguard, LWCO, Airflow, Fuel pressures, High limits.

g. Set up and verify efficiencies at 20%, 50%, 75%, and 100%

h. Set up and verify burner turndown.

5. Readings at different firing rates (20, 50, 75 and 100%) of load for the modulating burner shall be taken with a written report of the tests submitted to the Engineer. The reports shall include readings for each firing rate tested and include stack temperatures, O2, CO, NOx, and overall boiler efficiency.

6. Auxiliary Equipment and Accessories: Observe and check all valves, draft fans, electric motors and other accessories and appurtenant equipment during the operational and capacity tests for leakage, malfunctioning, defects, and non compliance with referenced standards or overloading as applicable.

3.3. CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

B. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. At a minimum, training to include all safety procedures, maintenance procedures, control operations, and diagnostic procedures.

3. Provide minimum of two hours of training.

4. Instructor: Manufacturer's training personnel.

5. Location: At project site.

END OF SECTION

SECTION 23 5700 - HEAT EXCHANGERS FOR HVAC

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Plate type heat exchangers.

B. Accessories and trim.

1.2. RELATED REQUIREMENTS

A. Section 23 0913 - Instrumentation and Control Devices for HVAC.

B. Section 23 2113 - Hydronic Piping.

C. Section 23 2114 - Hydronic Specialties.

D. Section 23 2213 - Steam and Condensate Heating Piping.

E. Section 23 2214 - Steam and Condensate Heating Specialties.

1.3. REFERENCE STANDARDS

A. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2019.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data with dimensions, locations, and size of tappings and performance data.

C. Shop Drawings: Indicate dimensions, locations, and size of tappings and performance data.

1. Detail equipment assemblies and indicate weights, loads, required clearances, method of field assembly, and components.

2. Base Details: Detail fabrication including anchorages and attachments to structure and to supported equipment.

3. Design Data: Indicate in sufficient detail to verify that heat exchangers meet or exceed specified requirements.

D. Manufacturer's Instructions: Indicate installation and support requirements.

E. Field Test and Inspection Reprots.

F. Operation and Maintenance Data: Include start up and shut down instructions, assembly drawings, and spare parts lists.

G. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.5. DELIVERY, STORAGE, AND HANDLING

A. Protect internals from entry of foreign material by temporary caps on flanged openings.

1.6. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1. PLATE AND FRAME TYPE HEAT EXCHANGER

A. Manufacturer:

1. Aerco, Smart Plate Double Wall.

2. Substitutions: See Section 01 6000 - Product Requirements.

B. Frames: Carbon steel with baked epoxy enamel paint, stainless steel side bolts and shroud.

1. Caopacity to accommodate 20 peercent additional plates.
2. Provisions for anchoring to support.

C. Top and Bottom Carrying and Guide Bar: Painted carbon steel, aluminum, or stainless steel.

D. Double wall construction, atmostpherically vented with visible leak detection ports.

E. Plates: Stainless steel Type 316.

F. Tie Rods and Nuts: Steel or Stainless steel.

G. Gaskets: Ethylene propylene diene monomer (EDPM).

H. Nozzles: 125 psi rated lined flange type.

I. Piping Connections: Factory fabricated of materials compatible with heat exchanger material. Attach tappings before testing and labeling.

1. NPS 2 and Smaller: Threaded ends according to ASME B1.20.1.
2. NPS 2-1/2 and Larger: Flanged ends accoring to ASME B16.5 for steel and stanless steel flanges and according to ASME B16.24 for copper and copper-alloy flanges.

2.2. ACCESSORIES

A. Shroud: Removable stainless steel sheet.

B. Pressure Releif Valve: Cast-iron or Bronze, ASME rated and stamped.

C. DDC controls integrated with Boiler controls system and building automation system.

PART 3 EXECUTION

3.1. INSTALLATION

A. Examine areas for compliance with requirements for installation tolerances and for structural rigidity, strength, anchors, and other conditions affecting performance of heat exchangers.

B. Examine roughing-in for heat exchanger piping to verify actual locations of piping connections before equipment installation.

C. Procveed with installation only after unsatisfactory conditions have been corrected.

D. Install in accordance with manufacturer's instructions.

E. Install to permit removal of plates with minimum disturbance to installed equipment and piping.

F. Support heat exchangers on concrete housekeeping pad.

G. Pipe relief valves to nearest floor drain.

H. Pipe drain valves to nearest floor drain.

3.2. STEAM TO WATER HEAT EXCHANGER TRIM

A. Shell: Pressure gauge tapping with pigtail siphon, vacuum breaker; refer to Section 23 2214.

B. Water Inlet: Thermometer well, pressure gauge tapping, valved drain; refer to Section 23 2114.

C. Water Outlet: Thermometer well for temperature regulator sensor, ASME rated pressure and temperature relief valve, thermometer well, pressure gauge tapping; refer to Section 23 2114.

3.3. CONNECTIONS

A. Install in accordance with Section 23 2113 and Section 23 2116. Drawings indicate general arrangement of piping, fittings, and specialties.

B. Maintain manufacturer's recommended clearances for tube removal, service and maintenance.

C. Install piping adjacent to heat exchangers to allow space for service and maintenance of heat exchangers. Arrange piping for easy removal of heat exchangers.

3.4. FIELD QUALITY CONTROL

A. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Leak Test: After installation, charge system and test for leaks. Repair leaks and retest until no leaks exist.

2. Test and adjust controls and safeties. Replace damaged and malfunctioning controls and equipment.

B. Heat exchanger will be considered defective if it does not pass tests and inspections.

C. Prepare test and inspection reports.

3.5. CLEANING

A. After completing system installation, including outlet fitting and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damagecd finishes.

3.6. DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain heat exchangers. Video record the training sessions. Provide in accordance with Section 01 7900.

END OF SECTION

SECTION 23 6423 - SCROLL WATER CHILLERS

PART 1 GENERAL

1.1. 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.

1.2. RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete housekeeping pads.

B. Section 23 0513 - Common Motor Requirements for HVAC Equipment.

C. Section 23 0548 - Vibration and Seismic Controls for HVAC.

D. Section 23 0553 - Identification for HVAC Piping and Equipment.

E. Section 23 0593 - Testing, Adjusting, and Balancing for HVAC.

F. Section 23 0800 - Commissioning of HVAC.

G. Section 23 0993 - Sequence of Operations for HVAC Controls.

H. Section 23 2113 - Hydronic Piping.

I. Section 23 2114 - Hydronic Specialties.

J. Section 26 0583 - Wiring Connections.

1.3. 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 and Designation and Classification of Refrigerants ; 2019, with Errata (2020).

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; 2019.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

F. UL 1995 - Heating and Cooling Equipment; Current Edition, Including All Revisions.

1.4. 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.

C. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.

1.5. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. When required, provide certification of inspection in compliance with the requirements of Authority Having Jurisdiction.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Comply with manufacturer's written installation instructions for rigging, unloading, and transporting units.

B. Deliver units to the job site completely assembled and charged with refrigerant and oil by manufacturer.

1.7. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty to include coverage for materials only for compressor.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Carrier, a part of UTC Building and Industrial Systems, a unit of United Technologies Corp.

B. Substitutions: See Section 01 6000 - Product Requirements.

1. The chilled water system has been designed based on specific capacities and characteristics of equipment specified in this section and other sections.

2.2. CHILLER APPLICATIONS

2.3. 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. or testing firm acceptable to the Authority Having Jurisdiction as suitable for the purpose specified and indicated.
5. Energy Efficiency: ASHRAE Std 90.1 I-P.
6. Enclosures:
    a. Frame:
        1) Heavy-gage steel.
        2) Factory apply hot-dipped galvanized or air-dried paint finish.
    b. Steel Chiller Cabinets:
        1) Factory apply baked on enamel or baked on powder paint finish.
    c. Electrical Equipment: NEMA 250 or UL 1995 as applicable. Single-point power connection.

2.4. COMPRESSORS AND EVAPORATOR

A. Compressors: Hermetic scroll type.

1. Unit: Fully hermetic type with multiple, direct drive compressors with discharge and suction 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 or 3500 rpm, suction gas-cooled, with thermal or current overload protection.
6. Provide compressor sound reduction blankets.

B. Evaporator: Provide shell and tube type.

1. Shell and tube type.
    a. Shell, removable heads and tube support sheets constructed of carbon steel.
    b. Tubes: Mechanically expand and fasten, seamless, externally or internally enhanced, copper tubes into intermediate tube support sheets along the length of shell to avoid contact and relative motion between tubes.
    c. Refrigerant Working-Side Pressure Rating: 400 psig minimum.
    d. Water Working-Side Pressure Rating: 150 psig minimum.
    e. Provide with flanged connections.
    f. Insulation for all cold surfaces.
        1) Insulation is factory installed on shell, connections, and suction piping.
        2) 0.75 inches minimum thick, closed cell, expanded polyvinyl chloride, polyurethane, or vinyl nitrate polymer insulation with a maximum k value of 0.28.
    g. Provide factory installed vents and water drain connections on evaporator or piping.
    h. Provide factory installed fittings for temperature control sensors on evaporator or piping.
    i. Freeze Protection for Outdoor Locations: Provide thermostatically controlled electric heater to protect from freezing at ambient temperatures down to minus 20 degrees F.

2.5. AIR-COOLED CONDENSER AND FANS

A. Provide finned-tube 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.

B. Coil Guards: Provide corrosion proof, louvered panels, heavy gage wire panels, or grilles, factory installed. Provide coil protection for shipping by enclosing entire condenser coil with heavy plastic to prevent coil damage during shipping or rigging.

1. Provide cotton wood screens to protect coils equivalent to Air Solution Company Standard Duty Filters with Standard Duty Commercial Mesh.

C. Fans and Motors:

1. Fans: Dynamically balance propeller, shrouded-axial, or airfoil type fans of reinforced polymer or glass fiber reinforced composite corrosion resistant construction equipped with sealed, permanently lubricated ball bearings.
2. Discharge Fan Guards: Corrosion resistant, heavy gage, steel wire.
3. Discharge Direction: Vertical.
4. Motors: Direct drive, totally enclosed for outdoor use with current overload protection.
5. VFDs: Variable frequency drive for each condenser fan motor.

2.6. REFRIGERATION CIRCUITS

A. Provide multiple independent refrigeration circuit(s) with multiple compressor(s) per circuit.

B. Provide discharge shut-off valve, liquid line shut-off valve, filter-drier, expansion valve, and refrigerant relief device for each independent circuit.

2.7. 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 gages, 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. Automatic Adjustable Operating Controls:
    a. Temperature of chilled water leaving chiller.
    b. Chiller system capacity control based on set-points and system load.
    c. Compressor short-cycling prevention.
    d. Lead/lag for multiple compressors.
    e. Automatic reset on power source failure.
    f. Load limiting.
2. Normal Operation Monitoring and Open Cover-less Displays:
    a. Hours of operation.
    b. Suction and discharge refrigerant pressures.
    c. Automatic diagnostics.
    d. Number of starts.
    e. On/off compressor status.
    f. Entering and leaving chilled water temperatures.
    g. Status of operation.
    h. Weekly purge cycle totalization if applicable.
    i. Oil pressure.
3. Set-Points:
    a. Leaving chilled water temperature.
    b. Date/time.
4. Automatic Chiller Shut-Down Safety Controls and Alarm:
    a. Automatic Reset:
        1) Chilled water flow interlock.
        2) Voltage protection (over/under).
        3) Phase reversal protection.
    b. Manual Reset:
        1) Evaporator low pressure.
        2) High motor winding temperature.
        3) Low chilled water temperature.
        4) Low chilled water flow.
        5) High condenser refrigerant discharge pressure.
        6) Motor current overload and phase loss.

7) Low oil flow.

c. Remote Alarm: Activate remote, audible bell upon safety shutdown of chiller.

5. 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

3.1. 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.

3.2. MANUFACTURER'S FIELD SERVICES

A. Perform factory startup of the chiller by factory trained and authorized servicing technicians confirming equipment has been correctly installed prior to equipment becoming operational and covered under the manufacturer's warranty.

B. Supply initial charge of refrigerant and oil if not completely factory charged.

C. Demonstrate system operations and verify specified performance.

3.3. CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of equipment to Owner's designated representative.

D. Demonstration: Demonstrate operation of system to Owner's personnel.

1. Use operation and maintenance data as reference during demonstration.

2. Briefly describe function, operation, and maintenance of each component.

E. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. Provide minimum of two hours of training.

END OF SECTION

SECTION 23 7313 - MODULAR CENTRAL-STATION AIR-HANDLING UNITS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Casing construction.

B. Fan section.

C. Coil section.

D. Filter and air cleaner section.

E. Damper section.

F. Access section.

G. Roof mounting curb.

1.2. 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 0593 - Testing, Adjusting, and Balancing for HVAC.

D. Section 23 0719 - HVAC Piping Insulation.

E. Section 23 3300 - AIR DUCT ACCESSORIES: Flexible duct connections.

F. Section 23 8413 - Humidifiers.

G. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

H. Section 26 2923 - Variable-Frequency Motor Controllers.

1.3. REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. AHRI 410 - Forced-Circulation Air-Cooling and Air-Heating Coils; 2001, with Addendum (2011).

C. AMCA (DIR) - (Directory of) Products Licensed Under AMCA International Certified Ratings Program; 2015.

D. AMCA 99 - Standards Handbook; 2016.

E. AMCA 210 - Laboratory Methods of Testing Fans for Certified Aerodynamic Performance Rating; 2016.

F. AMCA 300 - Reverberant Room Method for Sound Testing of Fans; 2014.

G. AMCA 301 - Methods for Calculating Fan Sound Ratings from Laboratory Test Data; 2014.

H. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2017 (Amended (2020).

I. ASHRAE Std 62.1 - Ventilation for Acceptable Indoor Air Quality; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. ASTM B177/B177M - Standard Guide for Engineering Chromium Electroplating; 2011 (Reapproved 2017).

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

M. UL (DIR) - Online Certifications Directory; Current Edition.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the installation of AHUs with size, location and installation of service utilities.

B. Coordinate the work with other trades for installation of roof mounted air handling units on roof curbs.

C. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data:

1. Published Literature: Indicate dimensions, weights, capacities, ratings, gauges and finishes of materials, and electrical characteristics and connection requirements.

2. Filters: Data for filter media, filter performance data, filter assembly, and filter frames.

3. Fans: Performance and fan curves with specified operating point clearly plotted, power, RPM.

4. Sound Power Level Data: Fan outlet and casing radiation at rated capacity.

5. Electrical Requirements: Power supply wiring including wiring diagrams for interlock and control wiring, clearly indicating factory-installed and field-installed wiring.

C. Shop Drawings: Indicate assembly, unit dimensions, weight loading, required clearances, construction details, field connection details, and electrical characteristics and connection requirements.

D. Specimen Warranty: Submit sample of manufacturer's warranty.

E. Executed Warranty: Submit documentation of final executed warranty 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.

2. Extra Filters: One set for each unit.

1.6. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Accept products on site in factory-fabricated protective containers, with factory-installed shipping skids and lifting lugs. Inspect for damage.

B. Store in clean dry place and protect from weather and construction traffic. Handle carefully to avoid damage to components, enclosures, and finish.

C. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.8. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Carrier Corporation: www.carrier.com.

B. Daikin Applied: www.daikinapplied.com.

C. Trane Inc: www.trane.com.

D. York International Corporation / Johnson Controls Inc: www.york.com.

2.2. REGULATORY REQUIREMENTS

A. Comply with NFPA 70.

B. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified and indicated.

2.3. CASING CONSTRUCTION

A. Full Perimeter Base Rail:

1. Construct of galvanized steel.
2. Provide base rail of sufficient height to raise unit for external trapping of condensate drain pans.

B. Casing:

1. Construct of one piece, insulated, 2-inch thick, thermally broken, double wall R-13 foamed panels.
2. Provide mid-span, no through metal, internal thermal break.
3. Construct outer panels of G60 galvanized steel and inner panels of G90 galvanized steel.
4. Casing Air Pressure Performance Requirements:
   a. Able to withstand up to 8 inches w.g. positive or negative static pressure.
   b. Not to exceed 0.0042 inches per inch deflection at 1.5 times design static pressure up to a maximum of plus 8 inches w.g. in positive pressure sections and minus 8 inches w.g. in negative pressure sections.

C. Access Doors:

1. Construction, thermal and air pressure performance same as casing.
2. Provide surface mounted handles on hinged, swing doors.

D. Outdoor Unit Roof:

1. Factory install single layer outer roof above inner roof.
2. Slope at a minimum of 0.125 inches per foot from one side of unit to the other side, or from center to sides of unit.
3. Roof assembly to overhang each unit wall or base rail to overhang curb to facilitate water runoff and prevent water intrusion into roof curb to base connection.

E. Outside Air and Exhaust Air Weather Hood:

1. Fabricate from same material as casing outer panel.
2. Extend hood past perimeter of unit casing opening so as not to instruct airflow path.
3. Paint hoods with same finish as external surface of outdoor units.
4. Provide inlet hood for each fresh air damper with a moisture eliminator to prevent entrainment of water into the unit from outside air.
5. Provide exhaust hoods for each exhaust air opening.
6. Size each hood for 100 percent of nominal fresh air damper capacities.
7. Protect each hood with bird screen to prevent nesting at intake or exhaust air flow paths.

F. Unit Flooring: Construct with sufficient strength to support expected people and equipment loads associated with maintenance activities. Provide with min. 0.044" thick aluminum treadplate secured to floor panel.

G. Casing Leakage: Seal joints and provide airtight access doors so that air leakage does not exceed one percent of design flow at the specified casing pressure.

H. Insulation:

1. Provide minimum thermal thickness of 13 R throughout.
2. Completely fill panel cavities in each direction to prevent voids and settling.
3. Comply with NFPA 90A.

I. Drain Pan Construction:

1. Provide cooling coil and humidifier sections with an insulated, double wall, stainless steel drain pan complying with ASHRAE Std 62.1 for indoor air quality and sufficiently sized to collect all condensate.
2. Slope in two planes to promote positive drainage and eliminate stagnate water conditions.
3. Locate outlet of sufficient diameter at lowest point of pan to prevent overflow at normal operating conditions.
4. Provide threaded drain connections constructed of drain pan material, extended sufficient distance beyond the base to accommodate field installed, condensate drain trapping.

J. Marine Lights:

1. Provide factory-mounted, water- and dust-resistant LED fixture(s) where indicated on drawings, with the following characteristics:
   a. Non-ferrous metal housing.
   b. Glass or polycarbonate lens.
   c. Factory wired to a single switch within factory provided service module.
   d. Instant on white light with minimum 8000 hour service life.
2. Provide factory installed service module including GFCI receptacle independent from load side; designed to receive power from field supplied 120 volt source.

K. Finish:

1. Outdoor Units:
   a. Coat external surface of unit casing with primer and minimum 1.5 mil, enamel paint finish.
   b. Comply with salt spray test in accordance with ASTM B177/B177M.
   c. Color: Manufacturer's standard color.
2. Indoor Units:
   a. Provide exterior, galvanized steel panels without paint.
   b. Color: Manufacturer's standard color.

2.4. FAN SECTION

A. Type: Air foil, direct-drive plenum type fan, conforming to AMCA 99. Refer to Section 23 3413.

B. Performance Ratings: Determined in accordance with AMCA 210 and labeled with AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301; tested to AMCA 300 and label with AMCA Certified Sound Rating Seal.

D. Bearings: Self-aligning, grease lubricated, with lubrication fittings extended to exterior of casing with plastic tube and grease fitting rigidly attached to casing.

E. Mounting:

1. Locate fan and motor internally on welded steel base coated with corrosion resistant paint.

2. Factory mount motor on slide rails.
3. Provide access to motor, drive, and bearings through removable casing panels or hinged access doors.
4. Mount base on vibration isolators.

F. External Motor Junction Box: Factory mount NEMA 4 external junction box and connect to extended motor leads from internally mounted motors.

G. Motor Wiring Conduit: Factory wire fan motor wiring to the unit mounted starter-disconnect, variable frequency drive, and external motor junction box. Variable frequency drives shall be provided by temperature controls contractor for field installation.

H. Fan Accessories:

I. Flexible Duct Connections:

1. For separating fan, coil, and adjacent sections.

J. Drives:

1. Comply with AMCA 99.
2. Bearings: Heavy duty pillow block type, ball bearings, with ABMA STD 9, L-10 life at 50,000 hours.
3. Shafts: Solid, hot rolled steel, ground and polished, with key-way, and protectively coated with lubricating oil.

2.5. COIL SECTION

A. Casing: Provide access to both sides of coils. Enclose coils with headers and return bends fully contained within casing. Slide coils into casing through removable end panel with blank off sheets and sealing collars at connection penetrations.

B. Drain Pans: 24 inch downstream of coil and down spouts for cooling coil banks more than one coil high.

C. Eliminators: Three break of Type 304 stainless steel, mounted over drain pan.

D. Air Coils:

1. Certify capacities, pressure drops, and selection procedures in accordance with AHRI 410.

E. Fabrication:

1. Tubes: 5/8 inch OD seamless copper expanded into fins, brazed joints.
2. Fins: Aluminum.
3. Casing: Die formed channel frame of galvanized steel.

F. Water Heating Coils:

1. Headers: Seamless copper tube with brazed joints.
2. Configuration: Drainable, with threaded plugs for drain and vent; serpentine type with return bends on smaller sizes and return headers on larger sizes.

G. Water Cooling Coils:

1. Headers: Seamless copper tube with brazed joints.
2. Configuration: Drainable, with threaded plugs for drain and vent; threaded plugs in return bends and in headers opposite each tube.

2.6. FILTER AND AIR CLEANER SECTION

A. General: Provide filter sections with filter racks, minimum of one access door for filter removal, and filter block-offs to prevent air bypass.

B. Throwaway Filters:

1. Media: 2 inch fiberglass with rigid supporting mesh across the leaving face, capable of operating up to a maximum of 500 fpm without loss of efficiency and holding capacity.
2. Frame: Rigid.
3. Minimum Efficiency Reporting Value: 8 MERV when tested in accordance with ASHRAE Std 52.2.

C. Cartridge Filters:

1. Media: 2 inch, pleated, 8 MERV prefilter and 4 inch 13 MERV closely spaced, pleated, fine-fiber, cartridge filter, sealed into gasketed, metal headers, and capable of operating up to a maximum of 625 fpm for without loss of efficiency and holding capacity.
2. Filter Rack: Side-access rack designed to hold the metal headers.

D. Differential Pressure Gauge:

1. Provide factory installed dial type differential pressure gauge, flush mounted with casing outer wall, and fully piped to both sides of each filter to indicate status.
2. Maintain plus/minus 5 percent accuracy within operating limits of 20 degrees F to 120 degrees F.

2.7. DAMPER SECTION

A. Mixing Section: Provide a functional section to support the damper assembly for modulating the volume of outdoor, return, and exhaust air.

B. Outdoor and Exhaust Air Dampers:

1. Arrange in parallel or opposed-blade configuration. Return, outside, and exhaust air dampers must be driven separately.
2. Extruded aluminum frame with mounting flanges on both sides.
3. Extruded aluminum, air-foil profile blades, internally insulated with polyurethane foam (min. R-value of 2.0), and thermally broken.
4. EPDM blade seal and extruded silicone frame seals.
5. Self-lubricating stainless steel or synthetic sleeve bearings.
6. Aluminum and zinc-plated steel fasteners and linkage hardware.
7. Dampers designed for operation in temperatures ranging from -40°F to 212°F.
8. Leakage Class 1A at 1in. w.g. static pressure differential. Provide leakage testing and pressure ratings in compliance with AMCA 500-D test methods.

C. Return Air Dampers:

1. Arrange in parallel or opposed-blade configuration. Return, outside, and exhaust air dampers must be driven separately.
2. Extruded aluminum frame with mounting flanges on both sides.
3. Extruded aluminum, air-foil profile blades.
4. EPDM blade seal and extruded silicone frame seals.
5. Self-lubricating stainless steel or synthetic sleeve bearings.
6. Aluminum and zinc-plated steel fasteners and linkage hardware.
7. Dampers designed for operation in temperatures ranging from -40°F to 212°F.
8. Leakage Class 1A at 1in. w.g. static pressure differential. Provide leakage testing and pressure ratings in compliance with AMCA 500-D test methods.

2.8. ACCESS SECTION

A. Provide access section downstream of coils and as needed to allow for inspection, cleaning, and maintenance of factory or field-installed components.

B. Construct access doors same as previously specified within this Section.

2.9. ROOF MOUNTING CURB

A. Roof Mounting Curb: 30 inches high galvanized steel, insulated, channel frame with gaskets and nailer strips.

B. Include roof curb accessories for each roof mounted unit.

PART 3 EXECUTION

3.1. INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Bolt sections together with gaskets.

C. Make connections to coils with unions or flanges.

D. Hydronic Coils:

1. Hydronic Coils: Connect water supply to leaving air side of coil (counterflow arrangement).
2. Provide shut-off valve on supply line and lockshield balancing valve with memory stop on return line.
3. Locate water supply at bottom of supply header and return water connection at top.
4. Provide manual air vents at high points complete with stop valve.
5. Ensure water coils are drainable and provide drain connection at low points.

3.2. SYSTEM STARTUP

A. Provide manufacturer's field representative to perform systems startup.

B. Prepare and start equipment and systems in accordance with manufacturers' instructions and recommendations.

C. Adjust for proper operation within manufacturer's published tolerances.

3.3. CLOSEOUT ACTIVITIES

A. Demonstrate proper operation of equipment to Owner's designated representative.

B. Demonstration: Demonstrate operation of system to Owner's personnel.

1. Use operation and maintenance data as reference during demonstration.
2. Briefly describe function, operation, and maintenance of each component.

C. Training: Train Owner's personnel on operation and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of two hours of training.

END OF SECTION

SECTION 23 8200 - CONVECTION HEATING AND COOLING UNITS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Unit heaters.

B. Electric unit heaters.

1.2. RELATED REQUIREMENTS

A. Section 23 0513 - Common Motor Requirements for HVAC Equipment.

B. Section 23 0716 - HVAC EQUIPMENT INSULATION.

C. Section 23 0719 - HVAC Piping Insulation.

D. Section 23 0913 - Instrumentation and Control Devices for HVAC.

E. Section 23 2113 - Hydronic Piping.

F. Section 23 2114 - Hydronic Specialties.

G. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections. Installation of room thermostats. Electrical supply to units.

1.3. REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2018.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide typical catalog of information including arrangements.

C. Shop Drawings:

1. Indicate cross sections of cabinets, grilles, bracing and reinforcing, and typical elevations.

2. Indicate air coil and frame configurations, dimensions, materials, rows, connections, and rough-in dimensions.

3. Submit schedules of equipment and enclosures typically indicating length and number of pieces of element and enclosure, corner pieces, end caps, cap strips, access doors, pilaster covers, and comparison of specified heat required to actual heat output provided.

4. Submit the following for blower-coil units indicating:

a. Overall dimensions including installation, operation, and service clearances.

b. Lift points, recommendations, and center of gravity.

c. Fan curves with specified operating point clearly plotted.

d. Safety and start-up instructions.

D. Warranty: Submit manufacturer's warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.5. QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1. HYDRONIC UNIT HEATERS

A. Manufacturers:

1. Modine Manufacturing Company.
2. Sterling Hydronics, a Mestek Company.
3. Trane Inc.

B. Coils: Seamless copper tubing, silver brazed to steel headers, and with evenly spaced aluminum fins mechanically bonded to tubing.

C. Perform factory run test under normal operating conditions, water, and steam flow rates.

D. Casing: Minimum 18 gage, 0.0478 inch thick sheet steel casing with threaded pipe connections for hanger rods for horizontal models and minimum 18 gage, 0.0478 inch thick sheet steel top and bottom plates for vertical projection models.

E. Finish: Factory applied baked primer coat.

F. Fan: Direct drive propeller type, statically and dynamically balanced, with fan guard; horizontal models with permanently lubricated sleeve bearings; vertical models with grease lubricated ball bearings.

G. Air Outlet: Adjustable pattern diffuser on vertical projection models and four way louvers on horizontal projection models.

H. Totally Enclosed Motors: Permanently lubricated sleeve bearings on horizontal models, grease lubricated ball bearings on vertical models.

I. Control: Local disconnect switch. BAS connectivity.

J. Electrical Characteristics:

1. For electrical characteristics, refer to the equipment schedule on the drawings.

2.2. ELECTRIC UNIT HEATERS

A. Manufacturers:

1. INDEECO (Industrial Engineering and Equipment Company).
2. Modine Manufacturing Company.
3. Trane Inc.
4. Berko.
5. Reznor.

B. Provide products listed, classified, and labeled by Underwriters Laboratories Inc. (UL), Intertek (ETL), or testing firm acceptable to Authority Having Jurisdiction as suitable for the purpose indicated.

C. Assembly: Suitable for mounting from ceiling or structure above with built-in controls, thermal safety cut-out, and electric terminal box.

D. Acceptable Heating Element Assemblies:

1. Horizontal Projection Units:
    a. Steel fins copper brazed to steel sheath and epoxy sealed for moisture resistance.
    b. Nickel chromium resistance wire surrounded with magnesium oxide and sheathed in steel, spiral-finned tubes.
2. Vertical Projection Units:
    a. Finned tubular.

b. Nickel chromium resistance wire surrounded with magnesium oxide and sheathed in steel, spiral-finned tubes.

E. Housing:

1. Horizontal Projection Units:

a. Construction materials to consist of heavy gage steel with polyester powder coat or high gloss baked enamel finish.

b. Provide with threaded holes for threaded rod suspension.

c. Provisions for access to internal components for maintenance, adjustments, and repair.

2. Vertical Projection Units:

a. Provide with mounting support brackets

b. Provisions for access to internal components for maintenance, adjustments, and repair.

F. Air Inlets and Outlets:

1. Inlets: Provide protective grilles with fan blade guard.

2. Outlets: Provide directional louvers.

G. Fan: Factory balanced, direct drive, axial type with fan guard.

H. Motor: Totally enclosed, thermally protected, and provided with permanently lubricated bearings.

I. Controls:

1. Disconnect.

2. 24-volt relay.

3. Fan override to purge residual heat when de-energized.

4. Built-in thermostat.

J. Electrical Characteristics:

1. Disconnect Switch: Factory mount disconnect switch.

2. For electrical characteristics, refer to the equipment schedule on the drawing

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that surfaces are suitable for installation.

B. Verify that field measurements are as indicated on drawings.

3.2. INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Install equipment exposed to finished areas after walls and ceilings are finished and painted.

C. Unit Heaters:

1. Hang from building structure, with pipe hangers anchored to building, not from piping or electrical conduit.

2. Mount as high as possible to maintain greatest headroom unless otherwise indicated.

D. Units with Hydronic Coils:

1. Provide with shut-off valve on supply piping and tamper-proof, balancing valve with memory stop on return piping.

E. Units with Cooling Coils: Connect drain pan to condensate drain.

F. Units with Electric Heating Elements:

1. Install as indicated including electrical devices furnished by manufacturer but not factory installed.
2. Install wiring in accordance with the manufacturer's wiring diagram submittal and Section 26 0583.

3.3. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

Provide manufacturer's field representative to test, inspect, and instruct.

3.4. CLEANING

A. After construction and painting is completed, clean exposed surfaces of units.

B. Vacuum clean coils and inside of units.

C. Touch-up marred or scratched surfaces of factory-finished cabinets using finish materials furnished by the manufacturer.

D. Install new filters.

3.5. CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

3.6. PROTECTION

A. Provide finished cabinet units with protective covers during the balance of construction.

END OF SECTION

SECTION 26 0010 - BASIC ELECTRICAL REQUIREMENTS

PART 1 - GENERAL

1.1. RELATED DOCUMENTS

A. This Section supplements Division 1, General Requirements.

B. Where contradictions occur between this Section and Division 1, the more stringent of the two shall apply. Architect and Engineer shall decide which is most stringent.

C. Provisions of this section shall also apply to all sections of Division 26, and Division 28.

D. The specifications are complementary to the drawings and their requirements shall have the same priority as the drawings

1.2. COORDINATION WITH OTHER TRADES

A. Contract Documents:

1. General: The Contract Documents are diagrammatic, showing certain physical relationships which must be established within the electrical work and its interface with other work. Such establishment is the exclusive responsibility of the Contractor. Drawings shall not be scaled for the purpose of establishing material quantities.

2. Work out all conditions in advance of installation. If necessary, and before work proceeds in those areas, prepare coordination drawings showing all work in congested areas. Provide additional work necessary to overcome congested conditions at no increase in contract sum.

3. Coordinate the electrical work to the progress of the work of other trades.

4. Complete the entire installation as soon as the condition of the building will permit.

5. Coordinate ceiling cavity space carefully with all trades. In the event of conflict, install electrical and electric systems within the cavity space allocation in the following order:

a. Lighting.

b. Condensate piping.

c. Plumbing piping.

d. Mechanical ductwork.

e. Fire sprinkler piping.

f. Air diffusers.

g. Domestic water piping.

h. Hydronic piping.

i. Pneumatic control piping.

B. Discrepancies:

1. Examine Drawings and Specifications.

2. Report any discrepancies to the Architect and obtain written instructions before proceeding.

3. Should there be a conflict within or between the Specifications or Drawings, the more stringent or higher quality requirements shall apply. The determination of the more stringent or higher quality shall lie with the Architect.

4. Items called for in either specifications or drawings shall be required as if called for in both.

5. Be responsible for providing proper documentation of equipment product data and shop drawings to all entities providing service.

6. Coordination Drawings:

a. Acceptance by the Architect does not imply acceptance of any deviations from contract documents requirements or acceptance of uncoordinated work. Review is for general conformance to the design concept and general compliance with the information given in the contract documents.

b. Prepare Coordination Drawings at a 1/4" = 1'-0" scale, showing the required dimensions. In addition to the mentioned areas above, also submit the following:

1) All electrical equipment rooms such as fan rooms, boiler rooms, chiller rooms, etc.

2) Indicate all major piping, electrical equipment and conduits, structural and Architectural elements in these areas as well. Provide all necessary sections and elevations for clarification.

3) When electronic Building Information Modeling (BIM) files have been provided to the contractor, the contractor shall only consider the files as design to only show the intent of the design. The contractor shall be responsible for the Coordination drawings based on the design.

4) Utility Connections:

(a) Coordinate the connection of electrical systems with utilities.

(b) Comply with requirements of utilities.

(c) Coordinate electrical utility interruptions at least one week in advance with the Owner and the Utility Company unless otherwise indicated.

(1) Plan work so that duration of the interruption is kept to a minimum.

1.3. COORDINATION WITH EXISTING OCCUPIED AREAS

A. Minimize disruptions to operation of electrical systems in occupied areas.

B. Coordinate any required disruptions with the Owner, one week in advance.

C. Provide temporary connections to prevent long disruptions.

1.4. DELEGATED DESIGN BY CONTRACTOR

A. The construction of this building requires the Contractor to design several systems or subsystems. All such designs shall be the complete responsibility of the Contractor.

B. Systems or subsystems which require engineering responsibility by the Contractor include, but are not limited to:

1. Any system not fully detailed.
2. Equipment supports, not fully detailed.
3. Conduit hangers and anchors not specified in these documents, or catalogued by the manufacturer.
4. Lighting controls and wiring.
5. Fire Alarm Systems.
6. Conduit systems for Data, Nurse Call, and Fire Alarm.

1.5. REGULATORY REQUIREMENTS

A. Codes: Comply with the codes adopted by authority having jurisdiction (which shall include but not be limited to):

1. Applicable editions of NFPA.
2. Requirements of Fire Departments serving the project.
3. Regulations of the Health Department having jurisdiction.
4. Regulations of the Office of State Fire Marshal or its equivalent.

5. Americans with Disabilities Act (ADA).

B. Requirements of Local Utility Companies:

1. Comply with rules and requirements of local utility companies. Include in bid the cost of all service fees, EUSERC cabinets, meter boxes, meters, conduit, and such equipment which will be required for the project.

C. Other Regulations: Comply with the latest applicable regulations and ordnances of the following:

1. U. S. and State Department of Labor Safety Regulations pertaining to the completed project.
2. Clean Air Act.
3. Clean Water Act.
4. Requirements of product listings by nationally recognized listing agencies as recognized by the Occupational Safety and Hazards Agency (OSHA) and the Architect.

D. Contradictions: Where Codes are contradictory, follow the most stringent, unless otherwise indicated in Plans or Specifications. Architect shall determine which is most stringent.

E. Codes are a minimum requirement approved by the AHJ, in many cases the Project Documents will exceed the minimum requirements of the codes, Project Documents must be be followed.

F. Inspections and Tests:

1. Inspections and tests required shall be completed by a third party NETA Testing Agency/Contractor. Contractractor shalll arrange for all required inspections and testing.
2. Contractor shall pay all inspections and testing charges.
3. Notify Architect two (2) business days before tests.
4. Inspections reports and Test Reports shall be provide to the Architect for review and shall be included in the final Record Documents.

1.6. OWNER-FURNISHED EQUIPMENT

A. All equipment called out in the Specifications or shown on the Drawings as "Owner-Furnished Equipment" or equipment furnished by other Divisions shall be installed and connected as required. Provide rough-ins for all future connections indicated.

1.7. INSTALLATION GENERAL REQUIREMENTS

A. Furnish, apply, install, connect, erect, clean, and condition manufactured materials and equipment as recommended in manufacturer's printed directions (maintained on job site during installation).

B. Provide all attachment devices and materials necessary to secure materials together or to other materials.

C. Make allowance for ample and normal expansion and contraction for all building components and piping systems that are subject to such.

D. Install materials only when conditions of temperature, moisture, humidity, and conditions of adjacent building components are conducive to achieving the best installation results.

E. Erect, install, and secure components in a structurally sound and appropriate manner.

F. Where necessary, temporarily brace, shore, or otherwise support members until final connections are installed.

G. Leave all temporary bracing, shoring, or other structural supports in place as long as practical for safety and to maintain proper alignment.

H. Handle materials in a manner to prevent scratching, abrading, distortion, chipping, breaking, or other disfigurement.

I. Conduct work in a manner to avoid injury or damage to previously placed work. Any work so impaired or damaged shall be replaced at no expense to Owner.

J. Fabricate and install materials true to line, plumb, and level.

K. Leave finished surfaces smooth and flat, free from wrinkles, warps, scratches, dents, and other imperfections.

L. Furnish materials in longest practical lengths and largest practical sizes to avoid all unnecessary jointing.

M. Make all joints secure, tightly fitted, and as inconspicuous as possible by the best accepted practice in joining and fabricating.

N. Contact Architect for mounting height or position of any unit not specifically indicated or located on Drawings or specified in Specifications.

O. Job mixed multi-component materials used in the work shall be mixed in such regulated and properly sized batches that material can be used before it begins to "set."

P. Mixing of a partially "set" batch with another batch of fresh materials will not be accepted and entire batch shall be discarded and removed from site.

Q. Clean all mixing tools and appliances that can be contaminated prior to mixing of fresh materials.

R. In addition to the above, refer to each Section of the Specifications for additional installation requirements for the proper completion of all work.

PART 2 - PRODUCTS

2.1. GENERAL

A. Certain products are specified without equals. Substitutions for these will not be considered.

B. Follow subsitution instructions in Front End Documents for any manufacturer not listed in the Project Manual or the drawings that the contractor may want considered for substitution. .

C. Coordination of general equivalents and substitutions: Where Contract Documents permit selection from several general equivalents, or where substitutions are authorized, coordinate clearance and other interface requirements with electrical and other work.

1. Provide necessary additional items so that selected or substituted item operates equivalent to the basis of design and properly fits in the available space allocated for the basis of design.

2. Provide all features which are standard and specified on the basis of design.

3. Contractor is responsible for assuring that piping, conduit, duct, flue, and other service locations for general equivalents or substitutions do not cause access, service, or operational difficulties any greater than would be encountered with the basis of design. Acceptance by the Architect does not imply acceptance of any deviations from contract documents requirements.

4. Confirm if modifications to electrical, structural or architectural requirements for substituted or general equivalents are needed such as: wire size, conduit size, MCA, MOCP, weight, support, etc. Coordinate with General and Electrical Contractors prior to bid.

PART 3 – EXECUTION

3.1. COORDINATION OF ELECTRICAL INSTALLATION.

A. Inspection and Preparation:

1. Examine the work interfacing with electrical work, and the conditions under which the work will be performed, and notify the Architect of conditions detrimental to the proper completion of the work.

2. Do not proceed with the work until unsatisfactory conditions have been corrected. Lack of notifying Architect of conditions is in no way cause for change order request.

B. Layout:

1. Layout the electrical work in conformity with the Contract Drawings, Coordination Drawings and other Shop Drawings, product data and similar requirements so that the entire electrical plant will perform as an integrated system, properly interfaced with other work, recognizing that portions of the work are shown only in diagrammatic form.
2. Where coordination requirements conflict with individual system requirements, comply with the Architect's decision on resolution of the conflict.
3. Take necessary field measurements to determine space and connection requirements.
4. Provide sizes and shapes of equipment so the final installation conforms to the intent of the Contract Documents.

C. Integrate electrical work in ceiling spaces with suspension system, light fixtures and other work so that required performances of each will be achieved.

3.2. PRODUCT INSTALLATION

A. Manufacturer's Instructions:

1. Except where more stringent requirements are indicated, comply with the product manufacturer's instructions and recommendations.
2. Consult with manufacturer's technical representatives, who are recognized as technical experts, for specific instructions on special project conditions.
3. If a conflict exists, notify the Architect / Engineer in writing and obtain his instruction before proceeding with the work in question.

B. Movement of Equipment:

1. Wherever possible, arrange for the movement and positioning of equipment so that enclosing partitions, walls and roofs will not be delayed or need to be removed.
2. Otherwise, advise Contractor of opening requirements to be maintained for the subsequent entry of equipment.

C. Heavy Equipment:

1. Coordinate the movement of heavy items with shoring and bracing so that the building structure will not be overloaded during the movement and installation.
2. Where electrical products to be installed on an existing roof are too heavy to be hand-carried, do not transport across the existing roof deck; position by crane or other device so as to avoid overloading the roof deck.

D. Return Air Path: Coordinate electrical work in return air plenum to avoid obstructing return air path.

1. Do not make changes in layout which will reduce return air path cross-sectional areas.
2. Report any obstructions by work of other Divisions to Architect.

E. Support:

1. Anchor and secure all equipment to the building substrate and structure.

F. Clearances:

1. Install conduit and cables:
    a. Straight and true.
    b. Aligned with other work and with general lines of the building.
    c. Concealed, where possible, in occupied spaces.
    d. Out-of-the-way with maximum passageway and headroom remaining in each space.

2. Except as otherwise indicated, arrange electrical services and overhead equipment with a minimum of:
    a. 7'6" headroom in storage spaces. Do not obstruct windows, doors or other openings.
3. Give the right-of-way to piping systems required to slope for drainage (over other service lines and ductwork).

3.3. PROTECTION OF WORK

A. All conduit ends, panelboards, motor controls, disconnecting means, and equipment left unconnected shall be capped, plugged or otherwise properly protected to prevent damage or the intrusion of foreign matter.

B. Any equipment or conduit system found to have been damaged or contaminated shall be replaced or cleaned to the Engineer's satisfaction.

3.4. ADJUSTING

A. Adjust all equipment and system components as shown or as otherwise required to result in intended system operation.

B. At completion of work, provide written certification that all systems are functioning properly without defects.

3.5. START-UP

A. Assign a Start-Up Coordinator to this project.

B. The Start-Up Coordinator shall develop detailed start-up procedures, equipment checkout procedure and data forms for recording compliance with contract document performance criteria, and will assist in developing schedules for checkout and Owner acceptance.

C. The Start-Up Coordinator shall be responsible for maintaining documentation of Start-Up activities until final acceptance of the project.

D. The documentation shall be kept current by the Start-Up Coordinator and shall be available for inspection at all times. At the time of acceptance of the project, the Start-Up Coordinator shall surrender 3 completed copies of the documentation to the Owner's representative.

1. Coordinate with the mechanical installation the requirements for the startup of mechanical and plumbing systems:
    a. All equipment, components, and systems have been set, started-up, and adjusted including checking the following: proper equipment electrical rotation, control connections, factory trained technician startup, etc.
    b. All electric power connections, disconnects, fuses, circuit breakers, etc. are properly sized and installed.

3.6. TRAINING

A. Refer to Division 1 sections of the specifications regarding requirements of Record Drawings, Operation and Maintenance Manual submittal and systems training.

1. Demonstrate that each system operates properly.
2. Explain the operation of each system to the Owner's Representative.
3. Explain use of O&M manual in operating and maintaining systems.
4. Date, time, and duration of training will be determined by Owner.
5. Training agendas and schedules shall be developed and approved by Owner, Engineer, and Architect prior to training.

6. Document and turn over to owner the training sessions on DVD and placed in O&M Manuals. At the end of all sessions, compile all sessions on a single DVD and turn over to owner as part of the O & M manuals.

B. For specific systems requiring extended instruction, refer to individual Division 26 sections.

END OF SECTION

SECTION 26 0505 - SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Electrical demolition.

1.2. RELATED REQUIREMENTS

A. Section 01 7000 - Execution and Closeout Requirements: Additional requirements for alterations work.

1.3. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Sustainable Design Documentation: Submit certification of removal and appropriate disposal of abandoned cables containing lead stabilizers.

PART 2 PRODUCTS

2.1. MATERIALS AND EQUIPMENT

A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify field measurements and circuiting arrangements are as indicated.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to Architect before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.2. 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.

2. Make temporary connections to maintain service in areas adjacent to work area.

E. Existing Fire Alarm System: Maintain existing system in service until new system is accepted. Disable system only to make switchovers and connections. 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.

4. Make temporary connections to maintain service in areas adjacent to work area.

F. Existing Telephone System: 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. Notify Owner at least 24 hours before partially or completely disabling system.

2. Notify telephone utility company at least 24 hours before partially or completely disabling system.
3. Make temporary connections to maintain service in areas adjacent to work area.

3.3. DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
   1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
   2. PCB- and DEHP-containing lighting ballasts.
   3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
B. Remove, relocate, and extend existing installations to accommodate new construction.
C. Remove abandoned wiring to source of supply.
D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.
E. 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.
F. Disconnect and remove abandoned panelboards and distribution equipment.
G. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
H. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.
I. Repair adjacent construction and finishes damaged during demolition and extension work.
J. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
K. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4. CLEANING AND REPAIR

A. See Section 01 7419 - Construction Waste Management and Disposal for additional requirements.

END OF SECTION

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Single conductor building wire.

B. Service entrance cable.

C. Metal-clad cable.

D. Wiring connectors.

E. Electrical tape.

F. Heat shrink tubing.

G. Oxide inhibiting compound.

H. Wire pulling lubricant.

I. Cable ties.

1.2. RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0505 - Selective Demolition for Electrical: Disconnection, removal, and/or extension of existing electrical conductors and cables.

C. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 28 4600 - Fire Detection and Alarm: Fire alarm system conductors and cables.

1.3. REFERENCE STANDARDS

A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013.

B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011.

C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010 (Reapproved 2014).

D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2014).

E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2010.

F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.

G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

H. NECA 120 - Standard for Installing Armored Cable (AC) and Metal-Clad Cable (MC); 2012.

I. NEMA WC 70 - Nonshielded Power Cable 2000 V or Less for the Distribution of Electrical Energy; 2009.

J. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.

M. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.

N. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.

O. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.

P. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

Q. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

R. UL 854 - Service-Entrance Cables; Current Edition, Including All Revisions.

S. UL 1569 - Metal-Clad Cables; Current Edition, Including All Revisions.

1.4. 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.

1.5. 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.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.8. 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

2.1. 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.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is permitted only as follows:

1. Where not otherwise restricted, may be used:

a. For underground service entrance, installed in raceway.

F. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:

1. Where not otherwise restricted, may only be used:

a. Where concealed above accessible ceilings for final connections from junction boxes to luminaires.

1) Maximum Length: 6 feet.

2.2. 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 Exposed in Spaces Used for Environmental Air (only where specifically permitted): Plenum rated, listed and labeled as suitable for use in return air plenums.

I. 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.

J. Minimum Conductor Size:

1. Branch Circuits: 12 AWG.

a. Exceptions:

1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.

2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.

2. Control Circuits: 14 AWG.

K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

L. 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. 208Y/120 V, 3 Phase, 4 Wire System:

1) Phase A: Black.

2) Phase B: Red.

3) Phase C: Blue.

4) Neutral/Grounded: White.

b. Equipment Ground, All Systems: Green.

c. Isolated Ground, All Systems: Green with yellow stripe.

d. 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.

e. For control circuits, comply with manufacturer's recommended color code.

2.3. SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:

1. Copper Building Wire:

a. Cerro Wire LLC: www.cerrowire.com.

b. Encore Wire Corporation: www.encorewire.com.

c. Southwire Company: www.southwire.com.

d. Substitutions: See Section 01 6000 - Product Requirements.

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.

a. Installed Underground: Type XHHW-2.

2.4. SERVICE ENTRANCE CABLE

A. Manufacturers:

1. Copper Service Entrance Cable:

a. Cerro Wire LLC: www.cerrowire.com.

b. Encore Wire Corporation: www.encorewire.com.

c. Southwire Company: www.southwire.com.

d. Substitutions: See Section 01 6000 - Product Requirements.

B. Service Entrance Cable for Underground Use: NFPA 70, Type USE single-conductor cable listed and labeled as complying with UL 854, Type USE-2, and with UL 44, Type RHH/RHW-2.

C. Conductor Stranding: Stranded.

D. Insulation Voltage Rating: 600 V.

2.5. METAL-CLAD CABLE

A. Manufacturers:

1. AFC Cable Systems Inc: www.afcweb.com.
2. Encore Wire Corporation: www.encorewire.com.
3. Southwire Company: www.southwire.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:

1. Size 10 AWG and Smaller: Solid.
2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Provide oversized neutral conductors where indicated or required.

G. Provide dedicated neutral conductor for each phase conductor where indicated or required.

H. Grounding: Full-size integral equipment grounding conductor.

1. Provide additional isolated/insulated grounding conductor where indicated or required.

I. Armor: Steel, interlocked tape.

2.6. 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. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. 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.

D. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
2. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.
3. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors where connectors are required.
4. Conductors for Control Circuits: Use crimped terminals for all connections.

E. 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.

F. Mechanical Connectors: Provide bolted type or set-screw type.

G. Compression Connectors: Provide circumferential type or hex type crimp configuration.

H. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.7. 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.
3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
5. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.

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. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

D. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.1. 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.

3.2. PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.3. INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.
2. When circuit destination is indicated without specific routing, determine exact routing required.
3. Arrange circuiting to minimize splices.
4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.

8. 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.
9. 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. Install metal-clad cable (Type MC) in accordance with NECA 120.

E. 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.

F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

G. 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.

H. Terminate cables using suitable fittings.
1. Metal-Clad Cable (Type MC):
    a. Use listed fittings.
    b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

I. Install conductors with a minimum of 12 inches of slack at each outlet.

J. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.

K. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

L. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

M. 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.

N. 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.
1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
3. Wet Locations: Use heat shrink tubing.

O. Insulate ends of spare conductors using vinyl insulating electrical tape.

P. 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.

Q. Identify conductors and cables in accordance with Section 26 0553.

R. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

S. 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.

3.4. 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

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1. 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. Ground plate electrodes.

G. Ground enhancement material.

H. Ground access wells.

I. Pre-fabricated signal reference grids.

1.2. 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.

1. Includes oxide inhibiting compound.

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.

1.3. 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; 2010.

C. NEMA GR 1 - Grounding Rod Electrodes and Grounding Rod Electrode Couplings; 2007.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

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.

1.4. 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.

1.5. 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.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1. 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 or alternate test described in IEEE 81.

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 three electrodes in an equilateral triangle configuration 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.

d. Provide ground access well for first connected electrode.

6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.

7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.

a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.

b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.

c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

8. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.

F. Service-Supplied System Grounding:

1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.

2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.

G. Separately Derived System Grounding:

1. Separately derived systems include, but are not limited to:

a. Generators, when neutral is switched in the transfer switch.

2. Provide grounding electrode conductor to connect derived system grounded conductor to common grounding electrode conductor ground riser. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.

3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.

4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.

5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.

6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.

7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.

H. 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.

b. Metal gas piping.

c. Metal process piping.

8. Provide bonding for interior metal air ducts.

9. Provide bonding for metal building frame.

10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.

I. 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 2 by 12 inches unless otherwise indicated or required.
    d. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.

J. Pole-Mounted Luminaires: Also comply with Section 26 5600.

2.2. 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.
    a. Exceptions:
        1) Use mechanical connectors for connections to electrodes at ground access wells.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
    a. Exceptions:
        1) Use exothermic welded connections for connections to metal building frame.
4. Manufacturers - Mechanical and Compression Connectors:
    a. Advanced Lightning Technology (ALT): www.altfab.com.
    b. Burndy LLC: www.burndy.com.
    c. Harger Lightning & Grounding: www.harger.com.
    d. Thomas & Betts Corporation: www.tnb.com.
    e. Substitutions: See Section 01 6000 - Product Requirements.
5. Manufacturers - Exothermic Welded Connections:
    a. Burndy LLC: www.burndy.com.
    b. Cadweld, a brand of Erico International Corporation: www.erico.com.

c. Substitutions: See Section 01 6000 - Product Requirements.

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): www.altfab.com.
   b. Erico International Corporation: www.erico.com.
   c. Harger Lightning & Grounding: www.harger.com.

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.
   b. Erico International Corporation: www.erico.com.
   c. Galvan Industries, Inc: www.galvanelectrical.com.
   d. Harger Lightning & Grounding: www.harger.com.
   e. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1. 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.

3.2. 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.
2. Indoor Installations: Unless otherwise indicated, install with 4 inches of top of rod exposed.

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.

3.3. 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

1.1. SECTION INCLUDES

A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.2. RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 26 0533.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.

C. Section 26 0533.16 - BOXES: Additional support and attachment requirements for boxes.

D. Section 26 5100 - Interior Lighting: Additional support and attachment requirements for interior luminaires.

E. Section 26 5600 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.3. 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; 2010.

F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.4. 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.

1.5. 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.

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 Qualification Statement: 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.

1.6. QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

C. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

D. Installer Qualifications for Powder-Actuated Fasteners (when specified): Certified by fastener system manufacturer with current operator's license.

E. Installer Qualifications for Field-Welding: As specified in Section 05 5000.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1. 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. 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. 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. Materials for Metal Fabricated Supports: Comply with Section 05 5000.

C. 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: www.cooperindustries.com.
    b. Erico International Corporation: www.erico.com.
    c. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
    d. Thomas & Betts Corporation: www.tnb.com.
    e. Substitutions: See Section 01 6000 - Product Requirements.

D. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

1. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
    b. Erico International Corporation: www.erico.com.
    c. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
    d. Thomas & Betts Corporation: www.tnb.com.
    e. Substitutions: See Section 01 6000 - Product Requirements.

E. 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. Channel Material:
    a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
    b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
3. Minimum Channel Thickness: Steel sheet, 12 gage, 0.1046 inch.
4. Minimum Channel Dimensions: 1-5/8 inch width by 13/16 inch height.
5. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
    b. Thomas & Betts Corporation: www.tnb.com.
    c. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.
    e. Source Limitations: Furnish channels (struts) and associated fittings, accessories, and hardware produced by a single manufacturer.

F. 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. Single Conduit up to 1 inch (27 mm) trade size: 1/4 inch diameter.
    c. Single Conduit larger than 1 inch (27 mm) trade size: 3/8 inch diameter.
    d. Trapeze Support for Multiple Conduits: 3/8 inch diameter.
    e. Outlet Boxes: 1/4 inch diameter.

f. Luminaires: 1/4 inch diameter.

G. 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: www.cooperindustries.com.
   b. Erico International Corporation: www.erico.com.
   c. PHP Systems/Design: www.phpsd.com.
   d. Unistrut, a brand of Atkore International Inc: www.unistrut.com.
   e. Substitutions: See Section 01 6000 - Product Requirements.

H. 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 Masonry: Use toggle bolts.
5. Hollow Stud Walls: Use toggle bolts.
6. Steel: Use beam clamps, machine bolts, or welded threaded studs.
7. Sheet Metal: Use sheet metal screws.
8. Wood: Use wood screws.
9. Plastic and lead anchors are not permitted.
10. Powder-actuated fasteners are permitted only as follows:
    a. Where approved by Architect.
    b. Use only threaded studs; do not use pins.
11. Hammer-driven anchors and fasteners are permitted only as follows:
    a. Nails are permitted for attachment of nonmetallic boxes to wood frame construction (when specified).
    b. Staples are permitted for attachment of nonmetallic-sheathed cable to wood frame construction (when specified).
12. 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.

13. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.
14. Manufacturers - Mechanical Anchors:
    a. Hilti, Inc: www.us.hilti.com.
    b. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com.
    c. Powers Fasteners, Inc: www.powers.com.
    d. Simpson Strong-Tie Company Inc: www.strongtie.com.
    e. Substitutions: See Section 01 6000 - Product Requirements.
15. Manufacturers - Powder-Actuated Fastening Systems:
    a. Hilti, Inc: www.us.hilti.com.
    b. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com.
    c. Powers Fasteners, Inc: www.powers.com.
    d. Simpson Strong-Tie Company Inc: www.strongtie.com.
    e. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1. 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.

3.2. 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): Comply with Section 05 5000.

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. Unless otherwise indicated, mount floor-mounted equipment on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.

5. 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. Box Support and Attachment: Also comply with Section 26 0533.16.

L. Busway Support and Attachment: Also comply with Section 26 2513.

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.

3.3. 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 26 0533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Intermediate metal conduit (IMC).

C. Flexible metal conduit (FMC).

D. Liquidtight flexible metal conduit (LFMC).

E. Electrical metallic tubing (EMT).

F. Rigid polyvinyl chloride (PVC) conduit.

G. Conduit fittings.

H. Accessories.

1.2. RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete encasement of conduits.

B. Section 07 8400 - Firestopping.

C. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables.

D. Section 26 0526 - Grounding and Bonding for Electrical Systems.

E. Section 26 0529 - Hangers and Supports for Electrical Systems.

F. Section 26 0533.16 - BOXES.

G. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 26 2100 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

1.3. REFERENCE STANDARDS

A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2005.

B. ANSI C80.3 - American National Standard for Steel Electrical Metallic Tubing (EMT); 2005.

C. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit (EIMC); 2005.

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

E. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.

F. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2003.

G. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

H. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2013.

I. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2015.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.

L. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.

M. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.

N. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.

O. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.

P. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.

Q. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.

R. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.

1.4. 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.

1.5. 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.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1. 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.

D. Embedded Within Concrete:

1. Within Slab on Grade: Not permitted.
2. Within Slab Above Ground (within structural slabs only where approved by Structural Engineer): Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or rigid PVC conduit.
3. Within Concrete Walls Above Ground: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or rigid PVC conduit.
4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from concrete.
5. Where electrical metallic tubing (EMT) emerges from concrete into salt air, 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.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), 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, intermediate metal conduit (IMC), or electrical metallic tubing (EMT).

J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

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 or intermediate metal conduit (IMC).

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.

2.2. CONDUIT REQUIREMENTS

A. Electrical Service Conduits: Also comply with Section 26 2100.

B. Fittings for Grounding and Bonding: Also comply with Section 26 0526.

C. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. 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: 3/4 inch (21 mm) trade size.
4. Flexible Connections to Luminaires: 1/2 inch (16 mm) trade size.
5. Underground, Interior: 3/4 inch (21 mm) trade size.
6. Underground, Exterior: 3/4 inch (21 mm) trade size.

F. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3. GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedeg.com.
2. Republic Conduit: www.republic-conduit.com.
3. Wheatland Tube Company: www.wheatland.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

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: www.bptfittings.com.
    b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
    c. Thomas & Betts Corporation: www.tnb.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

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.

2.4. INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:
1. Allied Tube & Conduit: www.alliedeg.com.
2. Republic Conduit: www.republic-conduit.com.
3. Wheatland Tube Company: www.wheatland.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

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: www.bptfittings.com.
    b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
    c. Thomas & Betts Corporation: www.tnb.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.
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.

2.5. FLEXIBLE METAL CONDUIT (FMC)

A. Manufacturers:
1. AFC Cable Systems, Inc: www.afcweb.com.
2. Electri-Flex Company: www.electriflex.com.
3. International Metal Hose: www.metalhose.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

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: www.bptfittings.com.
    b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
    c. Thomas & Betts Corporation: www.tnb.com.

d. Substitutions: See Section 01 6000 - Product Requirements.

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.

2.6. LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:

1. AFC Cable Systems, Inc: www.afcweb.com.

2. Electri-Flex Company: www.electriflex.com.

3. International Metal Hose: www.metalhose.com.

4. Substitutions: See Section 01 6000 - Product Requirements.

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: www.bptfittings.com.

b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.

c. Thomas & Betts Corporation: www.tnb.com.

d. Substitutions: See Section 01 6000 - Product Requirements.

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.

2.7. ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedeg.com.

2. Republic Conduit: www.republic-conduit.com.

3. Wheatland Tube Company: www.wheatland.com.

4. Substitutions: See Section 01 6000 - Product Requirements.

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: www.bptfittings.com.

b. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.

c. Thomas & Betts Corporation: www.tnb.com.

d. Substitutions: See Section 01 6000 - Product Requirements.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

3. Material: Use steel.

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. Damp or Wet Locations (where permitted): Use fittings listed for use in wet locations.
6. Embedded Within Concrete (where permitted): Use fittings listed as concrete-tight. Fittings that require taping to be concrete-tight are acceptable.

2.8. RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:
   1. Cantex Inc: www.cantexinc.com.
   2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com.
   3. JM Eagle: www.jmeagle.com.
   4. Substitutions: See Section 01 6000 - Product Requirements.

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.

2.9. 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. Pull Strings: Use nylon cord with average breaking strength of not less than 200 pound-force.

E. Sealing Compound for Sealing Fittings: Listed for use with the particular fittings to be installed.

F. Modular Seals for Conduit Penetrations: Rated for minimum of 40 psig; Suitable for the conduits to be installed.

PART 3 EXECUTION

3.1. 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.

3.2. 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 rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

F. Install electrical nonmetallic tubing (ENT) in accordance with NECA 111.

G. 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.

H. 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. Use of wire for support of conduits is not permitted.
11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with the most stringent requirements.

I. 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.

J. 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. Provide metal escutcheon plates for conduit penetrations exposed to public view.
10. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

K. Underground Installation:

1. Minimum Cover, Unless Otherwise Indicated or Required:
    a. Underground, Exterior: 24 inches.
2. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.

L. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Include proposed conduit arrangement with submittals.
2. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.
3. Install conduits within middle one third of slab thickness.
4. Secure conduits to prevent floating or movement during pouring of concrete.

M. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 3000 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

N. 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 conduits are subject to earth movement by settlement or frost.

O. 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.

P. 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.

Q. Provide grounding and bonding in accordance with Section 26 0526.

R. Identify conduits in accordance with Section 26 0553.

3.3. 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. Correct deficiencies and replace damaged or defective conduits.

3.4. CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.5. 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

PART 1 GENERAL

1.1. 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. Floor boxes.

1.2. 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 0553 - Identification for Electrical Systems: Identification products and requirements.

H. Section 26 2726 - Wiring Devices:

1. Wall plates.

2. Additional requirements for locating boxes for wiring devices.

I. Section 26 2813 - Fuses: Spare fuse cabinets.

1.3. REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

C. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2012.

D. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.

E. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

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 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.4. 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.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. 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.

C. Project Record Documents: Record actual locations for outlet and device boxes, pull boxes, cabinets and enclosures, and floor boxes.

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.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1. 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 cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
4. Use nonmetallic boxes where exposed rigid PVC conduit is used.
5. Use suitable concrete type boxes where flush-mounted in concrete.
6. Use suitable masonry type boxes where flush-mounted in masonry walls.
7. Use raised covers suitable for the type of wall construction and device configuration where required.
8. Use shallow boxes where required by the type of wall construction.
9. Do not use "through-wall" boxes designed for access from both sides of wall.
10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
12. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
13. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
14. 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: 4 inch square by 2-1/8 inch (100 by 54 mm) trade size.
    c. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
15. Wall Plates: Comply with Section 26 2726.
16. Manufacturers:
    a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com.
    b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com.
    c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com.
    d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com.
    e. Thomas & Betts Corporation: www.tnb.com.
    f. Substitutions: See Section 01 6000 - Product Requirements.

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 hinged-cover enclosures unless otherwise indicated.
    b. Boxes 6 square feet and Larger: Provide 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.
5. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
6. Manufacturers:
    a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com.
    b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com.
    c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com.
    d. Substitutions: See Section 01 6000 - Product Requirements.

PART 3 EXECUTION

3.1. 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.

3.2. 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.
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. Install flush-mounted boxes on opposite sides of walls in different stud spaces, boxes shall not be installed back to back.
7. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.

8. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Install in sperate stud cavities, if not possible, provide minimum 6 inches horizontal separation unless otherwise indicated.
9. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
10. 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.
11. 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.
12. 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 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.
3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.

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 nominal 4 inch high concrete pad constructed in accordance with Section 03 3000.

M. Install boxes as required to preserve insulation integrity.

N. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

P. Close unused box openings.

Q. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

R. Provide grounding and bonding in accordance with Section 26 0526.

S. Identify boxes in accordance with Section 26 0553.

3.3. CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.4. 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

1.1. SECTION INCLUDES

A. Metal cable tray systems:

1. Metal wire mesh/basket cable tray.

1.2. 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.

1.3. REFERENCE STANDARDS

A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.

B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

C. ASTM A780/A780M - Standard Practice for Repair of Damaged and Uncoated Areas of Hot-Dip Galvanized Coatings; 2009 (Reapproved 2015).

D. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

F. NEMA VE 1 - Metal Cable Tray Systems; 2009.

G. NEMA VE 2 - Cable Tray Installation Guidelines; 2013.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4. 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 Architect 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.

1.5. 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. 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.

E. Project Record Documents: Record actual routing of cable tray and locations of supports.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. 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

2.1. 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 based on safety factor of 1.5 and working load only (no additional concentrated static load), with ratings for metal cable tray systems in accordance with NEMA VE 1.

F. Unless otherwise indicated, specified load/fill depths and inside widths are nominal values, with values for metal cable tray systems in accordance with NEMA VE 1 including applicable allowable tolerances.

2.2. METAL CABLE TRAY SYSTEMS

A. Manufacturers:

1. Metal Cable Tray System:

a. Cablofil, a brand of Legrand North America, Inc: www.legrand.us.

b. Chalfant Manufacturing Company: www.chalfant-obo.com.

c. Cope, a brand of Atkore International Inc: www.copecabletray.com.

d. Thomas & Betts Corporation: www.tnb.com.

2. Substitutions: See Section 01 6000 - Product Requirements.

3. 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.
4. Source Limitations: Furnish cable tray system and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

B. Comply with NEMA VE 1.

C. Finishes:
1. Zinc Electroplated Steel: Comply with ASTM B633.
2. Mill-Galvanized Before Fabrication (Pre-Galvanized) Steel: Comply with ASTM A653/A653M, G90 coating.
3. Hot-Dip Galvanized After Fabrication (H.D.G.A.F.) Steel: Comply with ASTM A123/A123M.

D. Metal Wire Mesh/Basket Cable Tray:
1. Material: Zinc electroplated steel or mill-galvanized before fabrication (pre-galvanized) steel.
2. Tray Depth: As indicated on drawings.
3. Span/Load Rating: As indicated on drawings.
4. Mesh Spacing: 2 by 4 inches.
5. Tray Width: As indicated on drawings.

2.3. 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

3.1. 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.

3.2. 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. Metal Wire Mesh/Basket Cable Tray: Field fabricate fittings in accordance with manufacturer's instructions, using only manufacturer-approved connectors classified for bonding.
1. Inside Radius of Fittings: 12 inches.

G. Hot-Dip Galvanized After Fabrication (H.D.G.A.F.) Steel Cable Tray: After cutting, drilling, or deburring, use approved zinc-rich paint to repair finish in accordance with ASTM A780/A780M.

H. 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.

I. 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.

J. Provide end closures at unconnected ends of cable tray runs.

K. 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.

L. 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. 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.

M. 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.

N. 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.

O. Penetrations: Install firestopping to preserve fire resistance rating of building elements, using materials and methods specified in Section 07 8400.

P. Identification Requirements, in Addition to Those Specified in Section 26 0553.
1. Use warning labels to identify cable tray with the word message "WARNING! Do Not Use As A Walkway, Ladder, Or Support For Personnel. Use Only As A Mechanical Support For Cables, Tubing and Raceways." at maximum intervals of 20 feet.

3.3. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect cable tray system 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 cable tray system components.

3.4. ADJUSTING

A. Adjust tightness of mechanical connections to manufacturer's recommended torque settings.

3.5. 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.

3.6. PROTECTION

A. Protect cable tray system from subsequent construction operations.

END OF SECTION

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Wire and cable markers.

D. Voltage markers.

E. Floor marking tape.

F. Warning signs and labels.

1.2. 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 0573 - Power System Studies: Arc flash hazard warning labels.

E. Section 26 2300 - Low-Voltage Switchgear: Factory-installed mimic bus.

F. Section 26 2726 - Wiring Devices: Device and wallplate finishes; factory pre-marked wallplates.

1.3. REFERENCE STANDARDS

A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011.

B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

D. NFPA 70E - Standard for Electrical Safety in the Workplace; 2015.

E. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.4. 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.

1.5. 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.

D. 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.

1.6. QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

1.7. FIELD CONDITIONS

A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.1. 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. Switchboards:

1) Identify ampere rating.

2) Identify voltage and phase.

3) Identify power source and circuit number. Include location.

4) Use identification nameplate to identify main overcurrent protective device.

5) Use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.

b. Panelboards:

1) Identify ampere rating.

2) Identify voltage and phase.

3) Identify power source and circuit number. Include location.

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.

c. Enclosed switches, circuit breakers, and motor controllers:

1) Identify voltage and phase.

2) Identify power source and circuit number. Include location.

3) Identify load(s) served. Include location.

d. Enclosed Contactors:

1) Identify ampere rating.

2) Identify voltage and phase.

3) Identify configuration, e.g., E.O.E.H. (electrically operated, electrically held) or E.O.M.H. (electrically operated, mechanically held).

4) Identify coil voltage.

5) Identify load(s) and associated circuits controlled. Include location.

e. Transfer Switches:

1) Identify power source and circuit number for both normal power source and standby power source. Include location when not within sight of equipment.

2) Identify short circuit current rating based on the specific overcurrent protective device type and settings protecting the transfer switch.

2. Service Equipment:
   a. Use identification nameplate to identify each service disconnecting means.
3. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
4. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
5. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
6. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
7. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
8. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
   a. Field-Painted Floor Markings: Alternating black and white stripes, 3 inches wide, painted in accordance with Section 09 9123 and 09 9113.
9. 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.
10. Arc Flash Hazard Warning Labels: Comply with Section 26 0573.
11. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.

B. Identification for Conductors and Cables:
1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.
2. 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.
3. 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:
   a. At each source and load connection.
   b. Within boxes when more than one circuit is present.
   c. Within equipment enclosures when conductors and cables enter or leave the enclosure.
4. Use wire and cable markers to identify connected grounding electrode system components for grounding electrode conductors.

C. Identification for Raceways:
1. Use voltage markers to identify highest voltage present for accessible conduits at maximum intervals of 20 feet.

2. 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.
3. Use identification labels, handwritten text using indelible marker, or plastic marker tags to identify spare conduits at each end. Identify purpose and termination location.

D. Identification for Boxes:
1. Use voltage markers to identify highest voltage present.
2. Use voltage markers or color coded boxes to identify systems other than normal power system.
    a. Color-Coded Boxes: Field-painted in accordance with Section 09 9123 and 09 9113 per the same color code used for raceways.
3. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.
    a. For exposed boxes in public areas, use only identification labels.
4. Use warning labels to identify electrical hazards for boxes containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".

E. Identification for Devices:
1. Wiring Device and Wallplate Finishes: Comply with Section 26 2726.
2. Use identification label to identify fire alarm system devices.
3. Use engraved wallplate to identify serving branch circuit for all receptacles.
4. Use engraved wallplate to identify load controlled for wall-mounted control devices controlling loads that are not visible from the control location and for multiple wall-mounted control devices installed at one location.

2.2. IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:
1. Materials:
    a. Indoor Clean, Dry Locations: Use plastic nameplates.
    b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
2. 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.
    a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.

5. 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: www.bradyid.com.
   b. Brother International Corporation: www.brother-usa.com.
   c. Panduit Corp: www.panduit.com.
   d. Substitutions: See Section 01 6000 - Product Requirements.
2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
   a. Use only for indoor locations.
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.
   c. Other information as indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height:
   a. System Designation: 1 inch.
   b. Equipment Designation: 1/2 inch.
   c. Other Information: 1/4 inch.
   d. Exception: Provide minimum text height of 1 inch for equipment located more than 10 feet above floor or working platform.
5. Color:
   a. Normal Power System: White text on black background.
   b. Emergency Power 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.

E. Format for Caution and Warning Messages:

1. Minimum Size: 2 inches by 4 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: 1/2 inch.
5. Color: Black text on yellow background unless otherwise indicated.

F. Format for Receptacle Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Power source and circuit number or other designation indicated.
a. Include voltage and phase for other than 120 V, single phase circuits.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

G. Format for Control Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Load controlled or other designation indicated.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Black text on clear background.

H. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
2. Legend: Designation indicated and device zone or address.
3. Text: All capitalized unless otherwise indicated.
4. Minimum Text Height: 3/16 inch.
5. Color: Red text on white background.

2.3. WIRE AND CABLE MARKERS

A. Manufacturers:
1. Brady Corporation: www.bradyid.com.
2. HellermannTyton: www.hellermanntyton.com.
3. Panduit Corp: www.panduit.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

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.
1. Do not use handwritten text.

F. Minimum Text Height: 1/8 inch.

G. Color: Black text on white background unless otherwise indicated.

2.4. VOLTAGE MARKERS

A. Manufacturers:

1. Brady Corporation: www.bradyid.com.
2. Brimar Industries, Inc: www.brimar.com.
3. Seton Identification Products: www.seton.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl type markers.

1. EES conduits in Healthcare facilites shall have markers installed on raceways per NEC.

C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

D. Minimum Size:

1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
2. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.
3. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.
4. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

E. Legend:

1. Markers for Voltage Identification: Highest voltage present.
2. Markers for System Identification:
   a. Emergency Power System: Text "EMERGENCY".
   b. Other Systems: Type of service.

F. Color: Black text on orange background unless otherwise indicated.

2.5. FLOOR MARKING TAPE

A. Manufacturers:

1. Brady Corporation: www.bradyid.com.
2. Brimar Industries, Inc: www.brimar.com/#sle.
3. Seton Identification Products: www.seton.com.
4. Substitutions: See Section 01 6000 - Product Requirements.

B. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlaminate, 3 inches wide, with alternating black and white stripes.

2.6. WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:

1. Materials:
   a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
   b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
3. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. 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.
    a. Do not use labels designed to be completed using handwritten text.
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

3.1. PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2. 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. Boxes: Outside face of cover.
9. Conductors and Cables: Legible from the point of access.
10. 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.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Secure rigid signs using stainless steel screws.

G. Mark all handwritten text, where permitted, to be neat and legible.

3.3. 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

SECTION 26 0573 - POWER SYSTEM STUDIES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.

1. Includes arc flash hazard warning labels.

D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.2. RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.

B. Section 26 2100 - Low-Voltage Electrical Service Entrance.

1. Includes Utility Company contact information.

C. Section 26 2413 - Switchboards.

D. Section 26 2416 - Panelboards.

E. Section 26 2813 - Fuses.

F. Section 26 2816.13 - Enclosed Circuit Breakers.

G. Section 26 2816.16 - Enclosed Switches.

H. Section 26 2913 - Enclosed Controllers.

1.3. REFERENCE STANDARDS

A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011.

B. IEEE 141 - IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants; 1993 (Reaff 1999).

C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001.

D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.

E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.

F. IEEE 1584 - IEEE Guide for Performing Arc Flash Hazard Calculations; 2002, including 1584a (2004) and 1584b (2011) amendments.

G. NEMA MG 1 - Motors and Generators; 2018.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2015.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.

2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Pre-Study Meeting: Conduct meeting with Owner to discuss system operating modes and conditions to be considered in studies.

C. Sequencing:

1. Submit study reports prior to or concurrent with product submittals.
2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect.
3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Study preparer's qualifications.

C. Field testing agency's qualifications.

D. Study reports, stamped or sealed and signed by study preparer.

E. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.

1. Include characteristic time-current trip curves for protective devices.
2. Include impedance data for busway.
3. Include impedance data for engine generators.
4. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
5. Include documentation of listed series ratings upon request.
6. Identify modifications made in accordance with studies that:
    a. Can be made at no additional cost to Owner.
    b. As submitted will involve a change to the contract sum.

F. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.

G. Site-specific arc flash hazard warning labels.

H. Field quality control reports.

I. Certification that field adjustable protective devices have been set in accordance with requirements of studies.

J. Project Record Documents: Revise studies as required to reflect as-built conditions.

1. Include hard copies with operation and maintenance data submittals.
2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.6. POWER SYSTEM STUDIES

A. Scope of Studies:

1. Perform analysis of new electrical distribution system as indicated on drawings.
2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including

parts of system affecting calculations being performed (e.g. fault current contribution from motors).

3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
    a. Known Operating Modes:
        1) Utility as source.

B. General Study Requirements:
1. Comply with NFPA 70.
2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:
1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
    a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
        1) Obtain up-to-date information from Utility Company.
        2) Utility Company: See Section 26 2100 for Utility Company contact information.
    b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
    c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
    d. Protective Devices:
        1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
        2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
    e. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
    f. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Short-Circuit Study:
1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
    a. Maximum utility fault currents.
    b. Maximum motor contribution.
    c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:

1. Comply with applicable portions of IEEE 242 and IEEE 399.
2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
3. Analyze protective devices and associated settings for suitable margins between time-current curves to achieve full selective coordination while providing adequate protection for equipment and conductors.

F. Arc Flash and Shock Risk Assessment:

1. Comply with NFPA 70E.
2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.
    a. Where reasonable, study preparer may assume a maximum clearing time of two seconds in accordance with IEEE 1584, provided that the conditions are such that a worker's egress from an arc flash event would not be inhibited.
    b. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.
3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
    a. Maximum and minimum utility fault currents.
    b. Maximum and minimum motor contribution.
    c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:

1. General Requirements:
    a. Identify date of study and study preparer.
    b. Identify study methodology and software product(s) used.
    c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
    d. Identify base used for per unit values.
    e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
    f. Include conclusions and recommendations.
2. Short-Circuit Study:
    a. For each scenario, identify at each bus location:
        1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
        2) Fault point X/R ratio.
        3) Associated equipment short circuit current ratings.
    b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.

3. Protective Device Coordination Study:
    a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
    b. For each graph include (where applicable):
        1) Partial single-line diagram identifying the portion of the system illustrated.
        2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
        3) Conductors: Damage curves.
        4) Transformers: Inrush points and damage curves.
        5) Motors: Full load current, starting curves, and damage curves.
    c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
        1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
        2) Include ground fault pickup and delay.
        3) Include fuse ratings.
        4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.
    d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.
4. Arc Flash and Shock Risk Assessment:
    a. For the worst case for each scenario, identify at each bus location:
        1) Calculated incident energy and associated working distance.
        2) Calculated arc flash boundary.
        3) Bolted fault current.
        4) Arcing fault current.
        5) Clearing time.
        6) Arc gap distance.
    b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.
    c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

1.7. QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in the preparation of studies of similar type and complexity using specified computer software.
    1. Study preparer may be employed by the manufacturer of the electrical distribution equipment.
    2. Study preparer may be employed by field testing agency.

B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.

1. Field Supervisor: Certified electrical testing technician; NETA ETT Level III.

C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

1. Acceptable Software Products:

a. EasyPower LLC: www.easypower.com.

b. ETAP/Operation Technology, Inc: www.etap.com.

c. SKM Systems Analysis, Inc: www.skm.com.

d. Substitutions: Not permitted.

PART 2 PRODUCTS

2.1. ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.

1. Materials: Comply with Section 26 0553.

2. Minimum Size: 4 by 6 inches.

3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.

a. Include orange header that reads "WARNING" unless otherwise indicated.

b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.

c. Include the following information:

1) Arc flash boundary.

2) Available incident energy and corresponding working distance.

3) Site-specific PPE (personnel protective equipment) requirements.

4) Nominal system voltage.

5) Limited approach boundary.

6) Restricted approach boundary.

7) Equipment identification.

8) Date calculations were performed.

PART 3 EXECUTION

3.1. INSTALLATION

A. Install arc flash warning labels in accordance with Section 26 0553.

3.2. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.

C. Inspect and test in accordance with NETA ATS, except Section 4.

D. Adjust equipment and protective devices for compliance with studies and recommended settings.

E. Notify Architect of any conflicts with or deviations from studies. Obtain direction before proceeding.

F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.3. CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.

1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.
2. Provide minimum of eight hours of training.
3. Instructor: Representative of entity performing study.
4. Location: At project site.

END OF SECTION

SECTION 26 0918 - REMOTE CONTROL SWITCHING DEVICES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Networked switching controls.

B. Programmable switching controls.

C. Remote control switching relays.

D. Remote switches.

E. Remote sensors.

F. Power supplies.

G. Relay cabinets.

1.2. RELATED REQUIREMENTS

A. Section 26 0533.13 - Conduit for Electrical Systems.

B. Section 26 0533.16 - BOXES: Switch outlets and installation of switch devices.

C. Section 26 2416 - Panelboards.

1.3. REFERENCE STANDARDS

A. NEMA ICS 4 - Application Guideline for Terminal Blocks; 2015.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data showing dimensions and ratings for components.

C. Shop Drawings: Indicate wiring diagrams of system, showing interface with branch circuit wiring.

D. 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.

E. Project Record Documents: Record actual locations of components and record circuiting and switching arrangements.

F. Maintenance Data: Include replacement parts numbers.

1.5. 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.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Acuity Brands, Inc: www.acuitybrands.com.

B. Lutron Electronics, Inc: www.lutron.com.

C. Eaton/Copper Controls: www:cooperindustries/content/public/en/lighting/connected_systems.html.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.2. NETWORKED LIGHTING CONTROL

A. Description: Distributed switching control using networking programmable relay panels, with central computer for operator interface, programming control sequences, and monitoring.

B. Central Computer: Furnished by Contractor and Vendor..

C. Software Features:

1. Security: Password protection for accessing and modifying data.
2. Data Protection: Full data backup capability.
3. Operating Schedules: Capacity of 12 for each programmable relay panel and 12 system wide time schedules. System-wide schedules adjust relay panel schedules globally.
4. Programming: Available from central computer and downloaded to individual programmable relay panels.
5. Diagnostics: Include diagnostic and testing procedures to enable troubleshooting.
6. Maintenance Data: Track runtime in minutes and relay operation in cycles.
7. Warning Flicker: Flash lights 5 minutes before shutting down.
8. Time Delay: Allow adjustable time delay between scheduled ON-OFF and operation of individual relay.
9. Egress and Common Area Links: Operate identified relays ON when other circuits in common area are energized; allow adjustable time delay after other circuits de-energize before operating identified relays OFF.

D. Networking Hardware and Software: Support 2-wire communications between programmable relay panels, allow global switching and telephone control, and include RS-232 serial data port for connecting central computer.

2.3. PROGRAMMABLE RELAY PANELS

A. Description: Relay cabinet with power supply, terminal blocks, and logic cards for the specified programming functions.

B. Relays per Panel: As indicated.

C. Programming Functions:

1. Multiple Switch Control: More than 1 switch can control each relay.
2. Pilot Status Indication: Signal for indicating relay status at remote location.
3. Relay Grouping: Allow relays to be grouped for common control.
4. Scheduling: Allow scheduling of 99 events each capable of switching 1 relay groups according to a programmed time schedule. Allow for up to 12 holidays.

D. Cabinet: Surface-mounted sheet metal cabinet.

2.4. REMOTE CONTROL SWITCHING RELAYS

A. Description: Heavy duty, two-coil momentary contact type remote control relays.

B. Contacts: Rated 20 amperes at 277 volts and with isolated and non-isolated pilot contacts where indicated.

C. Line Voltage Connections: Clamp type screw terminals.

2.5. REMOTE SWITCHES

A. Wall Switch: Interchangeable type.

1. Description: Momentary contact, three position switches, ivory color, rated 3 amperes at 25 VAC.

B. Key Switches: Match non-key switch ratings.
   1. Description: Spade key type.
C. Switches with Pilot Lamp:
   1. Description: Momentary contact three position rocker type, ivory color, rated 3 amperes at 25 VAC, with integral red pilot light.
D. Switch Plates:
   1. Description: Smooth plastic, color to matchother wiring devices see section 26 2726..
E. Master Sequencer:
   1. Description: Electronic circuit module to allow single switch to control up to 8 relays.

2.6. REMOTE SENSORS

A. Exterior Lighting Sensor:
   1. Description: Photodiode lighting sensor in weatherproof housing.
B. Interior Lighting Sensor:
   1. Description: Photodiode lighting sensor suitable for mounting on wall or ceiling and characterized with a dead band to eliminate ON-OFF cycling of relays in response to its own switching action.
C. Skylight Lighting Sensor:
   1. Description: Photodiode lighting sensor suitable for measuring direct daylight and characterized with an averaging function.
D. Atrium Lighting Sensor:
   1. Description: Photodiode lighting sensor suitable for averaging ceiling brightness.
E. Photocell Control Unit:
   1. Photodiode control unit with PHOTOCELL ENABLE and MASTER OVERRIDE inputs for remote control, 3-minute time delay.
   2. Selectable ranges for 1 to 10 fc, 10 to 100 fc, 100 to 1000 fc, 1000 to 10,000 fc.

2.7. RELAY CABINETS

A. Boxes: Galvanized steel with removable endwalls.
B. Box Size: 24 inches wide x 48 inches high x 6 inches deep.
C. Interior Panel: Metal, suitable for mounting components, matte white.
D. Fronts: Steel, flush type with concealed trim clamps door with concealed hinge, and flush lock keyed to match branch circuit panelboard. Finish with gray baked enamel.
E. Metal Barriers: Between wiring of different systems and voltages.
F. Power Terminals: NEMA ICS 4, unit construction type with closed back and tubular pressure screw connectors, rated 600 volts.
G. Signal and Control Terminals: NEMA ICS 4, modular construction type, suitable for channel mounting, with tubular pressure screw connectors, rated 300 volts.
H. Ground Bus Terminal Block: Bond each connector to enclosure.
I. Plastic Raceway:
   1. Description: Plastic channel with hinged or snap-on cover.
J. Power Supply: NFPA 70, Class 2 transformer.
   1. Ratings: 120 /24 volt, 75 VA momentary, 40 VA continuous.
   2. Rectifier: Silicon, rated 20 amperes intermittent, 7.5 amperes continuous, 30 VAC, 100 PRV.

PART 3 EXECUTION

3.1. INSTALLATION

A. Install wiring in conduit in accordance with Section 26 0533.13.

B. Install relays to be accessible. Allow space for adequate ventilation and circulation of air.

3.2. CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Demonstrate proper operation of system.

END OF SECTION

SECTION 26 0923 - LIGHTING CONTROL DEVICES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Occupancy sensors.

B. Outdoor photo controls.

C. Daylighting controls.

1.2. 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 0533.16 - BOXES.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 0918 - Remote Control Switching Devices: Remotely controlled devices for lighting control, including networked lighting controls, programmable relay panels, and remote control switching relays.

F. Section 26 2726 - Wiring Devices: Devices for manual control of lighting, including wall switches, wall dimmers, and fan speed controllers.

1. Includes finish requirements for wall controls specified in this section.

2. Includes accessory receptacles, switches, dimmers and wall plates, to match lighting controls specified in this section.

G. Section 26 5100 - Interior Lighting.

H. Section 26 5600 - Exterior Lighting.

1.3. REFERENCE STANDARDS

A. 47 CFR 15 - Radio Frequency Devices; current edition.

B. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.

C. ANSI C136.24 - American National Standard for Roadway and Area Lighting Equipment - Nonlocking (Button) Type Photocontrols; 2004 (R2010).

D. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

E. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

G. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2011.

H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

I. UL 773 - Plug-in, Locking Type Photocontrols for Use with Area Lighting; Current Edition, Including All Revisions.

J. UL 773A - Nonindustrial Photoelectric Switches for Lighting Control; Current Edition, Including All Revisions.

K. UL 916 - Energy Management Equipment; Current Edition, Including All Revisions.

L. UL 917 - Clock-Operated Switches; Current Edition, Including All Revisions.

M. UL 1472 - Solid-State Dimming Controls; Current Edition, Including All Revisions.

1.4. 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.

B. Sequencing:

1. Do not install lighting control devices until final surface finishes and painting are complete.

1.5. 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.
2. Daylighting Controls: Provide lighting plan indicating location, model number, and orientation of each photo sensor and associated system component.

D. Samples (if requested):

1. Occupancy Sensors: One for each type and color specified.
2. In-Wall Time Switches: One for each type and color specified.
3. In-Wall Interval Timers: One for each type and color specified.
4. Daylighting Control Photo Sensors: One for each type and color specified.

E. Field Quality Control Reports.

F. 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.

G. Operation and Maintenance Data: Include detailed information on device programming and setup.

H. 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 Locking Receptacle-Mounted Outdoor Photo Controls: Five percent of total quantity installed for each type, but not less than two of each type.

I. Project Record Documents: Record actual installed locations and settings for lighting control devices.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. 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.

1.8. FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9. 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.

D. Provide two year manufacturer warranty for all daylighting controls.

PART 2 PRODUCTS

2.1. 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.

2.2. OCCUPANCY SENSORS

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell.com.
2. Lutron Electronics Company, Inc: www.lutron.com.
3. Sensor Switch Inc: www.sensorswitch.com.
4. WattStopper: www.legrand.us/wattstopper.aspx.
5. Acuity Controls: www.Acuitybrands.com
6. Eaton (Cooper) Controls: www.Cooperindustries.com/content/public/en/lighting_lighting.html
7. 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 (PIR) Occupancy Sensors: Designed to detect occupancy by sensing movement of thermal energy between zones.

b. Ultrasonic Occupancy Sensors: Designed to detect occupancy by sensing frequency shifts in emitted and reflected inaudible sound waves.

c. 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. Passive Infrared Lens Field of View: Field customizable by addition of factory masking material, adjustment of integral blinders, or similar means to block motion detection in selected areas.

7. Turn-Off Delay: Field adjustable, with time delay settings up to 30 minutes.

8. Sensitivity: Field adjustable.

9. Adaptive Technology: Field selectable; capable of self-adjusting sensitivity and time delay according to conditions.

10. Integral Photocell: For field selectable and adjustable inhibition of automatic turn-on of load when ambient lighting is above the selected level.

11. 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.

12. Load Rating for Line Voltage Occupancy Sensors: As required to control the load indicated on drawings.

13. Isolated Relay for Low Voltage Occupancy Sensors: SPDT dry contacts, ratings as required for interface with system indicated.

14. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.

15. Wireless Sensors:

a. RF Range: 30 feet through typical construction materials.

b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.

c. Power: Battery-operated with minimum ten-year battery life.

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. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).

e. 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.

f. Provide selectable audible alert to notify occupant of impending load turn-off.

g. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.

h. Provide vandal resistant lenses for passive infrared (PIR) and dual technology wall switch occupancy sensors where indicated.

2. Passive Infrared (PIR) Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

3. Passive Infrared/Ultrasonic Dual Technology Wall Switch Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

D. Wall Dimmer Occupancy Sensors:

1. General Requirements:

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 dimming control capability , and no leakage current to load in off mode.

b. Operation: Field selectable to operate either as occupancy sensor (automatic on/off) or as vacancy sensor (manual-on/automatic off).

c. Manual-Off Override Control Capability: 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.

d. Dimmer: 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, and listed as complying with UL 1472; type and rating suitable for load controlled.

e. Provide field adjustable dimming preset for occupied state.

f. Provide fade-to-off operation to notify occupant of impending load turn-off.

g. Finish: Match finishes specified for wiring devices in Section 26 2726, unless otherwise indicated.

2. Passive Infrared (PIR) Wall Dimmer Occupancy Sensors: Capable of detecting motion within an area of 900 square feet.

E. Ceiling Mounted Occupancy Sensors:

1. All Ceiling Mounted Occupancy Sensors:

a. Description: Low profile occupancy sensors designed for ceiling installation.

b. Unless otherwise indicated or required to control the load indicated on drawings, provide low voltage units, for use with separate compatible accessory power packs.

c. Provide field selectable setting for disabling LED motion detector visual indicator.

d. Occupancy sensor to be field selectable as either manual-on/automatic-off or automatic on/off.

e. Finish: White unless otherwise indicated.

2. Passive Infrared (PIR) Ceiling Mounted Occupancy Sensors:

a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

3. Ultrasonic Ceiling Mounted Occupancy Sensors:

a. Standard Range Sensors: Capable of detecting motion within an area of 500 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

b. Medium Range Sensors: Capable of detecting motion within an area of 1,000 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

c. Extended Range Sensors: Capable of detecting motion within an area of 2,000 square feet at a mounting height of 9 feet.

4. Passive Infrared/Ultrasonic Dual Technology Ceiling Mounted Occupancy Sensors:

a. Standard Range Sensors: Capable of detecting motion within an area of 450 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

b. Extended Range Sensors: Capable of detecting motion within an area of 1,200 square feet at a mounting height of 9 feet, with a field of view of 360 degrees.

F. 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.

b. Long Range Sensors: Capable of detecting motion within a distance of 80 feet at a mounting height of 10 feet.

c. High Bay Sensors: Capable of detecting motion within a distance of 50 feet at a mounting height of 30 feet.

3. Passive Infrared/Ultrasonic Dual Technology Directional Occupancy Sensors: Capable of detecting motion within a distance of 40 feet at a mounting height of 10 feet.

G. 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.

2.3. OUTDOOR PHOTO CONTROLS

A. Manufacturers:

1. Intermatic, Inc: www.intermatic.com.

2. Tork, a division of NSI Industries LLC: www.tork.com.

3. Substitutions: See Section 01 6000 - Product Requirements.

B. Stem-Mounted Outdoor Photo Controls:

1. Description: Direct-wired photo control unit with threaded conduit mounting stem and field-adjustable swivel base, listed and labeled as complying with UL 773A.
2. Housing: Weatherproof, impact resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Provide external sliding shield for field adjustment of light level activation.
5. Light Level Activation: 1 to 5 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
6. Voltage: As required to control the load indicated on the drawings.
7. Failure Mode: Fails to the on position.
8. Load Rating: As required to control the load indicated on the drawings.
9. Provide accessory wall-mounting bracket where indicated or as required to complete installation.

C. Locking Receptacle-Mounted Outdoor Photo Controls

1. Description: Plug-in locking type photo control unit complying with ANSI C136.10 for mounting on a compatible receptacle, listed and labeled as complying with UL 773.
2. Housing: Weatherproof, impact resistant UV stabilized polypropylene, color to be selected.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 footcandles turn-on and 1.5 to 1 turn-off to turn-on ratio with instant turn-on and delayed turn-off.
5. Voltage: As required to control the load indicated on the drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control the load indicated on the drawings.
8. Surge Protection: 160 joule metal oxide varistor.

D. Button Type Outdoor Photo Controls

1. Description: Direct-wired photo control unit complying with ANSI C136.24 with weatherproof gasketed wall plate where required or indicated, listed and labeled as complying with UL 773A.
2. Housing: Weather resistant polycarbonate.
3. Photo Sensor: Cadmium sulfide.
4. Light Level Activation: 1 to 3 footcandles turn-on and 3 to 1 turn-off to turn-on ratio with delayed turn-off.
5. Voltage: As required to control the load indicated on the drawings.
6. Failure Mode: Fails to the on position.
7. Load Rating: As required to control the load indicated on the drawings.

2.4. DAYLIGHTING CONTROLS

A. Manufacturers:

1. Hubbell Control Solutions: www.hubbell.com/hubbellcontrolsolutions/en/#sle.
2. Lutron Electronics Company, Inc: www.lutron.com.
3. Acuity Controls:: www.Acuitybrands.com.
4. Eaton (Cooper) Controls: www.Cooperindustries.com/content/public/en/lighting.html
5. WattStopper: www.legrtand.us/wattstopperaspx.
6. Substitutions: See Section 01 6000 - Product Requirements.

7. Source Limitations: Furnish products produced by a single manufacturer and obtained from a single supplier.

B. System Description: Control system consisting of photo sensors and compatible control modules and power packs, contactors, or relays as required for automatic control of load indicated according to available natural light; capable of integrating with occupancy sensors and manual override controls.

C. Daylighting Control Photo Sensors: Low voltage class 2 photo sensor units with output signal proportional to the measured light level and provision for zero or offset based signal.

1. Sensor Type: Filtered silicon photo diode.
2. Sensor Range:
   a. Indoor Photo Sensors: 5 to 100 footcandles.
   b. Outdoor Photo Sensors: 5 to 250 footcandles.
   c. Atrium Photo Sensors: 200 to 2,500 footcandles.
   d. Skylight Photo Sensors: 1,000 to 6,000 footcandles.
   e. Open Loop Photo Sensors: 3 to 6,000 footcandles.
3. Finish: White unless otherwise indicated.
4. Where wired sensors are indicated, wireless sensors are acceptable provided that all components and wiring modifications necessary for proper operation are included.
5. Wireless Daylighting Control Photo Sensors:
   a. RF Range: 30 feet through typical construction materials.
   b. Electromagnetic Interference/Radio Frequency Interference (EMI/RFI) Limits: Comply with FCC requirements of 47 CFR 15, for Class B application.
   c. Power: Battery-operated with minimum ten-year battery life.

D. Dimming Photo Sensors: Photo sensor units with integral controller compatible with specified dimming ballasts, for direct continuous dimming of up to 50 ballasts.

E. Daylighting Control Switching Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors, for switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.

1. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
2. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.
3. Control Capability:
   a. Single Zone Switching Modules: Capable of controlling one programmable channel.
   b. Multi-Zone Switching Modules: Capable of controlling up to three separately programmable channels.

F. Daylighting Control Switching Modules for Wireless Sensors:

1. Description: Plenum rated, self-contained relay compatible with specified wireless photo sensors for switching of line voltage loads in response to changes in measured light levels according to selected settings.
2. Operation: Unless otherwise indicated, load to be turned on when light level is below selected low set point and load to be turned off when light level is above selected high set point, with a no switching dead band between set points to prevent unwanted cycling.
3. Input Delay: To prevent unwanted cycling due to intermittent light level fluctuations.

4. Control Capability: Capable of controlling one programmable channel.
5. Input Supply Voltage: Dual rated for 120/277 V ac.
6. Load Rating: As required to control the load indicated on drawings.
7. Provide auxiliary contact closure output where indicated.
8. Rated Life of Relay: One million cycles.

G. Daylighting Control Dimming Modules for Low Voltage Sensors: Low voltage class 2 control unit compatible with specified photo sensors and with specified dimming ballasts, for both continuous dimming of compatible dimming ballasts and switching of compatible power packs, contactors, or relays in response to changes in measured light levels according to selected settings.

1. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
2. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.
3. Control Capability: Capable of controlling up to three separately programmable channels, with up to 50 ballasts per channel.
4. Dimming and Fade Rates: Adjustable from 5 to 60 seconds.
5. Cut-Off Delay: Selectable and adjustable from 0 to 20 minutes.
6. Output Voltage: Compatible with specified dimming ballasts.

H. Daylighting Control Dimming Modules for Wireless Sensors:

1. Description: Plenum rated control unit compatible with specified wireless photo sensors and with specified dimming ballasts, for continuous dimming of compatible dimming ballasts in response to changes in measured light levels according to selected settings.
2. Operation: Unless otherwise indicated, specified load to be continuously brightened as not enough daylight becomes available and continuously dimmed as enough daylight becomes available.
3. Load to be turned off when available daylight is sufficient to fully dim the load, after the selected time delay.

I. Power Packs for Low Voltage Daylighting Control Modules:

1. Description: Plenum rated, self-contained low voltage class 2 transformer and relay compatible with specified low voltage daylighting control modules for switching of line voltage loads. Provide quantity and configuration of power and slave packs with all associated wiring and accessories as required to control the load indicated on drawings.
2. Input Supply Voltage: Dual rated for 120/277 V ac.
3. Load Ratings: As required to control the load indicated on drawings.
4. Load Ratings:

J. Accessories:

1. Where indicated, provide compatible accessory wall switches for manual override control.
2. Where indicated, provide compatible accessory wireless controls for manual override control.

PART 3 EXECUTION

3.1. 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.

3.2. 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.

3.3. 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. 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.

C. Install lighting control devices in accordance with manufacturer's instructions.

D. Unless otherwise indicated, connect lighting control device grounding terminal or conductor to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

E. Install lighting control devices plumb and level, and held securely in place.

F. Where required and not furnished with lighting control device, provide wall plate in accordance with Section 26 2726.

G. Provide required supports in accordance with Section 26 0529.

H. 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.

I. Identify lighting control devices in accordance with Section 26 0553.

J. Occupancy Sensor Locations:

1. 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.

2. 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. Daylighting Control Photo Sensor Locations:

1. Location Adjustments: Locations indicated are diagrammatic and only intended to indicate which rooms or areas require devices. Provide quantity and locations as required for proper control of respective room or area based on manufacturer's recommendations for installed devices.

2. Unless otherwise indicated, locate photo sensors for closed loop systems to accurately measure the light level controlled at the designated task location, while minimizing the measured amount of direct light from natural or artificial sources such as windows or pendant luminaires.

3. Unless otherwise indicated, locate photo sensors for open loop systems to accurately measure the level of daylight coming into the space, while minimizing the measured amount of lighting from artificial sources.

N. Lamp Burn-In: Operate lamps at full output for minimum of 100 hours or prescribed period per manufacturer's recommendations prior to use with any dimming controls. Replace lamps that fail prematurely due to improper lamp burn-in.

O. Unless otherwise indicated, install power packs for lighting control devices above accessible ceiling or above access panel in inaccessible ceiling near the sensor location.

P. Where indicated, install separate compatible wall switches for manual control interface with lighting control devices or associated power packs.

Q. Unless otherwise indicated, install switches on load side of power packs so that switch does not turn off power pack.

3.4. 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. Test time switches to verify proper operation.

E. Test outdoor photo controls to verify proper operation, including time delays where applicable.

F. Test daylighting controls to verify proper operation, including light level measurements and time delays where applicable. Record test results in written report to be included with submittals.

G. Correct wiring deficiencies and replace damaged or defective lighting control devices.

3.5. 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.

E. Adjust time switch settings to achieve desired operation schedule as indicated or as directed by Architect. Record settings in written report to be included with submittals.

F. Adjust external sliding shields on outdoor photo controls under optimum lighting conditions to achieve desired turn-on and turn-off activation as indicated or as directed by Architect.

G. Adjust daylighting controls under optimum lighting conditions after all room finishes, furniture, and window treatments have been installed to achieve desired operation as indicated or as directed by Architect. Record settings in written report to be included with submittals. Readjust controls calibrated prior to installation of final room finishes, furniture, and window treatments that do not function properly as determined by Architect.

3.6. CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.7. 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

SECTION 26 0986 - RELAY-BASED LIGHTING CONTROLS

PART 1 GENERAL

1.1. RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2. SUMMARY

A. Section Includes: Lighting control panels using mechanically held relays for switching.

B. Section Includes: Networked lighting control panels using control-voltage relays for switching and that are interoperable with BAS.

1.3. DEFINITIONS

A. BAS: Building automation system.

B. IP: Internet protocol.

C. Monitoring: Acquisition, processing, communication, and display of equipment status data, metered electrical parameter values, power quality evaluation data, event and alarm signals, tabulated reports, and event logs.

D. PC: Personal computer; sometimes plural as "PCs."

E. RS-485: A serial network protocol, similar to RS-232, complying with TIA-485-A.

1.4. ACTION SUBMITTALS

A. Product Data: For each type of product.

1. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes for control modules, power distribution components, relays, manual switches and plates, and conductors and cables.

2. Include rated capacities, operating characteristics, electrical characteristics, and furnished specialties and accessories.

B. Shop Drawings: For each relay panel and related equipment.

1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.

2. Detail enclosure types and details for types other than NEMA 250, Type 1.

3. Detail wiring partition configuration, current, and voltage ratings.

4. Short-circuit current rating of relays.

5. Include diagrams for power, signal, and control wiring.

6. Block Diagram: Show interconnections between components specified in this Section and devices furnished with power distribution system components. Indicate data communication paths and identify networks, data buses, data gateways, concentrators, and other devices to be used. Describe characteristics of network and other data communication lines.

1.5. INFORMATIONAL SUBMITTALS

A. Coordination Drawings: Submit evidence that lighting controls are compatible with connected monitoring and control devices and systems specified in other Sections.

1. Show interconnecting signal and control wiring, and interface devices that prove compatibility of inputs and outputs.

2. For networked controls, list network protocols and provide statements from manufacturers that input and output devices comply with interoperability requirements of the network protocol.

B. Qualification Data: For testing agency.

C. Field quality-control reports.

D. Software licenses and upgrades required by and installed for operation and programming of digital and analog devices.

E. Sample Warranty: For manufacturer's special warranty.

1.6. CLOSEOUT SUBMITTALS

A. Operation and Maintenance Data: For lighting controls to include in emergency, operation, and maintenance manuals.

B. Software and Firmware Operational Documentation:

1. Software operating and upgrade manuals.

2. Program Software Backup: On magnetic media or compact disk, complete with data files.

3. Device address list.

4. Printout of software application and graphic screens.

1.7. MAINTENANCE MATERIAL SUBMITTALS

A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Lighting Control Relays: Equal to 10% percent of amount installed, but no fewer than 2 of each size.

1.8. QUALITY ASSURANCE

A. Testing Agency Qualifications: Member company of NETA or an NRTL.

1. Testing Agency's Field Supervisor: Certified by NETA to supervise on-site testing.

1.9. DELIVERY, STORAGE, AND HANDLING

A. Handle and prepare panels for installation according to NECA 407.

PART 2 PRODUCTS

2.1. SYSTEM DESCRIPTION

A. Input signal from field-mounted manual switches, or digital signal sources, shall open or close one or more lighting control relays in the lighting control panels. Any combination of inputs shall be programmable to any number of control relays.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

C. Comply with 47 CFR, Subparts A and B, for Class A digital devices.

D. Comply with UL 916.

2.2. PERFORMANCE REQUIREMENTS

A. BAS Interface: Provide hardware and software to enable the BAS to monitor, control, display, and record data for use in processing reports.

1. Hardwired Points:

a. Monitoring: On-off status, of each relay.

b. Control: On-off operation, of each relay.

2. Communication Interface: Comply with ASHRAE 135. The communication interface shall enable the BAS operator to remotely control and monitor lighting from a BAS operator workstation. Control features and monitoring points displayed locally at lighting panel shall be available through the BAS.

2.3. LIGHTING CONTROL RELAY PANELS

A. Products: Subject to compliance with requirements, provide one of the following:

1. Acuity Brands, Inc., Lighting Control & Design, Inc: GR2400
2. Leviton MFG. Company Inc.: Z-Max Plus
3. Lightolier controls, a Phillips Group brand; Lyteswitch.
4. Siemens Energy & Automation, Inc.: LCP3000EZ
5. Greengate, a, Eaton Corporation brand
6. Hubbell Controls
7. WattStopper, a Legrand Group brand; Lighting Integrator

B. Description: Standalone lighting control panel using mechanically latched relays to control lighting and appliances.

C. Lighting Control Panel:

1. A single enclosure with incoming lighting branch circuits, control circuits, switching relays, and on-board timing and control unit.
2. A vertical barrier separating branch circuits from control wiring.

D. Control Unit: Contain the power supply and electronic control for operating and monitoring individual relays.

1. Timing Unit:
    a. 365-day calendar, astronomical clock, and automatic adjustments for daylight savings and leap year.
    b. Clock configurable for 12-hour (A.M./P.M.) or 24-hour format.
    c. Four independent schedules, each having 24 time periods.
    d. Schedule periods settable to the minute.
    e. Day-of-week, day-of-month, day-of-year with one-time or repeating capability.
    f. 10 special date periods.
2. Sequencing Control with Override:
    a. Automatic sequenced on and off switching of selected relays at times set at the timing unit, allowing timed overrides from external switches.
    b. Sequencing control shall operate relays one at a time, completing the operation of all connected relays in not more than 10 seconds.
    c. Override control shall allow any relay connected to it to be switched on or off by a field-deployed manual switch or by an automatic switch, such as an occupancy sensor.
    d. Override control "blink warning" shall warn occupants approximately five minutes before actuating the off sequence.
3. Nonvolatile memory shall retain all setup configurations. After a power failure, the controller shall automatically reboot and return to normal system operation, including accurate time of day and date.

E. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 277 V. Short-circuit current rating shall be not less than 5 kA. Control shall be three-wire, 24-V ac.

F. Relays: Electrically operated, mechanically held single-pole switch, rated at 20 A at 120-V tungsten, 30 A at 277-V ballast, 1.5 hp at 120 V, and 3 hp at 277 V. Short-circuit current rating shall be not less than 14 kA. Control shall be three-wire, 24-V ac.

G. Power Supply: NFPA 70, Class 2, sized for connected equipment, plus 20 percent spare capacity. Powered from a dedicated branch circuit of the panelboard that supplies power to the line side of the relays, sized to provide control power for the local panel-mounted relays, bus system, low-voltage inputs, field-installed occupancy sensors, and photo sensors.

H. Operator Interface:

1. Integral alphanumeric keypad and digital display, and intuitive drop-down menus to assist in programming.
2. Log and display relay on-time.
3. Connect relays to one or more time and sequencing schemes.

2.4. MANUAL SWITCHES AND PLATES

A. Push-Button Switches: Modular, momentary contact, three wire, for operating one or more relays and to override automatic controls.

1. Match color and style specified in Section 26 2726 "Wiring Devices."
2. Integral green LED pilot light to indicate when circuit is on.
3. Internal white LED locator light to illuminate when circuit is off.

B. Wall Plates: Single and multi-gang plates as specified in Section 26 2726 "Wiring Devices."

C. Legend: Engraved or permanently silk-screened on wall plate where indicated. Use designations indicated on Drawings.

2.5. FIELD-MOUNTED SIGNAL SOURCES

A. Daylight Harvesting Switching Controls: Comply with Section 26 0923 "Lighting Control Devices." Control power may be taken from the lighting control panel, and signal shall be compatible with the relays.

B. Indoor Occupancy Sensors: Comply with Section 26 0923 "Lighting Control Devices." Control power may be taken from the lighting control panel, and signal shall be compatible with the relays.

2.6. CONDUCTORS AND CABLES

A. Power Wiring to Supply Side of Class 2 Power Source: Not smaller than No. 12 AWG, complying with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

B. Classes 2 and 3 Control Cables: Multi-conductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

C. Class 1 Control Cables: Multi-conductor cable with copper conductors not smaller than No. 18 AWG, complying with Section 26 0519 "Low-Voltage Electrical Power Conductors and Cables."

D. Digital and Multiplexed Signal Cables: Unshielded, twisted-pair cable with copper conductors, complying with TIA/EIA-568-B.2, Category 6 for horizontal copper cable and with Section 27 1500 "Communications Horizontal Cabling."

PART 3 EXECUTION

3.1. EXAMINATION

A. Receive, inspect, handle, and store panels according to NECA 407.

B. Examine panels before installation. Reject panels that are damaged or rusted or have been subjected to water saturation.

C. Examine elements and surfaces to receive panels for compliance with installation tolerances and other conditions affecting performance of the Work.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2. WIRING INSTALLATION

A. Comply with NECA 1.

B. Wiring Method: Install cables in raceways except within consoles, cabinets, desks, and counters. Conceal raceway except in unfinished spaces.

1. Comply with requirements for raceways and boxes specified in Section 26 0533 "Raceways and Boxes for Electrical Systems."

C. Wiring Method: Conceal conductors and cables in accessible ceilings, walls, and floors where possible.

D. Wiring within Enclosures: Bundle, lace, and train conductors to terminal points with no excess and without exceeding manufacturer's limitations on bending radii. Install lacing bars and distribution spools.

3.3. PANEL INSTALLATION

A. Comply with NECA 1.

B. Install panels and accessories according to NECA 407.

C. Mount top of trim 90 inches above finished floor unless otherwise indicated.

D. Mount panel cabinet plumb and rigid without distortion of box.

E. Install filler plates in unused spaces.

3.4. IDENTIFICATION

A. Identify system components, wiring, cabling, and terminals. Comply with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

B. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Section 26 0553 "Identification for Electrical Systems."

C. Create a directory to indicate loads served by each relay; incorporate Owner's final room designations. Obtain approval before installing. Use a PC or typewriter to create directory; handwritten directories are unacceptable.

D. Lighting Control Panel Nameplates: Label each panel with a nameplate complying with requirements for identification specified in Section 26 0553 "Identification for Electrical Systems."

3.5. FIELD QUALITY CONTROL

A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.

B. Manufacturer's Field Service: Engage a factory-authorized service representative to test and inspect components, assemblies, and equipment installations, including connections.

C. Perform the following tests and inspections with the assistance of a factory-authorized service representative:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.

2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

D. Acceptance Testing Preparation:

1. Test continuity of each circuit.

E. Lighting control panel will be considered defective if it does not pass tests and inspections.

F. Prepare test and inspection reports, including a certified report that identifies lighting control panels and describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations made after remedial action.

3.6. STARTUP SERVICE

A. Engage a factory-authorized service representative to perform startup service.

1. Complete installation and startup checks according to manufacturer's written instructions.

2. Confirm correct communications wiring, initiate communications between panels, and program the lighting control system according to approved configuration schedules, time-of-day schedules, and input override assignments.

3.7. ADJUSTING

A. Occupancy Adjustments: When requested within 12 months from date of Substantial Completion, provide on-site assistance in adjusting system to suit actual occupied conditions. Provide up to two visits to Project during other-than-normal occupancy hours for this purpose.

3.8. SOFTWARE SERVICE AGREEMENT

A. Technical Support: Beginning at Substantial Completion, service agreement shall include software support for two years.

B. Upgrade Service: At Substantial Completion, update software to latest version. Install and program software upgrades that become available within two years from date of Substantial Completion. Upgrading software shall include operating system and new or revised licenses for using software.

1. Upgrade Notice: At least 30 days to allow Owner to schedule and access the system and to upgrade computer equipment if necessary.

3.9. DEMONSTRATION

A. Engage a factory-authorized service representative to train Owner's maintenance personnel to adjust, operate, and maintain the control unit and operator interface.

END OF SECTION

SECTION 26 2100 - LOW-VOLTAGE ELECTRICAL SERVICE ENTRANCE

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Electrical service requirements.

1.2. 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 2413 - Switchboards: Service entrance equipment.

1. Includes utility metering transformer compartment.

H. Section 26 2416 - Panelboards: Service entrance equipment.

I. Section 26 2713 - Electricity Metering: Non-utility electrical metering.

J. Section 26 2816.16 - Enclosed Switches: Service entrance equipment.

K. Section 26 4300 - Surge Protective Devices: Service entrance surge protective devices.

1.3. 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.

1.4. REFERENCE STANDARDS

A. IEEE C2 - National Electrical Safety Code; 2012.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.5. 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. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

2. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.6. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Utility Company letter of availability for providing electrical service to project.

C. Product Data: Provide manufacturer's standard catalog pages and data sheets for each product. Include ratings, configurations, standard wiring diagrams, outline and support point dimensions, finishes, weights, service condition requirements, and installed features.

D. Shop Drawings: Include dimensioned plan views and sections indicating locations and arrangement of Utility Company and service entrance equipment, metering provisions, required clearances, and proposed service routing.

E. Drawings prepared by Utility Company.

1.7. 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.

4. The requirements of the local authorities having jurisdiction.

B. Maintain at the project site a copy of each referenced document that prescribes execution requirements.

C. Products: Listed, classified, and labeled as suitable for the purpose intended.

D. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.8. 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

2.1. 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:

1. Service Type: Underground.
2. Service Voltage: As inidcated on drawings..
3. Service Size: As inidcated on drawings.

C. Utility Company: Ameren-Illinois.

1. Point of Contact: Ryan Connor.
2. Address: _____.
3. Phone: 618-546-0230.
4. Email: rconnor@ameren.com.
5. Utility Company Project Reference Number: 735014.

D. Division of Responsibility: As indicated on drawings.

E. Products Furnished by Contractor: Comply with Utility Company requirements.

PART 3 EXECUTION

3.1. 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.

3.2. PREPARATION

A. Verify and mark locations of existing underground utilities.

3.3. 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 support and attachment components in accordance with Section 26 0529.

G. Provide grounding and bonding for service entrance equipment in accordance with Section 26 0526.

H. Identify service entrance equipment, including main service disconnect(s) in accordance with Section 26 0553.

3.4. PROTECTION

A. Protect installed equipment from subsequent construction operations.

END OF SECTION

SECTION 26 2413 - SWITCHBOARDS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.

B. Overcurrent protective devices for switchboards.

1.2. 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 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

F. Section 26 2100 - Low-Voltage Electrical Service Entrance.

G. Section 26 2713 - Electricity Metering: For interface with equipment specified in this section.

H. Section 26 2813 - Fuses: Fuses for fusible switches.

1. Includes requirements for spare fuses and spare fuse cabinets.

I. Section 26 4300 - Surge Protective Devices.

1.3. REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.

B. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2008.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.

E. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

G. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.

H. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; 2013.

I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 98 - Enclosed and Dead-Front Switches; 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 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

N. UL 891 - Switchboards; Current Edition, Including All Revisions.

O. UL 977 - Fused Power-Circuit Devices; Current Edition, Including All Revisions.

P. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

1.4. 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.

B. Service Entrance Switchboards:

1. Coordinate with Utility Company to provide switchboards with suitable provisions for electrical service and utility metering, where applicable.
2. Coordinate with Owner to arrange for Utility Company required access to equipment for installation and maintenance.
3. See Section 26 2100 for Utility Company contact information and additional requirements.
4. Obtain Utility Company approval of switchboard prior to fabrication.
5. Preinstallation Meeting: Convene one week prior to commencing work of this section to review requirements with Utility Company representative.
6. Arrange for inspections necessary to obtain Utility Company approval of installation.

1.5. 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. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Include documentation demonstrating selective coordination.

D. Service Entrance Switchboards: Include documentation of Utility Company approval of switchboard.

E. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 2 as production (routine) tests.

F. 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.

G. Field Quality Control Test Reports.

H. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.

I. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

J. 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.
3. Electronic Trip Circuit Breakers: Provide one portable test set.
4. Drawout Devices:
    a. Handles Necessary for Racking of Devices: One for each electrical room containing switchgear with drawout devices.
    b. Lifting Yokes: One of each different yoke required, for each electrical room containing drawout devices.
    c. Portable Lifting Devices: One for each electrical room containing switchboards with drawout devices and no integral top rail-mounted lifting device.
    d. Removable Covers: One for blocking each different opening size when device is temporarily removed from its compartment.
5. See Section 26 2813 for requirements for spare fuses and spare fuse cabinets.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. 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.

1.8. FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Switchboards:

1. ABB/GE: www.geindustrial.com.
2. Eaton Corporation: www.eaton.com.

3. Schneider Electric; Square D Products: www.schneider-electric.us.
4. Siemens Industry, Inc: www.usa.siemens.com.

B. Substitutions: See Section 01 6000 - Product Requirements.

C. 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.

2.2. 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. Front-Connected Switchboards:

1. Main Device(s): Individually-mounted.
2. Feeder Devices: Panel/group-mounted.
3. Arrangement: Front accessible only (not rear accessible), rear aligned.
4. Gutter Access: Bolted covers.

E. Service Entrance Switchboards:

1. Listed and labeled as suitable for use as service equipment according to UL 869A.
2. For solidly-grounded wye systems, provide factory-installed main bonding jumper between neutral and ground busses, and removable neutral disconnecting link for testing purposes.
3. Comply with Utility Company requirements for electrical service.
4. See Section 26 2100 for additional requirements.

F. 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.

G. 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. Listed series ratings are not acceptable.

H. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

I. 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: Copper.
5. Ground Bus Material: Copper.

J. Conductor Terminations: Suitable for use with the conductors to be installed.

1. Line Conductor Terminations:
   a. Main and Neutral Lug Material: Copper, suitable for terminating copper conductors only.
   b. Main and Neutral Lug Type: Mechanical.
2. Load Conductor Terminations:
   a. Lug Material: Copper, suitable for terminating copper conductors only.
   b. Lug Type:
      1) Provide mechanical lugs unless otherwise indicated.

K. Enclosures:

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
   a. Indoor Clean, Dry Locations: Type 1.
2. Finish: Manufacturer's standard unless otherwise indicated.

L. Future Provisions:

1. Prepare designated spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.
2. Equip distribution sections with full height vertical bussing to accommodate maximum utilization of space for devices.
3. Arrange and equip through bus and ground bus to accommodate future installation of additional switchboard sections.

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.

N. Owner Metering: Comply with Section 26 2713.

2.3. 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.
      1) Provide thermal magnetic circuit breakers unless otherwise indicated.
      2) Provide electronic trip circuit breakers where indicated.
   b. Minimum Interrupting Capacity:

c. 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.

1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.

2) Provide interchangeable trip units where indicated.

d. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

1) Provide the following field-adjustable trip response settings:

(a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.

(b) Long time delay.

(c) Short time pickup and delay.

(d) Instantaneous pickup.

(e) Ground fault pickup and delay where ground fault protection is indicated.

2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.

3) Provide communication capability where indicated: Compatible with system indicated.

e. 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.

2) 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.

f. Provide the following features and accessories where indicated or where required to complete installation:

1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.

3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.

5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

3. Insulated Case Circuit Breakers:

a. Description: Quick-make, quick-break, trip-free circuit breakers with two-step stored energy closing mechanism; standard 80 percent rated unless otherwise indicated; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.

b. Operation:

1) Provide manually operated circuit breakers unless otherwise indicated.

2) Provide electrically operated circuit breakers where indicated.

c. Construction:
   1) Provide fixed-mount circuit breakers unless otherwise indicated.
   2) Provide drawout circuit breakers where indicated.

d. Drawout Circuit Breakers:
   1) Allows withdrawal of circuit breaker into test and disconnected positions, with racking position indication (connected, test, disconnected, withdrawn).
   2) Provide safety interlock to prevent racking of circuit breaker while in the ON position.

e. Minimum Interrupting Capacity:
   1) As required by the Studies completed in section 26 0573

f. Trip Units: Solid state, microprocessor-based, true rms sensing.
   1) Provide the following field-adjustable trip response settings:
      (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
      (b) Long time delay.
      (c) Short time pickup and delay.
      (d) Instantaneous pickup.
      (e) Ground fault pickup and delay where ground fault protection is indicated.
   2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
   3) Provide communication capability where indicated: Compatible with system indicated.

g. 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.
   2) 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.

h. Provide the following features and accessories where indicated or where required to complete installation:
   1) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
   2) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
   3) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.4. SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Factory test switchboards according to NEMA PB 2, including the following production (routine) tests on each switchboard assembly or component:
   1. Dielectric tests.
   2. Mechanical operation tests.

3. Grounding of instrument transformer cases test.
4. Electrical operation and control wiring tests, including polarity and sequence tests.
5. Ground-fault sensing equipment test.

PART 3 EXECUTION

3.1. 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.

3.2. 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 nominal 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. Provide fuses complying with Section 26 2813 for fusible switches as indicated.

K. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

L. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed in accordance with Section 26 0573.

M. Provide filler plates to cover unused spaces in switchboards.

N. Identify switchboards in accordance with Section 26 0553.

3.3. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Provide services of a manufacturer's authorized representative to observe installation and assist in inspection and testing. Include manufacturer's reports with submittals.

C. Disconnect surge protective devices (SPDs) prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPDs connected.

D. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.

E. Inspect and test in accordance with NETA ATS, except Section 4.

F. Perform inspections and tests listed in NETA ATS, Section 7.1.

G. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

H. 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. Tests listed as optional are not required.

I. 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.

J. Meters: Perform inspections and tests listed in NETA ATS, Section 7.11.2.

K. Test shunt trips to verify proper operation.

L. Correct deficiencies and replace damaged or defective switchboards or associated components.

M. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.4. ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of switchboard covers and doors.

3.5. CLEANING

A. See Section 01 7419 - Construction Waste Management and Disposal, for additional requirements.

B. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.

C. Repair scratched or marred surfaces to match original factory finish.

3.6. CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. 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.

2. Provide minimum of two hours of training.

3. Instructor: Manufacturer's authorized representative.

4. Location: At project site.

3.7. PROTECTION

A. Protect installed switchboards from subsequent construction operations.

END OF SECTION

SECTION 26 2416 - PANELBOARDS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2. 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 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

F. Section 26 2713 - Electricity Metering: For interface with equipment specified in this section.

G. Section 26 2813 - Fuses: Fuses for fusible switches and spare fuse cabinets.

H. Section 26 4300 - Surge Protective Devices.

1.3. REFERENCE STANDARDS

A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; Federal Specification; Revision E, 2013.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NECA 407 - Standard for Installing and Maintaining Panelboards; 2009.

D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

E. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000 (R2005), with errata, 2008.

F. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

G. NEMA PB 1 - Panelboards; 2011.

H. NEMA PB 1.1 - General Instructions for Proper Installation, Operation and Maintenance of Panelboards Rated 600 Volts or Less; 2013.

I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.

L. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.

M. UL 67 - Panelboards; Current Edition, Including All Revisions.

N. UL 98 - Enclosed and Dead-Front Switches; Current Edition, Including All Revisions.

O. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

P. UL 869A - Reference Standard for Service Equipment; Current Edition, Including All Revisions.

Q. UL 943 - Ground-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

R. UL 1053 - Ground-Fault Sensing and Relaying Equipment; Current Edition, Including All Revisions.

S. UL 1699 - Arc-Fault Circuit-Interrupters; Current Edition, Including All Revisions.

1.4. 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.

1.5. 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.

1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

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.

2. Include wiring diagrams showing all factory and field connections.

D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 1 as routine tests.

E. Field Quality Control Test Reports.

F. 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.

G. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

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. Panelboard Keys: Two of each different key.

3. See Section 26 2813 for requirements for spare fuses and spare fuse cabinets.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. 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.

1.8. 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

2.1. MANUFACTURERS

A. ABB/GE: www.geindustrial.com.

B. Eaton Corporation: www.eaton.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Siemens Industry, Inc: www.usa.siemens.com.

E. Substitutions: See Section 01 6000 - Product Requirements.

F. Source Limitations: Furnish panelboards and associated components produced by the same manufacturer as the other electrical distribution equipment used for this project and obtained from a single supplier.

2.2. 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 determined by short circuit study performed in accordance with Section 26 0573.

2. Listed series ratings are not acceptable.

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: NEMA 250, Type 1.
2. Boxes: Galvanized steel unless otherwise indicated.
   a. Provide wiring gutters sized to accommodate the conductors to be installed.
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.
   d. Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts..
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. 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.

K. Load centers are not acceptable.

2.3. 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.
2. Provide thermal magnetic circuit breakers unless otherwise indicated.
3. Provide electronic trip circuit breakers where indicated.

E. Enclosures:
1. Provide surface-mounted enclosures unless otherwise indicated.

2. Fronts: Provide door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate 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.

2.4. 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 door-in-door trim with hinged cover for access to load terminals and wiring gutters, and separate 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.

2.5. 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. 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. Provide compression lugs where indicated.
   c. 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.
   a. Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
   b. Provide interchangeable trip units where indicated.
5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
   a. Provide the following field-adjustable trip response settings:

1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
2) Long time delay.
3) Short time pickup and delay.
4) Instantaneous pickup.
5) Ground fault pickup and delay where ground fault protection is indicated.

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 multi-pole circuit breakers for multi-wire branch circuits as required by NFPA 70.
11. 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.
    c. Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.
    d. Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.
    e. Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.6. SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Factory test panelboards according to NEMA PB 1.

PART 3 EXECUTION

3.1. 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.

3.2. 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. Provide fuses complying with Section 26 2813 for fusible switches as indicated.

N. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.

O. Multi-Wire Branch Circuits: Group grounded and ungrounded conductors together in the panelboard as required by NFPA 70.

P. Set field-adjustable circuit breaker tripping function settings as determined by overcurrent protective device coordination study performed according to Section 26 0573.

Q. Provide filler plates to cover unused spaces in panelboards.

R. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:

1. Emergency and night lighting circuits.
2. Fire detection and alarm circuits.
3. Communications equipment circuits.
4. Intrusion detection and access control system circuits.
5. Video surveillance system circuits.

S. Identify panelboards in accordance with Section 26 0553.

3.3. 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. Fusible Switches: Perform inspections and tests listed in NETA ATS, Section 7.5.1.1.

D. Molded Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers. Tests listed as optional are not required.

1. Perform insulation-resistance tests on all control wiring with respect to ground.
2. Test functions of the trip unit by means of secondary injection.

E. 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.

F. Test GFCI circuit breakers to verify proper operation.

G. Test AFCI circuit breakers to verify proper operation.

H. Test shunt trips to verify proper operation.

I. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

J. Correct deficiencies and replace damaged or defective panelboards or associated components.

3.4. ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

C. Load Balancing: For each panelboard, rearrange circuits such that the difference between each measured steady state phase load does not exceed 20 percent and adjust circuit directories accordingly. Maintain proper phasing for multi-wire branch circuits.

3.5. 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

SECTION 26 2713 - ELECTRICITY METERING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Equipment for Utility Company metering

1.2. 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 0533.16 - BOXES: Cabinets and enclosures for metering system components.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 2100 - Low-Voltage Electrical Service Entrance: Requirements for Utility Company electricity metering.

1.3. REFERENCE STANDARDS

A. ANSI C12.1 - Electric Meters Code for Electricity Metering; 2008.

B. ANSI C12.20 - American National Standard for Electricity Meters - 0.2 and 0.5 Accuracy Classes; 2010.

C. IEC 62053-21 - Electricity Metering Equipment (A.C.) - Particular Requirements - Part 21: Static Meters for Active Energy (Classes 1 and 2); 2003-01.

D. IEC 62053-22 - Electricity Metering Equipment (A.C.) - Particular Requirements - Part 22: Static Meters for Active Energy (Classes 0,2 S and 0,5 S); 2003-01.

E. IEC 62053-23 - Electricity Metering Equipment (A.C.) - Particular Requirements - Part 23: Static Meters for Reactive Energy (Classes 2 and 3); 2003-01.

F. IEEE 1459 - Standard Definitions for the Measurement of Electrical Power Quantities Under Sinusoidal, Nonsinusoidal, Balanced, or Unbalanced Conditions; 2010.

G. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2008.

H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

I. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

J. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate work to provide equipment suitable for interface with electricity metering systems to be provided.

2. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

B. Preinstallation Meeting: Conduct meeting with facility representative and other related equipment manufacturers to discuss electricity metering system interface requirements.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for electricity metering systems and associated components and accessories. Include ratings, configurations, standard wiring diagrams, dimensions, service condition requirements, and installed features.

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. Field Quality Control Test Reports.

E. Project Record Documents: Record actual installed locations of meters and final equipment settings.

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. Enclosure Keys: Two of each different key.
3. See Section 26 2813 for requirements for spare fuses and spare fuse cabinets.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

B. Store products in manufacturer's unopened packaging, keep dry and protect from damage until ready for installation.

1.8. FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Electricity Meters, for utility metering, must be in compliance and approved by the local utility company.:

2.2. EQUIPMENT FOR OWNER ELECTRICITY METERING

A. Provide microprocessor-based digital electricity metering systems including all instrument transformers, wiring, and connections necessary for measurements specified.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Provide electricity metering systems and associated components compatible with the equipment and associated circuits to be metered.

D. Service Conditions: Provide electricity meters suitable for operation under the service conditions at the installed location.

E. Enclosures:

1. Where not furnished by manufacturer, provide required cabinets and enclosures in accordance with Section 26 0533.16.
2. 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 or Type 4.

3. Provide lockable door(s) for outdoor locations.

4. Finish: Manufacturer's standard unless otherwise indicated.

F. Instrument Transformers:

1. Comply with IEEE C57.13, where applicable.

2. Select suitable ratio, burden, and accuracy as required for connected devices.

3. Current Transformers: Compatible with connected meters; replace meters damaged by connection of incompatible current transformers. Provide shorting terminal blocks for connection of secondaries where applicable.

4. Potential Transformers: Include primary and secondary fuses with disconnecting means.

G. Interface with Other Work:

1. All meters shall include a network communications device suitable for direct interface with building automation system as specified in Section 230900.

a. Acceptable protocols include BACNET adn MODBUS.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of metering systems and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive meters.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2. INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Provide required support and attachment components in accordance with Section 26 0529.

D. Provide grounding and bonding in accordance with Section 26 0526.

E. Provide fuses complying with Section 26 2813 as required.

F. Identify meters and associated wiring in accordance with Section 26 0553.

3.3. 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. Correct deficiencies and replace damaged or defective metering system components.

3.4. ADJUSTING

A. Program system parameters according to requirements of Owner.

3.5. CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.6. CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. See Section 01 7900 - Demonstration and Training, for additional requirements.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.

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: Manufacturer's authorized representative.
4. Location: At project site.

3.7. PROTECTION

A. Protect installed system components from subsequent construction operations.

END OF SECTION

SECTION 26 2726 - WIRING DEVICES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Wall switches.

B. Wall dimmers.

C. Receptacles.

D. Wall plates.

1.2. 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.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 0923 - Lighting Control Devices: Devices for automatic control of lighting, including occupancy sensors, in-wall time switches, and in-wall interval timers.

F. Section 26 2913 - Enclosed Controllers: Manual motor starters and horsepower rated motor-starting switches without overload protection.

1.3. REFERENCE STANDARDS

A. FS W-C-596 - Connector, Electrical, Power, General Specification for; Federal Specification; Revision G, 2001.

B. FS W-S-896 - Switches, Toggle (Toggle and Lock), Flush-mounted (General Specification); Federal Specification; Revision F, 1999.

C. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

D. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.

E. NEMA WD 1 - General Color Requirements for Wiring Devices; 1999 (R 2010).

F. NEMA WD 6 - Wiring Devices - Dimensional Specifications; 2012.

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.

1.4. 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. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Samples: One sample of each color available for thermoplastic cover plates.

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.

1.6. 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. Products: Listed, classified, and labeled as suitable for the purpose intended.

E. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in original manufacturer's packaging until ready for installation.

PART 2 PRODUCTS

2.1. 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 GFCI protection for receptacles installed within 6 feet of sinks.

E. Provide GFCI protection for receptacles installed in kitchens.

F. Unless noted otherwise, do not use combination switch/receptacle devices.

2.2. WIRING DEVICE FINISHES

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Wiring Devices Installed in Finished Spaces: White for normal power wiring devices, Red for receptacles on emergency power with matching nylon wall plate.

C. Wiring Devices Installed in Unfinished Spaces: Gray with galvanized steel wall plate.

2.3. ALL WIRING DEVICES

A. Provide products listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

B. Finishes:

2.4. WALL SWITCHES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell.com.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us.
4. Acuity Controls, www.acuity.com.

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: Industrial 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. Momentary Contact Wall Switches: Industrial specification grade, 20 A, 120/277 V with toggle type three position switch actuator and momentary contacts; single pole double throw, off with switch actuator in center position.

2.5. WALL DIMMERS

A. Manufacturers:

1. Leviton Manufacturing Company, Inc: www.leviton.com.
2. Lutron Electronics Company, Inc; Maestro Series: www.lutron.com.
3. Eaton (Copper) : http://www.cooperindustries.com/content/public/en/wiring_devices/products/lighting_controls/dimmers.html :
4. Wattstoper: www.legrand.us/wattstopper.aspx
5. Substitutions: See Section 01 6000 - Product Requirements.

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:

E. Provide accessory wall switches to match dimmer appearance when installed adjacent to each other.

2.6. RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell.com/wiringdevice-kellems/en.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/passandseymour.aspx.

4. Substitutions: See Section 01 6000 - Product Requirements.
5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

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.

C. Convenience Receptacles:
1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.
2. Weather Resistant Convenience Receptacles: Industrial specification 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.

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. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.
3. Weather Resistant GFCI Receptacles: Industrial specification 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.

2.7. WALL PLATES

A. Manufacturers:
1. Hubbell Incorporated: www.hubbell.com/wiringdevice-kellems/en.
2. Leviton Manufacturing Company, Inc: www.leviton.com.
3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/passandseymour.aspx..
4. Substitutions: See Section 01 6000 - Product Requirements.
5. Source Limitations: Where wall controls are furnished as part of lighting control system, provide accessory matching receptacles and wallplates by the same manufacturer in locations indicated.

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. Galvanized Steel Wall Plates: Rounded corners and edges, with corrosion resistant screws.

E. 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

3.1. 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 conditions are satisfactory for installation prior to starting work.

3.2. 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.

3.3. 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 to top of box: 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 back splash if vertical or 4 inches (100 mm) above counter backsplash if horizontal.

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. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

M. Do not share neutral conductor on branch circuits utilizing wall dimmers.

N. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

O. 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.

P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

Q. Identify wiring devices in accordance with Section 26 0553.

3.4. 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.

3.5. 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.

3.6. 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 2813 - FUSES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Fuses.

B. Spare fuse cabinet.

1.2. RELATED REQUIREMENTS

A. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

B. Section 26 0573 - Power System Studies: Additional criteria for the selection of protective devices specified in this section.

C. Section 26 2816.16 - Enclosed Switches: Fusible switches.

D. Section 26 2913 - Enclosed Controllers: Fusible switches.

1.3. REFERENCE STANDARDS

A. NEMA FU 1 - Low Voltage Cartridge Fuses; 2012.

B. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

C. UL 248-1 - Low-Voltage Fuses - Part 1: General Requirements; Current Edition, Including All Revisions.

D. UL 248-4 - Low-Voltage Fuses - Part 4: Class CC Fuses; Current Edition, Including All Revisions.

E. UL 248-8 - Low-Voltage Fuses - Part 8: Class J Fuses; Current Edition, Including All Revisions.

F. UL 248-10 - Low-Voltage Fuses - Part 10: Class L Fuses; Current Edition, Including All Revisions.

G. UL 248-12 - Low-Voltage Fuses - Part 12: Class R Fuses; Current Edition, Including All Revisions.

H. UL 248-15 - Low-Voltage Fuses - Part 15: Class T Fuses; Current Edition, Including All Revisions.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate fuse clips furnished in equipment provided under other sections for compatibility with indicated fuses.

a. Fusible Enclosed Switches: See Section 26 2816.16.

b. Fusible Switches for Enclosed Motor Controllers: See Section 26 2913.

2. Coordinate fuse requirements according to manufacturer's recommendations and nameplate data for actual equipment to be installed.

3. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard data sheets including voltage and current ratings, interrupting ratings, time-current curves, and current limitation curves.

1. Spare Fuse Cabinet: Include dimensions.

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 Fuses: One set(s) of three for each type and size installed.

3. Fuse Pullers: One set(s) compatible with each type and size installed.

4. Spare Fuse Cabinet Keys: Two.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Bussmann, a division of Eaton Corporation: www.cooperindustries.com/content/public/en/bussmann.html.

B. Littelfuse, Inc: www.littelfuse.com.

C. Mersen: ep-us.mersen.com.

D. Substitutions: See Section 01 6000 - Product Requirements.

2.2. APPLICATIONS

A. General Purpose Branch Circuits: Class RK1, time-delay.

B. Individual Motor Branch Circuits: Class RK1, time-delay.

C. In-Line Protection for Pole-Mounted Luminaires: Class CC, time-delay.

D. Primary Protection for Control Transformers: Class CC, time-delay.

2.3. FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Unless otherwise indicated, provide cartridge type fuses complying with NEMA FU 1, Class and ratings as indicated.

F. Voltage Rating: Suitable for circuit voltage.

G. Class R Fuses: Comply with UL 248-12.

1. Class RK1, Time-Delay Fuses:

2. Class RK1, Fast-Acting, Non-Time-Delay Fuses:

3. Class RK5, Time-Delay Fuses:

4. Class RK5, Fast-Acting, Non-Time-Delay Fuses:

H. Class J Fuses: Comply with UL 248-8.

1. Class J, Time-Delay Fuses:

2. Class J, Fast-Acting, Non-Time-Delay Fuses:

a. Products:

1) Substitutions: See Section 01 6000 - Product Requirements.

I. Class L Fuses: Comply with UL 248-10.

1. Class L, Time-Delay Fuses:

2. Class L, Fast-Acting, Non-Time-Delay Fuses:

J. Class T Fuses: Comply with UL 248-15.

K. Class CC Fuses: Comply with UL 248-4.

1. Class CC, Fast-Acting, Non-Time-Delay Fuses:

L. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

M. Provide the following accessories where indicated or where required to complete installation:

1. Fuseholders: Compatible with indicated fuses.

2. Fuse Reducers: For adapting indicated fuses to permit installation in switch designed for fuses with larger ampere ratings.

2.4. SPARE FUSE CABINET

A. Description: Wall-mounted sheet metal cabinet with shelves and hinged door with cylinder lock, suitably sized to store spare fuses and fuse pullers specified.

B. Finish: Manufacturer's standard, factory applied grey finish unless otherwise indicated.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that fuse ratings are consistent with circuit voltage and manufacturer's recommendations and nameplate data for equipment.

B. Verify that mounting surfaces are ready to receive spare fuse cabinet.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2. INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Install fuses with label oriented such that manufacturer, type, and size are easily read.

C. Install spare fuse cabinet where indicated.

D. Identify spare fuse cabinet in accordance with Section 26 0553.

END OF SECTION

SECTION 26 2816.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Enclosed safety switches.

1.2. 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 0573 - Power System Studies: Additional criteria for the selection of equipment and associated protective devices specified in this section.

E. Section 26 2813 - Fuses.

F. Section 26 2913 - Enclosed Controllers: Manual motor controllers.

1.3. REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

C. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

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.

1.4. 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.

1.5. 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. Include dimensioned plan and elevation views of enclosed switches and adjacent equipment with all required clearances indicated.

2. Include wiring diagrams showing all factory and field connections.

D. Field Quality Control Test Reports.

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, installation, and starting of product.

F. Project Record Documents: Record actual locations of enclosed switches.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. See Section 26 2813 for requirements for spare fuses and spare fuse cabinets.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. 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.

1.8. FIELD CONDITIONS

A. Maintain ambient temperature between -22 degrees F and 104 degrees F during and after installation of enclosed switches.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. ABB/GE: www.geindustrial.com.

B. Eaton Corporation: www.eaton.com.

C. Schneider Electric; Square D Products: www.schneider-electric.us.

D. Siemens Industry, Inc: www.usa.siemens.com.

E. Substitutions: See Section 01 6000 - Product Requirements.

F. 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.

2.2. 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 determined by short circuit study performed in accordance with Section 26 0573.

2. Minimum Ratings:

a. Switches Protected by Class H Fuses: 10,000 rms symmetrical amperes.

b. Heavy Duty Single Throw Switches Protected by Class R, Class J, Class L, or Class T Fuses: 200,000 rms symmetrical amperes.

c. Double Throw Switches Protected by Class R, Class J, or Class T Fuses: 100,000 rms symmetrical amperes.

G. Enclosed Safety Switches Used for Service Entrance: Listed and labeled as suitable for use as service equipment according to UL 869A.

H. Provide with switch blade contact position that is visible when the cover is open.

I. Fuse Clips for Fusible Switches: As required to accept fuses indicated.

1. Where NEMA Class R fuses are installed, provide rejection feature to prevent installation of fuses other than Class R.

J. Conductor Terminations: Suitable for use with the conductors to be installed.

K. Provide insulated, groundable fully rated solid neutral assembly where a neutral connection is required, with a suitable lug for terminating each neutral conductor.

L. Provide solidly bonded equipment ground bus in each enclosed safety switch, with a suitable lug for terminating each equipment grounding conductor.

M. 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.

N. Provide safety interlock to prevent opening the cover with the switch in the ON position with capability of overriding interlock for testing purposes.

O. 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.

P. Provide the following features and accessories where indicated or where required to complete installation:
1. Hubs: As required for environment type; sized to accept conduits to be installed.
2. Integral fuse pullers.
3. Auxiliary Switch: SPDT switch suitable for connection to system indicated, with auxiliary contact operation before switch blades open and after switch blades close.
4. Viewing Window: Positioned over switch blades for visual confirmation of contact position with door closed.

PART 3 EXECUTION

3.1. 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.

3.2. 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.
I. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
J. Identify enclosed switches in accordance with Section 26 0553.

3.3. 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.

3.4. ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5. 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

SECTION 26 2913 - ENCLOSED CONTROLLERS

PART 1 GENERAL

1.1. 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.
   5. Control terminal blocks.

1.2. 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 0573 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

E. Section 26 2813 - Fuses: Fuses for fusible switches.

F. Section 26 2923 - Variable-Frequency Motor Controllers.

1.3. REFERENCE STANDARDS

A. IEEE C57.13 - IEEE Standard Requirements for Instrument Transformers; 2008.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

D. NEMA ICS 2 - Industrial Control and Systems Controllers, Contactors and Overload Relays Rated 600 Volts; 2000 (R2005), with errata, 2008.

E. NEMA ICS 5 - Industrial Control and Systems: Control Circuit and Pilot Devices; 2000 (R2010).

F. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (R2011).

G. NEMA KS 1 - Heavy Duty Enclosed and Dead-Front Switches (600 Volts Maximum); 2013.

H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

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 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.

L. UL 60947-1 - Low-Voltage Switchgear and Controlgear - Part 1: General Rules; Current Edition, Including All Revisions.

M. UL 60947-4-1 - Low-Voltage Switchgear and Controlgear - Part 4-1: Contractors and Motor-starters - Electromechanical Contractors and Motor-starters; Current Edition, Including All Revisions.

1.4. 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.

1.5. 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.

1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.

C. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

1. Include dimensioned plan and elevation views of enclosed controllers and adjacent equipment with all required clearances indicated.
2. Include wiring diagrams showing all factory and field connections.
3. Include documentation demonstrating selective coordination upon request.

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, and installation of product.

E. Field Quality Control Test Reports.

F. 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.
2. Motor Circuit Protectors: Include magnetic instantaneous trip settings.

G. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.

H. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. Electronic Trip Circuit Breakers: Provide one portable test set.

3. Indicating Lights: Two of each different type.
4. See Section 26 2813 for requirements for spare fuses and spare fuse cabinets.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. 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.

1.8. FIELD CONDITIONS

A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. ABB/GE: www.geindustrial.com.

B. Eaton Corporation; Cutler-Hammer Product: www.eaton.com.

C. Rockwell Automation, Inc; Allen-Bradley Products: ab.rockwellautomation.com/#sle.

D. Schneider Electric; Square D Products: www.schneider-electric.us.

E. Siemens Industry, Inc: www.usa.siemens.com.

F. Substitutions: See Section 01 6000 - Product Requirements.

G. Source Limitations: Furnish enclosed motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.

2.2. 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 determined by short circuit study performed in accordance with Section 26 0573.

2. Listed series ratings are not acceptable.

F. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.

G. Conductor Terminations: Suitable for use with the conductors to be installed.

H. 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.

3. Finish: Manufacturer's standard unless otherwise indicated.

I. 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.

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. Minimum Contactor Size: NEMA Size 0.

4. Use of non-standard contactor sizes smaller than specified standard NEMA sizes is not permitted.

5. Disconnects: Circuit breaker type.

a. Disconnect Switches: Fusible type unless otherwise 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.

6. Pilot Devices Required:

a. Furnish local pilot devices for each unit as specified below unless otherwise indicated on drawings.

b. Contactors for motor applications where overload protection is provided separately or where motor contains integral thermal protectors to be provided with pilot devices as specified for magnetic motor starters above.

2.3. 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. Employ automatic reset or remote reset where indicated.
    c. Do not employ automatic reset with two-wire control.
6. Solid-State Overload Relays:
    a. Selectable inverse-time trip class rating; available ratings of Class 10, 20, and 30, minimum.
    b. Adjustable full load current.
    c. Phase loss protection.
    d. Phase imbalance protection.
    e. Ground fault protection.
    f. Ambient temperature insensitive.
    g. Thermal memory.
    h. Trip test function.
    i. Provide isolated alarm contact.

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. Motor Circuit Protectors:
    a. Description: Instantaneous-trip circuit breakers furnished with magnetic instantaneous tripping elements for short circuit protection, but not with thermal inverse time tripping elements for overload protection; UL 489 recognized only for use as part of a listed

combination motor controller with overload protection; ratings, configurations, and features as indicated on the drawings.

b. Provide field-adjustable magnetic instantaneous trip setting.

c. Provide the following features and accessories where indicated or where required to complete installation:

1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.

3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.

5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

3. 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; ratings, configurations, and features as indicated on the drawings.

1) Provide thermal magnetic circuit breakers unless otherwise indicated.

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.

1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.

c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

1) Provide the following field-adjustable trip response settings:

(a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.

(b) Long time delay.

(c) Short time pickup and delay.

(d) Instantaneous pickup.

(e) Ground fault pickup and delay where ground fault protection is indicated.

d. Provide the following features and accessories where indicated or where required to complete installation:

1) Shunt Trip: Provide coil voltage as required for connection to indicated trip actuator.

2) Pad-Lock Provision: For locking circuit breaker handle in OFF position.

3) Auxiliary Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped or been turned off.

4) Undervoltage Release: For tripping circuit breaker upon predetermined drop in coil voltage with field-adjustable time delay to prevent nuisance tripping.

5) Alarm Switch: SPDT switch suitable for connection to system indicated for indicating when circuit breaker has tripped.

2.4. 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. Nominal Size: 30 mm.
3. Pushbuttons: Unless otherwise indicated, provide momentary, non-illuminated type with flush button operator; normally open or normally closed as indicated or as required.
4. Selector Switches: Unless otherwise indicated, provide maintained, non-illuminated type with knob operator; number of switch positions as indicated or as required.
5. Indicating Lights: Push-to-test type unless otherwise indicated.
6. 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.
3. Timing Relays: Electronic or pneumatic as indicated.
    a. Adjustable Timing Range: As indicated on drawings.
4. Multi-Speed Motor Starters: Employ accelerating relays, decelerating relays, and compelling relays where indicated.
5. Accelerating Relays: Starts motor at low speed and then accelerates automatically through definite time intervals for each successive speed until selected speed is attained.
6. Decelerating Relays: Allows motor to decelerate automatically through definite time intervals for each successive speed until selected speed is attained.
7. Compelling Relays: Requires motor to start at low speed before a higher speed can be selected.

D. Control Power Transformers:

1. Size to accommodate burden of contactor coil(s) and all connected auxiliary devices, plus _____ VA spare capacity.
2. Include primary and secondary fuses.

E. Control Terminal Blocks: Include 25 percent spare terminals.

PART 3 EXECUTION

3.1. 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.

3.2. 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. Identify enclosed controllers in accordance with Section 26 0553.

3.3. 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 200 amperes. Tests listed as optional are not required.

F. Correct deficiencies and replace damaged or defective enclosed controllers or associated components.

3.4. ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

3.5. 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.

3.6. 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 controllers to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of enclosed controllers and associated 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: Manufacturer's authorized representative.
4. Location: At project site.

3.7. PROTECTION

A. Protect installed enclosed controllers from subsequent construction operations.

END OF SECTION

SECTION 26 2923 - VARIABLE-FREQUENCY MOTOR CONTROLLERS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Variable-frequency motor controllers for low-voltage (600 V and less) AC motor applications.

B. Overcurrent protective devices for motor controllers, including overload relays.

1.2. RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Housekeeping pads.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 2813 - Fuses.

1.3. REFERENCE STANDARDS

A. IEC 60529 - Degrees of Protection Provided by Enclosures (IP Code); 2013-08, with 2015 Corrigendum.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

D. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (R2011).

E. NEMA ICS 7 - Industrial Control and Systems: Adjustable-Speed Drives; 2006.

F. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation, and Operation of Adjustable Speed Drive Systems; 2006.

G. NEMA ICS 7.2 - Application Guide for AC Adjustable Speed Drive Systems; 2015.

H. NEMA ICS 61800-2 - Adjustable Speed Electrical Power Drive Systems, Part 2: General Requirements-Rating Specifications for Low Voltage Adjustable Frequency AC Power Drive Systems; 2005.

I. NEMA MG 1 - Motors and Generators; 2018.

J. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

K. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.

M. UL 61800-5-1 - Standard for Adjustable Speed Electrical Power Drive Systems - Part 5-1: Safety Requirements – Electrical, Thermal, and Energy; Current Edition, Including All Revisions.

1.4. SUBMITTALS

A. Shop Drawings: Indicate dimensions, voltage, controller sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.

B. 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.

C. Field quality control test reports.

D. Maintenance Materials: Furnish following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements for additional provisions.

2. Air Filters: Two of each different type.

1.5. QUALITY ASSURANCE

A. Comply with requirements of NFPA 70.

B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6. DELIVERY, STORAGE, AND HANDLING

A. Handle carefully in accordance with manufacturer's written instructions to avoid damage to internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Variable-Frequency Motor Controllers:

1. Danfoss: www.danfoss.com.
2. Eaton Corporation: www.eaton.com.
3. Rockwell Automation, Inc.; Allen-Bradley Products: ab.rockwellautomation.com.
4. Schneider Electric; Square D Products: www.schneider-electric.us.
5. Siemens Industry, Inc: www.usa.siemens.com.
6. Reliance Electric/Rockwell Automation: www.reliance.com.
7. Toshiba International Corporation: www.toshiba.com/tic/motors-drives
8. Yaskawa Electric America, Inc.: http://www.yaskawadrive.com

B. Substitutions: See Section 01 6000 - Product Requirements.

C. Source Limitations: Furnish variable-frequency motor controllers and associated components produced by a single manufacturer and obtained from a single supplier.

2.2. VARIABLE-FREQUENCY MOTOR CONTROLLERS

A. Provide variable-frequency motor control system consisting of required controller assemblies, operator interfaces, control power transformers, instrumentation and control wiring, sensors, accessories, system programming, etc. as necessary for complete operating system.

B. Provide products listed, classified, and labeled as suitable for purpose intended.

C. Controller Assemblies: Comply with NEMA ICS 7, NEMA ICS 7.1, and NEMA ICS 61800-2; list and label as complying with UL 61800-5-1 or UL 508A as applicable.

D. Provide controllers selected for actual installed motors and coupled mechanical loads in accordance with NEMA ICS 7.2, NEMA MG 1 Part 30, and recommendations of manufacturers of both controller and load, where not in conflict with specified requirements; considerations include, but are not limited to:

1. Motor type (e.g., induction, reluctance, and permanent magnet); consider NEMA MG 1 design letter or inverter duty rating for induction motors.
2. Motor load type (e.g., constant torque, variable torque, and constant horsepower); consider duty cycle, impact loads, and high inertia loads.
3. Motor nameplate data.
4. Requirements for speed control range, speed regulation, and braking.
5. Motor suitability for bypass starting method, where applicable.

E. Devices on Load Side of Controller: Suitable for application across full controller output frequency range.

F. Operating Requirements:

1. Input Voltage Tolerance: Plus/minus 10 percent of nominal.
2. Input Frequency Tolerance: Plus/minus 5 percent of nominal.

3. Efficiency: Minimum of 96 percent at full speed and load.
4. Input Displacement Power Factor: Minimum of 0.96 throughout speed and load range.
5. Overload Rating:
    a. Variable Torque Loads: Minimum of 110 percent of nominal for 60 seconds.
    b. Constant Torque Loads: Minimum of 150 percent of nominal for 60 seconds.

G. Power Conversion System: Microprocessor-based, pulse width modulation type consisting of rectifier/converter, DC bus/link, and inverter.
1. Rectifier/Converter: Diode-based, 6-pulse type unless otherwise indicated.

H. Control System:
1. Provide microprocessor-based control system for automatic control, monitoring, and protection of motors. Include sensors, wiring, and connections necessary for functions and status/alarm indications specified.
2. Provide integral operator interface for controller programming, display of status/alarm indications, fault reset, and local control functions including motor run/stop, motor forward/reverse selection, motor speed increase/decrease, and local/remote control selection.
3. Control Functions:
    a. Control Method: Selectable vector and scalar/volts per hertz unless otherwise indicated.
        1) Scalar/Volts per Hertz Control: Provide IR compensation for improved low-speed torque.
        2) Vector Control: Provide selectable autotuning function.
    b. Adjustable acceleration and deceleration time; linear and S-curve ramps; selectable coast to stop.
    c. Selectable braking control; DC injection or flux braking.
    d. Adjustable minimum/maximum speed limits.
    e. Adjustable pulse width modulation switching carrier frequency.
    f. Adjustable motor slip compensation.
    g. Selectable autorestart after noncritical fault; programmable number of time delay between restart attempts.
4. Status Indications:
    a. Motor run/stop status.
    b. Motor forward/reverse status.
    c. Local/remote control status.
    d. Output voltage.
    e. Output current.
    f. Output frequency.
    g. DC bus voltage.
    h. Motor speed.
5. Protective Functions/Alarm Indications:
    a. Overcurrent.
    b. Motor overload.
    c. Undervoltage.

d. Overvoltage.
e. Controller overtemperature.
f. Input/output phase loss.
g. Output short circuit protection.
h. Output ground fault protection.

6. Inputs:
   a. Digital Input(s): Three.
   b. Analog Input(s): Two.
7. Outputs:
8. Features:
   a. Password-protected security access.
   b. Event log.

I. Power Conditioning/Filtering:
   1. Provide DC link choke or input/line reactor for each controller unless otherwise indicated or required.
   2. Reactor Impedance: 3 percent, unless otherwise indicated or required.

J. Packaged Controllers: Controllers factory-mounted in separate enclosure with externally operable disconnect and specified accessories.
   1. Disconnects: Circuit breaker or disconnect switch type.
      a. Disconnect Switches: Fusible type or nonfusible type with separate input fuses.
      b. Provide externally operable handle with means for locking in OFF position. Provide safety interlock to prevent opening cover with disconnect in ON position with capability of overriding interlock for testing purposes.
      c. Provide auxiliary interlock for disconnection of external control power sources where applicable.
   2. Provide door-mounted remote operator interface.

K. Service Conditions:
   1. Provide controllers and associated components suitable for operation under following service conditions without derating:
      a. Altitude: Less than 3,300 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 service conditions at installed location.

L. Short Circuit Current Rating:
   1. Provide line/input reactors where specified by manufacturer for required short circuit current rating.

M. Conductor Terminations: Suitable for use with conductors to be installed.

N. Enclosures:
   1. Comply with NEMA ICS 6.
   2. NEMA 250 Environment Type or Equivalent IEC 60529 Rating: Unless otherwise indicated, as specified for following installation locations:

3. Finish: Manufacturer's standard unless otherwise indicated.
4. Cooling: Forced air or natural convection as determined by manufacturer.

2.3. OVERCURRENT PROTECTIVE DEVICES

2.4. SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements for additional requirements.

B. Factory test controllers in accordance with NEMA ICS 61800-2.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that ratings of controllers are consistent with indicated requirements.

C. Verify that mounting surfaces are ready to accept controllers.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2. INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install controllers in accordance with NECA 1 (general workmanship).

C. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

D. Do not exceed manufacturer's recommended maximum cable length between controller and motor.

E. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

F. Provide required support and attachment in accordance with Section 26 0529.

G. Install controllers plumb and level.

H. Provide grounding and bonding in accordance with Section 26 0526.

I. Install 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 settings of controllers and associated components according to installed motor requirements, in accordance with recommendations of manufacturers of controller and load.

L. Identify controllers in accordance with Section 26 0553.

3.3. FIELD QUALITY CONTROL

A. Inspect and test in accordance with NETA ATS, except Section 4.

B. Perform inspections and tests listed in NETA ATS, Section 7.17. Insulation-resistance test on control wiring listed as optional is not required.

C. Correct deficiencies and replace damaged or defective controllers or associated components.

3.4. CLOSEOUT ACTIVITIES

3.5. MAINTENANCE

END OF SECTION

SECTION 26 3213 - ENGINE GENERATORS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Packaged engine generator system and associated components and accessories:

1. Generator set enclosure.

1.2. RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Concrete equipment pads.

B. Section 23 3100 - HVAC Ducts and Casings.

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 3600 - Transfer Switches.

1.3. REFERENCE STANDARDS

A. ASTM D975 - Standard Specification for Diesel Fuel Oils; 2017.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NECA/EGSA 404 - Standard for Installing Generator Sets; 2014.

D. NEMA MG 1 - Motors and Generators; 2018.

E. NFPA 30 - Flammable and Combustible Liquids Code; 2018.

F. NFPA 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines; 2018.

G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

H. NFPA 99 - Health Care Facilities Code; 2015.

I. NFPA 110 - Standard for Emergency and Standby Power Systems; 2013.

J. UL 142 - Steel Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.

K. UL 1236 - Battery Chargers for Charging Engine-Starter Batteries; Current Edition, Including All Revisions.

L. UL 2085 - Protected Aboveground Tanks for Flammable and Combustible Liquids; Current Edition, Including All Revisions.

M. UL 2200 - Stationary Engine Generator Assemblies; Current Edition, Including All Revisions.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate compatibility of generator sets to be installed with work provided under other sections or by others.

a. Transfer Switches: See Section 26 3600.

2. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment or other potential obstructions within the spaces dedicated for engine generator system.

3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.

4. Coordinate the work to provide electrical circuits suitable for the power requirements of the actual auxiliary equipment and accessories to be installed.
5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5. 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, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features. Include alternator starting capabilities, engine fuel consumption rates, and cooling, combustion air, and exhaust requirements.
1. Include generator set sound level test data.
2. Include characteristic trip curves for overcurrent protective devices upon request.
3. Include alternator thermal damage curve upon request.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.

D. Derating Calculations: Indicate ratings adjusted for applicable service conditions.

E. Fuel Storage Tank Calculations: Indicate maximum running time for generator set configuration provided.

F. Specimen Warranty: Submit sample of manufacturer's warranty.

G. Evidence of qualifications for installer.

H. Evidence of qualifications for maintenance contractor (if different entity from installer).

I. 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 operation of product.

J. Manufacturer's factory emissions certification.

K. Manufacturer's certification that products meet or exceed specified requirements.

L. Source quality control test reports.

M. Provide NFPA 110 required documentation from manufacturer where requested by authorities having jurisdiction, including but not limited to:
1. Certified prototype tests.
2. Torsional vibration compatibility certification.
3. NFPA 110 compliance certification.
4. Certified rated load test at rated power factor.

N. Manufacturer’s detailed field testing procedures.

O. Field quality control test reports.

P. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.
1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

Q. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

R. Maintenance contracts.

S. Project Record Documents: Record actual locations of system components, installed circuiting arrangements and routing, and final equipment settings.

T. 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 Fuses: One of each type and size.
3. Extra Filter Elements: One of each type, including fuel, oil and air.

1.6. QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70 (National Electrical Code).
2. NFPA 110 (Standard for Emergency and Standby Power Systems); meet requirements for Level 1 system.
3. NFPA 37 (Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines).
4. NFPA 30 (Flammable and Combustible Liquids Code).

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.

1. Authorized service facilities located within 200 miles of project site.

D. Installer Qualifications: Company specializing in performing the work of this section with minimum three years documented experience with engine generator systems of similar size, type, and complexity; manufacturer's authorized installer.

E. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store generator sets in accordance with manufacturer's instructions and NECA/EGSA 404.

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 instructions to avoid damage to generator set components, enclosure, and finish.

1.8. FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide minimum one year manufacturer warranty covering repair or replacement due to defective materials or workmanship.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Packaged Engine Generator Set - Basis of Design: Cummins Power Generation Inc; www.cumminspower.com.

B. Substitutions: See Section 01 6000 - Product Requirements.

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 engine generator sets and associated components and accessories produced by a single manufacturer and obtained from a single supplier.

2.2. PACKAGED ENGINE GENERATOR SYSTEM

A. Provide new engine generator system consisting of all required equipment, sensors, conduit, boxes, wiring, piping, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. System Description:

1. Application: Emergency/standby.
2. Configuration: Single packaged engine generator set operated independently (not in parallel).
3. Total System Power Rating: As indicated on drawings, standby.

D. Packaged Engine Generator Set:

1. Type: Diesel (compression ignition).
2. Power Rating: As indicated on drawings, standby.
3. Voltage: As indicated on drawings.
4. Main Line Circuit Breaker:
    a. Type: Thermal magnetic. Two breakers to be provided, see drawings.
    b. Trip Rating: Select according to generator set rating.
    c. Features:
        1) Shunt trip.
        2) Auxiliary contacts.

E. Generator Set General Requirements:

1. Prototype tested in accordance with NFPA 110 for Level 2 systems.
2. Factory-assembled, with components mounted on suitable base.
3. List and label engine generator assembly as complying with UL 2200.
4. Power Factor: Unless otherwise indicated, specified power ratings are at 0.8 power factor for three phase voltages and 1.0 power factor for single phase voltages.
5. Provide suitable guards to protect personnel from accidental contact with rotating parts, hot piping, and other potential sources of injury.
6. Main Line Circuit Breakers: Provide factory-installed line side connections with suitable lugs for load side connections.

F. Service Conditions: Provide engine generator system and associated components suitable for operation under the service conditions at the installed location.

G. Starting and Load Acceptance Requirements:

1. Cranking Method: Cycle cranking complying with NFPA 110 (15 second crank period, followed by 15 second rest period, with cranking limiter time-out after 3 cycles), unless otherwise required.
2. Cranking Limiter Time-Out: If generator set fails to start after specified cranking period, indicate overcrank alarm condition and lock-out generator set from further cranking until manually reset.
3. Start Time: Capable of starting and achieving conditions necessary for load acceptance within 10 seconds (NFPA 110, Type 10).
4. Maximum Load Step: Supports 100 percent of rated load in one step.

H. Exhaust Emissions Requirements:

1. Comply with federal (EPA), state, and local regulations applicable at the time of commissioning; include factory emissions certification with submittals.
2. Do not make modifications affecting generator set factory emissions certification without approval of manufacturer and Engineer. Where such modifications are made, provide field emissions testing as necessary for certification.

I. Sound Level Requirements:

1. Comply with applicable noise level regulations.

2.3. ENGINE AND ENGINE ACCESSORY EQUIPMENT

A. Provide engine with adequate horsepower to achieve specified power output at rated speed, accounting for alternator efficiency and parasitic loads.

B. Engine Fuel System - Diesel (Compression Ignition):

1. Fuel Source: Diesel, ASTM D975 No. 2-D or approved cold weather diesel blends.
2. Fuel Storage: Sub-base fuel tank.
3. Engine Fuel Supply: Provide engine-driven, positive displacement fuel pump with replaceable fuel filter(s), water separator, check valve to secure prime, manual fuel priming pump, and relief-bypass valve. Provide fuel cooler where recommended by manufacturer.
4. Engine Fuel Connections: Provide suitable, approved flexible fuel lines for coupling engine to fuel source.
5. Sub-Base Fuel Tank:
    a. Provide sub-base mounted, double-wall fuel tank with secondary containment; listed and labeled as complying with UL 142.
    b. Tank Capacity: Size for minimum of 24 hours of continuous engine generator operation at 100 percent rated load, but not larger than permissible by applicable codes.
    c. Features:
        1) Direct reading fuel level gauge.
        2) Normal atmospheric vent.
        3) Emergency pressure relief vent.
        4) Fuel fill opening with lockable cap.
        5) Dedicated electrical conduit stub-up area.
        6) Low fuel level switch.
        7) Leak detection switch; located within secondary containment interstitial space for detection of primary tank fuel leak.

C. Engine Starting System:

1. System Type: Electric, with DC solenoid-activated starting motor(s).

2. Battery(s):
    a. Battery Type: Lead-acid.
    b. Battery Capacity: Size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature; capable of providing cranking through two complete periods of cranking limiter time-outs without recharging.
    c. Provide battery rack, cables, and connectors suitable for the supplied battery(s); size battery cables according to manufacturer's recommendations for cable length to be installed.
3. Battery-Charging Alternator: Engine-driven, with integral solid-state voltage regulation.
4. Battery Charger:
    a. Provide dual rate battery charger with automatic float and equalize charging modes and minimum rating of 10 amps; suitable for maintaining the supplied battery(s) at full charge without manual intervention.
    b. Capable of returning supplied battery(s) from fully discharged to fully charged condition within 24 hours, as required by NFPA 110 for Level 1 applications while carrying normal loads.
    c. Recognized as complying with UL 1236.
    d. Furnished with integral overcurrent protection; current limited to protect charger during engine cranking; reverse polarity protection.
    e. Provide integral DC output ammeter and voltmeter with five percent accuracy.
    f. Provide alarm output contacts as necessary for alarm indications.
5. Battery Heater: Provide thermostatically controlled battery heater to improve starting under cold ambient conditions.

D. Engine Speed Control System (Governor):
1. Single Engine Generator Sets (Not Operated in Parallel): Provide electronic isochronous governor for controlling engine speed/alternator frequency.
2. Generator Sets Used with Closed Transition Transfer Switches: Provide electronic isochronous governor with frequency regulation suitable for transfer.
3. Frequency Regulation, Electronic Isochronous Governors: No change in frequency from no load to full load; plus/minus 0.25 percent at steady state.

E. Engine Lubrication System:
1. System Type: Full pressure, with engine-driven, positive displacement lubrication oil pump, replaceable full-flow oil filter(s), and dip-stick for oil level indication. Provide oil cooler where recommended by manufacturer.
2. Oil Heater: Provide thermostatically controlled oil heater to improve starting under cold ambient conditions.

F. Engine Cooling System:
1. System Type: Closed-loop, liquid-cooled, with unit-mounted radiator/fan and engine-driven coolant pump; suitable for providing adequate cooling while operating at full load under worst case ambient temperature.
2. Fan Guard: Provide suitable guard to protect personnel from accidental contact with fan.
3. Ducted Radiators: Where ducted radiator air discharge is to be field-installed, provide suitable radiator duct flange/adapter.

4. Coolant Heater: Provide thermostatically controlled coolant heater to improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

G. Engine Air Intake and Exhaust System:

1. Air Intake Filtration: Provide engine-mounted, replaceable, dry element filter.
2. Engine Exhaust Connection: Provide suitable, approved flexible connector for coupling engine to exhaust system.
3. Exhaust Silencer: Provide critical grade or better exhaust silencer with sound attenuation not less than basis of design; select according to manufacturer's recommendations to meet sound performance requirements, where specified.

2.4. ALTERNATOR (GENERATOR)

A. Alternator: 4-pole, 1800 rpm (60 Hz output) revolving field, synchronous generator complying with NEMA MG 1; connected to engine with flexible coupling; voltage output configuration as indicated, with reconnectable leads for 3 phase alternators.

B. Exciter:

1. Exciter Type: Brushless; provide permanent magnet generator (PMG) excitation system; self-excited (shunt) systems are not permitted.
2. PMG Excitation Short-Circuit Current Support: Capable of sustaining 300 percent of rated output current for 10 seconds.
3. Voltage Regulation (with PMG excitation): Plus/minus 0.5 percent for any constant load from no load to full load.
4. Voltage Regulation (with shunt or PMG excitation): Plus/minus two percent for any constant load from no load to full load.

C. Temperature Rise: Comply with UL 2200.

D. Insulation System: NEMA MG 1, Class H; suitable for alternator temperature rise.

E. Enclosure: NEMA MG 1, drip-proof.

F. Total Harmonic Distortion: Not greater than five percent.

G. Alternator Heater: Provide strip heater to prevent moisture condensation on alternator windings.

2.5. GENERATOR SET CONTROL SYSTEM

A. Provide microprocessor-based control system for automatic control, monitoring, and protection of generator set. Include sensors, wiring, and connections necessary for functions/indications specified.

B. Control Panel:

1. Control Panel Mounting: Unit-mounted unless otherwise indicated; vibration isolated.
2. Generator Set Control Functions:
    a. Automatic Mode: Initiates generator set start/shutdown upon receiving corresponding signal from remote device (e.g. automatic transfer switch).
    b. Manual Mode: Initiates generator set start/shutdown upon direction from operator.
    c. Reset Mode: Clears all faults, allowing generator set restart after a shutdown.
    d. Emergency Stop: Immediately shuts down generator set (without time delay) and prevents automatic restarting until manually reset.
    e. Cycle Cranking: Programmable crank time, rest time, and number of cycles.
    f. Time Delay: Programmable for shutdown (engine cooldown) and start (engine warmup).
    g. Voltage Adjustment: Adjustable through range of plus/minus 5 percent.

3. Generator Set Status Indications:
    a. Voltage (Volts AC): Line-to-line, line-to-neutral for each phase.
    b. Current (Amps): For each phase.
    c. Frequency (Hz).
    d. Real power (W/kW).
    e. Reactive power (VAR/kVAR).
    f. Apparent power (VA/kVA).
    g. Power factor.
    h. Duty Level: Actual load as percentage of rated power.
    i. Engine speed (RPM).
    j. Battery voltage (Volts DC).
    k. Engine oil pressure.
    l. Engine coolant temperature.
    m. Engine run time.
    n. Generator powering load (position signal from transfer switch).
4. Generator Set Protection and Warning/Shutdown Indications:
    a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following protections/indications:
        1) Overcrank (shutdown).
        2) Low coolant temperature (warning).
        3) High coolant temperature (warning).
        4) High coolant temperature (shutdown).
        5) Low oil pressure (shutdown).
        6) Overspeed (shutdown).
        7) Low fuel level (warning).
        8) Low coolant level (warning/shutdown).
        9) Generator control not in automatic mode (warning).
        10) High battery voltage (warning).
        11) Low cranking voltage (warning).
        12) Low battery voltage (warning).
        13) Battery charger failure (warning).
    b. In addition to NFPA 110 requirements, provide the following protections/indications:
        1) High AC voltage (shutdown).
        2) Low AC voltage (shutdown).
        3) High frequency (shutdown).
        4) Low frequency (shutdown).
        5) Overcurrent (shutdown).
        6) Fuel tank leak (warning), where applicable.
    c. Provide contacts for local and remote common alarm.

d. Provide lamp test function that illuminates all indicator lamps.

5. Other Control Panel Features:

a. Event log.

b. Communications Capability: Compatible with system indicated. Provide all accessories necessary for proper interface.

c. Remote monitoring capability via PC.

C. Remote Annunciator:

1. Remote Annunciator Mounting: Wall-mounted; Provide flush-mounted annunciator for finished areas and surface-mounted annunciator for non-finished areas unless otherwise indicated.

2. Generator Set Status Indications:

a. Generator powering load (via position signal from transfer switch).

b. Communication functional.

3. Generator Set Warning/Shutdown Indications:

a. Comply with NFPA 110; configurable for NFPA 110 Level 1 or Level 2, or NFPA 99 systems including but not limited to the following indications:

1) Overcrank (shutdown).

2) Low coolant temperature (warning).

3) High coolant temperature (warning).

4) High coolant temperature (shutdown).

5) Low oil pressure (shutdown).

6) Overspeed (shutdown).

7) Low fuel level (warning).

8) Low coolant level (warning/shutdown).

9) Generator control not in automatic mode (warning).

10) High battery voltage (warning).

11) Low cranking voltage (warning).

12) Low battery voltage (warning).

13) Battery charger failure (warning).

b. Provide audible alarm with silence function.

c. Provide lamp test function that illuminates all indicator lamps.

D. Remote Emergency Stop: Provide approved red, mushroom style remote emergency stop button where indicated or required by authorities having jurisdiction.

2.6. GENERATOR SET ENCLOSURE

A. Enclosure Type: Sound attenuating, weather protective.

B. Enclosure Material: Steel or aluminum.

C. Hardware Material: Stainless steel.

D. Color: Manufacturer's standard.

E. Access Doors: Lockable, with all locks keyed alike.

F. Openings: Designed to prevent bird/rodent entry.

G. External Drains: Extend oil and coolant drain lines to exterior of enclosure for maintenance service.

H. Sound Attenuating Enclosures: Line enclosure with non-hydroscopic, self-extinguishing sound-attenuating material.

I. Exhaust Silencers: Where exhaust silencers are mounted within enclosure in main engine compartment, insulate silencer to minimize heat dissipation as necessary for operation at rated load under worst case ambient temperature.

J. Enclosure Space Heater: Provide thermostatically controlled enclosure space heater to prevent condensation and improve starting under cold ambient conditions; size according to manufacturer's recommendations for achieving starting and load acceptance requirements under worst case ambient temperature.

2.7. SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Perform production tests on generator sets at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

C. Generator Set production testing to include, at a minimum:

1. Operation at rated load and rated power factor.
2. Single step load pick-up.
3. Transient and steady state voltage and frequency performance.
4. Operation of safety shutdowns.

D. Diesel Fuel Storage Tanks: Perform pressurized leak test prior to shipment.

PART 3 EXECUTION

3.1. INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Install generator sets and associated accessories in accordance with NECA/EGSA 404.

D. Arrange equipment to provide minimum clearances and required maintenance access.

E. Unless otherwise indicated, mount generator set on properly sized, minimum 6 inch high concrete pad constructed in accordance with Section 03 3000.

F. Provide required support and attachment in accordance with Section 26 0529.

G. Use manufacturer's recommended oil and coolant, suitable for the worst case ambient temperatures.

H. Provide grounding and bonding in accordance with Section 26 0526.

I. Identify system wiring and components in accordance with Section 26 0553.

3.2. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Notify Owner and Architect at least two weeks prior to scheduled inspections and tests.

C. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

D. Provide all equipment, tools, and supplies required to accomplish inspection and testing, including load bank and fuel.

E. Preliminary inspection and testing to include, at a minimum:

1. Inspect each system component for damage and defects.
2. Verify tightness of mechanical and electrical connections are according to manufacturer's recommended torque settings.

3. Check for proper oil and coolant levels.

F. Prepare and start system in accordance with manufacturer's instructions.

G. Perform acceptance test in accordance with NFPA 110.

H. Inspection and testing to include, at a minimum:

1. Verify compliance with starting and load acceptance requirements.
2. Verify voltage and frequency; make required adjustments as necessary.
3. Verify phase sequence.
4. Verify control system operation, including safety shutdowns.
5. Verify operation of auxiliary equipment and accessories (e.g. battery charger, heaters, etc.).
6. Perform load tests in accordance with NFPA 110 (1.5 hour building load test followed by 2 hour full load test).

I. Provide field emissions testing where necessary for certification.

J. Sound Level Tests: Measure sound levels for compliance with specified requirements. Identify and report ambient noise conditions.

K. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

L. Submit detailed reports indicating inspection and testing results and corrective actions taken.

3.3. CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.4. CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Demonstration: Demonstrate proper operation of system to Owner, and correct deficiencies or make adjustments as directed.

C. Training: Train Owner's personnel on operation, adjustment, and maintenance of system.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
2. Provide minimum of four hours of training.
3. Location: At project site.

D. After successful acceptance test and just prior to Substantial Completion, replace air, oil, and fuel filters and fill fuel storage tank.

3.5. PROTECTION

A. Protect installed engine generator system from subsequent construction operations.

3.6. MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of engine generator system for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

C. Conduct site visit at least once every three months to perform inspection, testing, and preventive maintenance. Submit report to Owner indicating maintenance performed along with evaluations and recommendations.

D. Provide trouble call-back service upon notification by Owner:

1. Provide on-site response within 4 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. Maintain an on-site log 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.

END OF SECTION

SECTION 26 3600 - TRANSFER SWITCHES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Transfer switches for low-voltage (600 V and less) applications and associated accessories:

1. Automatic transfer switches.
2. Remote annunciators.

1.2. 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 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 0573 - Power System Studies: Additional criteria for the selection of equipment specified in this section.

F. Section 26 2100 - Low-Voltage Electrical Service Entrance.

G. Section 26 2816.16 - Enclosed Switches: Safety switches not listed for use as transfer switch equipment.

H. Section 26 3213 - Engine Generators: For interface with transfer switches.

1. Includes related demonstration and training requirements.

1.3. REFERENCE STANDARDS

A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

B. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

C. NEMA ICS 10 Part 1 - Industrial Control and Systems Part 1: Electromechanical AC Transfer Switch Equipment; 2005.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 1008 - Transfer Switch Equipment; Current Edition, Including All Revisions.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate compatibility of transfer switches to be installed with work provided under other sections or by others.

a. Engine Generators: See Section 26 3213.

2. 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.

3. Coordinate arrangement of equipment with the dimensions and clearance requirements of the actual equipment to be installed.

4. Coordinate the work with placement of supports, anchors, etc. required for mounting.

5. Notify Architect of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.5. 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, including ratings, configurations, dimensions, finishes, weights, service condition requirements, and installed features.

1. Where applicable, include characteristic trip curves for overcurrent protective devices upon request.

C. Shop Drawings: Include dimensioned plan views and sections indicating locations of system components, required clearances, and field connection locations. Include system interconnection schematic diagrams showing all factory and field connections.

1. Clearly indicate whether proposed short circuit current ratings are based on testing with specific overcurrent protective devices or time durations; indicate short-time ratings where applicable.

D. Specimen Warranty: Submit sample of manufacturer's warranty.

E. Evidence of qualifications for installer.

F. Evidence of qualifications for maintenance contractor (if different entity from installer).

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, installation, and operation of product.

H. Manufacturer's certification that products meet or exceed specified requirements.

I. Source quality control test reports.

J. Manufacturer’s detailed field testing procedures.

K. Operation and Maintenance Data: Include detailed information on system operation, equipment programming and setup, replacement parts, and recommended maintenance procedures and intervals.

1. Include contact information for entity that will be providing contract maintenance and trouble call-back service.

L. Executed Warranty: Submit documentation of final executed warranty completed in Owner's name and registered with manufacturer.

M. Maintenance contracts.

N. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

1.6. QUALITY ASSURANCE

A. Comply with the following:

1. NFPA 70 (National Electrical Code).

B. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store transfer switches in accordance with manufacturer's instructions.

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 instructions to avoid damage to transfer switch components, enclosure, and finish.

1.8. FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Transfer Switches:

1. ABB/GE: www.geindustrial.com
2. ASCO Power Technologies: www.ascopower.com/
3. Eaton Corporation: www.eaton.com/
4. Cummins Inc.: www.cummins.com/

2.2. TRANSFER SWITCHES

A. Provide complete power transfer system consisting of all required equipment, conduit, boxes, wiring, supports, accessories, system programming, etc. as necessary for a complete operating system that provides the functional intent indicated.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Construction Type: Either "contactor type" (open contact) or "breaker type" (enclosed contact) transfer switches complying with specified requirements are acceptable.

1. Transfer switches shall be "four pole" plug ground.

D. Comply with NEMA ICS 10 Part 1, and list and label as complying with UL 1008 for the classification of the intended application (e.g. emergency, optional standby).

E. Do not use double throw safety switches or other equipment not specifically designed for power transfer applications and listed as transfer switch equipment.

F. Load Classification: Classified for total system load (any combination of motor, electric discharge lamp, resistive, and tungsten lamp loads with tungsten lamp loads not exceeding 30 percent of the continuous current rating) unless otherwise indicated or required.

G. Switching Methods:

1. Obtain control power for transfer operation from line side of source to which the load is to be transferred.

H. Service Conditions: Provide transfer switches suitable for continuous operation at indicated ratings under the service conditions at the installed location.

I. Enclosures:

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
2. Finish: Manufacturer's standard unless otherwise indicated.

J. Short Circuit Current Rating:

1. Withstand and Closing Rating: Provide transfer switches, when protected by the supply side overcurrent protective devices to be installed, with listed withstand and closing 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.

K. Automatic Transfer Switches:

1. Description: Transfer switches with automatically initiated transfer between sources; electrically operated and mechanically held.
2. Control Functions:
    a. Automatic mode.
    b. Test Mode: Simulates failure of primary/normal source.
    c. Voltage and Frequency Sensing:
        1) Undervoltage sensing for each phase of primary/normal source; adjustable dropout/pickup settings.
        2) Undervoltage sensing for alternate/emergency source; adjustable dropout/pickup settings.
        3) Underfrequency sensing for alternate/emergency source; adjustable dropout/pickup settings.
    d. Outputs:
        1) Contacts for engine start/shutdown (except where direct generator communication interface is provided).
        2) Auxiliary contacts; one set(s) for each switch position.
    e. Adjustable Time Delays:
        1) Engine generator start time delay; delays engine start signal to override momentary primary/normal source failures.
        2) Transfer to alternate/emergency source time delay.
        3) Retransfer to primary/normal source time delay.
        4) Engine generator cooldown time delay; delays engine shutdown following retransfer to primary/normal source to permit generator to run unloaded for cooldown period.
    f. Engine Exerciser: Provides programmable scheduled exercising of engine generator selectable with or without transfer to load; provides memory retention during power outage.
3. Status Indications:
    a. Connected to alternate/emergency source.
    b. Connected to primary/normal source.
    c. Alternate/emergency source available.
4. Automatic Sequence of Operations:
    a. Upon failure of primary/normal source for a programmable time period (engine generator start time delay), initiate starting of engine generator where applicable.
    b. When alternate/emergency source is available, transfer load to alternate/emergency source after programmable time delay.
    c. When primary/normal source has been restored, retransfer to primary/normal source after a programmable time delay. Bypass time delay if alternate/emergency source fails and primary/normal source is available.
    d. Where applicable, initiate shutdown of engine generator after programmable engine cooldown time delay.

2.3. SOURCE QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Perform production tests on transfer switches at factory to verify operation and performance characteristics prior to shipment. Include certified test report with submittals.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of transfer switches are consistent with the indicated requirements.

C. Verify that rough-ins for field connections are in the proper locations.

D. Verify that mounting surfaces are ready to receive transfer switches.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2. INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).

B. Install products in accordance with manufacturer's instructions.

C. Arrange equipment to provide minimum clearances and required maintenance access.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install transfer switches plumb and level.

F. Unless otherwise indicated, mount floor-mounted transfer switches on properly sized 3 inch high concrete pad constructed in accordance with Section 03 3000.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Identify transfer switches and associated system wiring in accordance with Section 26 0553.

3.3. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Prepare and start system in accordance with manufacturer's instructions.

C. Automatic Transfer Switches:

1. Inspect and test in accordance with NETA ATS, except Section 4.

2. Perform inspections and tests listed in NETA ATS, Section 7.22.3. The insulation-resistance tests listed as optional are not required.

D. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.4. CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

3.5. 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 transfer switches to Owner, and correct deficiencies or make adjustments as directed.

D. Training: Train Owner's personnel on operation, adjustment, and maintenance of transfer switches.

1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.

2. Provide minimum of four hours of training.

3. Instructor: Manufacturer's authorized representative.

4. Location: At project site.

E. Coordinate with related generator demonstration and training as specified in Section 26 3213.

3.6. PROTECTION

A. Protect installed transfer switches from subsequent construction operations.

3.7. MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide to Owner a proposal as an alternate to the base bid, a separate maintenance contract for the service and maintenance of transfer switches for two years from date of Substantial Completion; Include a complete description of preventive maintenance, systematic examination, adjustment, inspection, and testing, with a detailed schedule.

END OF SECTION

SECTION 26 4300 - SURGE PROTECTIVE DEVICES

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Surge protective devices for service entrance locations.

B. Surge protective devices for distribution locations.

1.2. RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 2413 - Switchboards.

C. Section 26 2416 - Panelboards.

1.3. ABBREVIATIONS AND ACRONYMS

A. EMI/RFI: Electromagnetic Interference/Radio Frequency Interference.

B. SPD: Surge Protective Device.

1.4. REFERENCE STANDARDS

A. MIL-STD-220 - Method of Insertion Loss Measurement; Revision C, 2009.

B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2018.

D. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2013.

E. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

F. UL 1283 - Standard for Electromagnetic Interference Filters; Current Edition, Including All Revisions.

G. UL 1449 - Standard for Surge Protective Devices; Current Edition, Including All Revisions.

1.5. ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate size and location of overcurrent device compatible with the actual surge protective device and location to be installed. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to ordering equipment.

1.6. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Include detailed component information, voltage, surge current ratings, repetitive surge current capacity, voltage protection rating (VPR) for all protection modes, maximum continuous operating voltage (MCOV), nominal discharge current (I-n), short circuit current rating (SCCR), connection means including any required external overcurrent protection, enclosure ratings, outline and support point dimensions, weight, service condition requirements, and installed features.

1. SPDs with EMI/RFI filter: Include noise attenuation performance.

C. Shop Drawings: Include wiring diagrams showing all factory and field connections with wire and circuit breaker/fuse sizes.

D. Certificates: Manufacturer's documentation of listing for compliance with the following standards:

1. UL 1449.

2. UL 1283 (for Type 2 SPDs).

E. Field Quality Control Test Reports.

F. 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.

G. Operation and Maintenance Data: Include information on status indicators and recommended maintenance procedures and intervals.

H. Warranty: Submit sample of manufacturer's warranty and documentation of final executed warranty completed in Owner's name and registered with manufacturer.

I. Project Record Documents: Record actual connections and locations of surge protective devices.

1.7. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.8. DELIVERY, STORAGE, AND PROTECTION

A. Store in a clean, dry space in accordance with manufacturer's written instructions.

1.9. FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.10. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Manufacturer's Warranty: Provide minimum five year warranty covering repair or replacement of surge protective devices showing evidence of failure due to defective materials or workmanship.

C. Exclude surge protective devices from any clause limiting warranty responsibility for acts of nature, including lightning, stated elsewhere.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Field-installed, Externally Mounted Surge Protective Devices - Other Acceptable Manufacturers:

1. ABB/GE: www.geindustrial.com/.
2. Advanced Protection Technologies, Inc (APT): www.aptsurge.com.
3. Current Technology; a brand of Thomas & Betts Power Solutions: www.tnbpowersolutions.com.
4. Schneider Electric; Square D Brand Surgelogic Products: www.surgelogic.com.

B. Factory-installed, Internally Mounted Surge Protective Devices:

1. Same as manufacturer of equipment containing surge protective device, to provide a complete listed assembly including SPD.

C. Substitutions: See Section 01 6000 - Product Requirements.

D. Source Limitations: Furnish surge protective devices produced by a single manufacturer and obtained from a single supplier.

2.2. SURGE PROTECTIVE DEVICES - GENERAL REQUIREMENTS

A. Description: Factory-assembled surge protective devices (SPDs) for 60 Hz service; listed, classified, and labeled as suitable for the purpose intended; system voltage as indicated on the drawings.

B. Unless otherwise indicated, provide field-installed, externally-mounted or factory-installed, internally-mouonted SPDs.

C. List and label as complying with UL 1449, Type 1 when connected on line side of service disconnect overcurrent device and Type 1 or 2 when connected on load side of service disconnect overcurrent device.

D. Protected Modes:

1. Wye Systems: L-N, L-G, N-G, L-L.

E. UL 1449 Voltage Protection Ratings (VPRs):

1. 208Y/120V System Voltage: Not more than 1,000 V for L-N, L-G, and N-G modes and 1,200 V for L-L mode.

F. UL 1449 Maximum Continuous Operating Voltage (MCOV): Not less than 115% of nominal system voltage.

G. Enclosure Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

1. Indoor clean, dry locations: Type 1.

H. Mounting for Field-installed, Externally Mounted SPDs: Unless otherwise indicated, as specified for the following locations:

1. Provide surface-mounted SPD where mounted in non-public areas or adjacent to surface-mounted equipment.

2. Provide flush-mounted SPD where mounted in public areas or adjacent to flush-mounted equipment.

I. Equipment Containing Factory-installed, Internally Mounted SPDs: Listed and labeled as a complete assembly including SPD.

1. Switchboards: See Section 26 2413.

2. Panelboards: See Section 26 2416.

2.3. SURGE PROTECTIVE DEVICES FOR SERVICE ENTRANCE LOCATIONS

A. Surge Protective Device:

1. Protection Circuits: Field-replaceable non-modular.

2. Surge Current Rating: Not less than 120 kA per mode/240 kA per phase.

3. UL 1449 Nominal Discharge Current (I-n): 20 kA.

4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.

5. Diagnostics:

a. Protection Status Monitoring: Provide indicator lights to report the protection for each phase.

b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

2.4. SURGE PROTECTIVE DEVICES FOR DISTRIBUTION LOCATIONS

A. Surge Protective Device:

1. Protection Circuits: Field-replaceable non-modular.

2. Surge Current Rating: Not less than 80 kA per mode/160 kA per phase.
3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
5. Diagnostics:
    a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
    b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

2.5. SURGE PROTECTIVE DEVICES FOR BRANCH PANELBOARD LOCATIONS

A. Surge Protective Device:
1. Protection Circuits: Field-replaceable non-modular..
2. Surge Current Rating: Not less than 60 kA per mode/120 kA per phase.
3. UL 1449 Nominal Discharge Current (I-n): 20 kA.
4. UL 1449 Short Circuit Current Rating (SCCR): Not less than the available fault current at the installed location as indicated on the drawings.
5. Diagnostics:
    a. Protection Status Monitoring: Provide indicator lights to report the protection status for each phase.
    b. Alarm Notification: Provide indicator light and audible alarm to report alarm condition. Provide button to manually silence audible alarm.

PART 3 EXECUTION

3.1. EXAMINATION

A. Verify that field measurements are as indicated.
B. Verify that the service voltage and configuration marked on the SPD are consistent with the service voltage and configuration at the location to be installed.
C. Verify that electrical equipment is ready to accept connection of the SPD and that installed overcurrent device is consistent with requirements of drawings and manufacturer's instructions.
D. Verify system grounding and bonding is in accordance with Section 26 0526, including bonding of neutral and ground for service entrance and separately derived systems where applicable. Do not energize SPD until deficiencies have been corrected.
E. Verify that conditions are satisfactory for installation prior to starting work.

3.2. INSTALLATION

A. Perform work in accordance with NECA 1 (general workmanship).
B. Install products in accordance with manufacturer's instructions.
C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
D. Unless indicated otherwise, connect service entrance surge protective device on load side of service disconnect main overcurrent device.
E. Provide conductors with minimum ampacity as indicated on the drawings, as required by NFPA 70, and not less than manufacturer's recommended minimum conductor size.
F. Install conductors between SPD and equipment terminations as short and straight as possible, not exceeding manufacturer's recommended maximum conductor length. Breaker locations may be

reasonably rearranged in order to provide leads as short and straight as possible. Twist conductors together to reduce inductance.

G. Do not energize SPD until bonding of neutral and ground for service entrance and separately derived systems is complete in accordance with Section 26 0526 where applicable. Replace SPDs damaged by improper or missing neutral-ground bond.

H. Disconnect SPD prior to performing any high potential testing. Replace SPDs damaged by performing high potential testing with SPD connected.

3.3. 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 7.19.1.

D. Procure services of a qualified manufacturer's representative to observe installation and assist in inspection, testing, and adjusting. Include manufacturer's reports with field quality control submittals.

3.4. CLEANING

A. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Interior luminaires.

B. Emergency lighting units.

C. Exit signs.

D. Drivers.

E. Accessories.

1.2. RELATED REQUIREMENTS

A. Section 26 0529 - Hangers and Supports for Electrical Systems.

B. Section 26 0533.16 - BOXES.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

D. Section 26 0918 - Remote Control Switching Devices: Remote controls for lighting, including network lighting controls, programmable relay panels, and remote control switching relays.

E. Section 26 0923 - Lighting Control Devices.

F. Section 26 2726 - Wiring Devices: Manual wall switches and wall dimmers.

G. Section 26 5600 - Exterior Lighting.

1.3. REFERENCE STANDARDS

A. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 2012).

B. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

C. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

D. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

F. NECA/IESNA 500 - Standard for Installing Indoor Commercial Lighting Systems; 2006.

G. NECA/IESNA 502 - Standard for Installing Industrial Lighting Systems; 2006.

H. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2011.

I. NEMA LE 4 - Recessed Luminaires, Ceiling Compatibility; 2012.

J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

K. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

L. UL 924 - Emergency Lighting and Power Equipment; Current Edition, Including All Revisions.

M. UL 1598 - Luminaires; Current Edition, Including All Revisions.

N. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4. 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.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire.
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. LED Luminaires:
   a. Include estimated useful life, calculated based on IES LM-80 test data.
   b. Include IES LM-79 test report upon request.
2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.
3. LED's: Include rated life, color temperature, color rendering index (CRI), and initial and mean lumen output.

D. Samples:

1. Provide one sample(s) of each specified luminaire where indicated.
2. Provide one sample(s) of each luminaire proposed for substitution upon request.
3. Provide one sample(s) of each product finish illustrating color and texture upon request.

E. Certificates for Dimming Drivers: Manufacturer's documentation of compatibility with dimming controls to be installed.

F. Field quality control 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. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

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. Extra Lenses and Louvers: Two percent of total quantity installed for each type, but not less than one of each type.
3. Extra LED drivers: Ten percent of total quantily installed for each type of driver, but not less than two of each type..

J. Project Record Documents: Record actual connections and locations of luminaires and any associated remote components.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. 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.

1.8. FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.9. 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

2.1. MANUFACTURERS - LUMINAIRES

A. Furnish products from the Manurafactures listed in the Luminaire Schedule found on the drawings.

2.2. LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: Proposed substitutions shall be made in electronic format using the proper form found in the front end documents and must be submitted to the Architect 10 business days prior to Bid..

2.3. LUMINAIRES

A. Manufacturers:

1. Acceptable Manufacturers for each type of luminaire are listed on the luminaire schedule on the drawings..
2. Substitutions: Proposed substitutions shall be made in electronic format using the proper form found in the front end documents and must be submitted to the Architect 10 business days prior to Bid..

B. Provide products that comply with requirements of NFPA 70.

C. Provide products that are listed and labeled as complying with UL 1598, where applicable.

D. Provide products listed, classified, and labeled as suitable for the purpose intended.

E. Unless otherwise indicated, provide complete luminaires including LED's, reflectors, lenses, drivers, housings and other components required to position, energize and protect the light source and distribute the light.

F. 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.

G. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

H. 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.

I. LED Luminaires:

1. Components: UL 8750 recognized or listed as applicable.

2. Tested in accordance with IES LM-79 and IES LM-80.

3. LED Estimated Useful Life: Minimum of 50,000 hours at 70 percent lumen maintenance, calculated based on IES LM-80 test data.

2.4. EMERGENCY LIGHTING UNITS

A. Manufacturers:

1. Acceptable Manufacturers for each type of luminaire are listed on the luminaire schedule on the drawings..

2. Substitutions: Proposed substitutions shall be made in electronic format using the proper form found in the front end documents and must be submitted to the Architect 10 business days prior to Bid..

B. Description: Emergency lighting units complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

C. 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.

D. Battery:

1. Sealed maintenance-free lead calcium unless otherwise indicated.

2. Size battery to supply all connected lamps, including emergency remote heads where indicated.

E. Diagnostics: Provide power status indicator light and accessible integral test switch to manually activate emergency operation.

F. Provide low-voltage disconnect to prevent battery damage from deep discharge.

G. Accessories:

1. Provide compatible accessory mounting brackets where indicated or required to complete installation.

2. Provide compatible accessory high impact polycarbonate vandal shields for emergency lighting units located Gymnasiums and other area's of potential abuse.
3. Where indicated, provide emergency remote heads that are compatible with the emergency lighting unit they are connected to and suitable for the installed location.

2.5. 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. Accessories:
1. Provide compatible accessory high impact polycarbonate vandal shields for exit signs located in Gymnasiums and other area's of potential abuse.

2.6. DRIVERS

A. Manufacturers:

B. Dimmable LED Drivers:
1. Dimming Range: Continuous dimming from 100 percent to five 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.
b. Daylighting Controls: See Section 26 0923.

2.7. ACCESSORIES

A. Stems for Suspended Luminaires: Steel tubing, minimum 1/2" size, factory finished to match luminaire or field-painted as directed.

B. Threaded Rods for Suspended Luminaires: Zinc-plated steel, minimum 1/4" size, field-painted as directed.

C. Provide accessory plaster frames for luminaires recessed in plaster ceilings.

PART 3 EXECUTION

3.1. 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.

3.2. 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.

3.3. INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires securely, in a neat and workmanlike manner, as specified in NECA 500 (commercial lighting) and NECA 502 (industrial lighting).

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. 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 surface-mounted and recessed luminaires to ceiling support channels or framing members or to building structure.
4. Secure pendant-mounted luminaires to building structure.
5. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.
6. 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.
7. See appropriate Division 9 section where suspended grid ceiling is specified for additional requirements.

G. 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.

H. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.
2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.
3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet nominal length, with no more than 4 feet between supports.
4. Install canopies tight to mounting surface.
5. Unless otherwise indicated, support pendants from swivel hangers.

I. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

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.

3.4. 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.

3.5. 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.

3.6. 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.

3.7. 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 luminaires to Architect, and correct deficiencies or make adjustments as directed.

D. Just prior to Substantial Completion, replace all lamps that have failed.

3.8. PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 5537 - OBSTRUCTION AND LANDING LIGHTS

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Obstruction warning lights on building(s).

1.2. REFERENCE STANDARDS

A. FAA AC 70/7460-1 - Obstruction Marking and Lighting with Change 1; 2016.

B. FAA AC 150/5340-30 - Design and Installation Details for Airport Visual Aids; Revision H, 2014.

C. FAA AC 150/5345-43 - Specification for Obstruction Lighting Equipment; 2016h.

D. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

1.3. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide for each fixture.

1.4. QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this Section with minimum three years documented experience, and listed in FAA AC-150/5345-53 and its addendum.

B. Products: Listed, classified, and labeled as suitable for the purpose intended.

C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Flash Technology, a brand of SPX Corporation: www.spx.com/

B. Hughey & Phillips, LLC: www.hugheyandphillips.com/

C. Point Lighting Corporation: www.pointlighting.com/

D. Substitutions: See Section 01 6000 - Product Requirements.

2.2. OBSTRUCTION LIGHTS

A. Design obstruction lighting to comply with FAA AC 70/7460-1.

B. Red Obstruction Lights: FAA AC 150/5345-43, Type L-810, single fitting.

2.3. ACCESSORIES

A. Provide weatherproof outlet box with receptacle to receive photo-electric cell.

PART 3 EXECUTION

3.1. INSTALLATION

A. Install obstruction lighting in accordance with FAA AC 150/5340-30.

B. Install obstruction lighting units on 1-1/4 inch threaded conduit ends to project at least 12 inches above highest point of building.

3.2. FIELD QUALITY CONTROL

A. See Section 01 4000 - Quality Requirements, for additional requirements.

B. Inspect and test obstruction lighting equipment in accordance with FAA AC 150/5340-30.

END OF SECTION

SECTION 26 5600 - EXTERIOR LIGHTING

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Exterior luminaires.

B. Drivers

C. Lamps.

D. Poles and accessories.

E. Luminaire accessories.

1.2. RELATED REQUIREMENTS

A. Section 03 3000 - Cast-in-Place Concrete: Materials and installation requirements for concrete bases for poles.

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.

E. Section 26 0923 - Lighting Control Devices.

1. Includes automatic controls for lighting including outdoor photo controls.

F. Section 26 2726 - Wiring Devices: Receptacles for installation in poles.

G. Section 26 2813 - Fuses.

H. Section 26 5100 - Interior Lighting.

1.3. REFERENCE STANDARDS

A. AASHTO LTS - Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals; American Association of State Highway and Transportation Officials; 6th Edition, with 2015 Interim Revisions.

B. ANSI C82.4 - American National Standard for Ballasts for High-Intensity-Discharge and Low-Pressure Sodium Lamps (Multiple-Supply Type); 2002.

C. ANSI C136.10 - American National Standard for Roadway and Area Lighting Equipment - Locking-Type Photocontrol Devices and Mating Receptacles - Physical and Electrical Interchangeability and Testing; 2010.

D. ANSI O5.1 - American National Standard for Wood Poles -- Specifications and Dimensions; 2015.

E. IEEE C2 - National Electrical Safety Code; 2012.

F. IES LM-63 - IESNA Standard File Format for Electronic Transfer of Photometric Data and Related Information; 2002 (Reaffirmed 2008).

G. IES LM-79 - Approved Method: Electrical and Photometric Measurements of Solid-State Lighting Products; 2008.

H. IES LM-80 - Approved Method: Measuring Luminous Flux and Color Maintenance of LED Packages, Arrays, and Modules; Illuminating Engineering Society; 2015.

I. IES RP-8 - Roadway Lighting; 2014.

J. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2010.

K. NECA/IESNA 501 - Standard for Installing Exterior Lighting Systems; 2006.

L. NEMA 410 - Performance Testing for Lighting Controls and Switching Devices with Electronic Drivers and Discharge Ballasts; 2011.

M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

N. UL 8750 - Light Emitting Diode (LED) Equipment for Use in Lighting Products; Current Edition, Including All Revisions.

1.4. ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate placement of poles and associated foundations with utilities, curbs, sidewalks, trees, walls, fences, striping, etc. installed under other sections or by others. Coordinate elevation to obtain specified foundation height.

2. Notify Architect of any conflicts or deviations from Contract Documents to obtain direction prior to proceeding with work.

1.5. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings:

1. Provide photometric calculations where luminaires are proposed for substitution upon request.

2. Provide structural calculations for each pole proposed for substitution.

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, weight, effective projected area (EPA), and installed accessories; include model number nomenclature clearly marked with all proposed features.

1. LED Luminaires:

a. Include estimated useful life, calculated based on IES LM-80 test data.

b. Include IES LM-79 test report upon request.

2. Provide electronic files of photometric data certified by a National Voluntary Laboratory Accreditation Program (NVLAP) lab or independent testing agency in IES LM-63 standard format upon request.

3. Lamps: Include rated life and initial and mean lumen output.

4. Poles: Include information on maximum supported effective projected area (EPA) and weight for the design wind speed.

D. Sustainable Design Documentation: Submit manufacturer's product data on lamp mercury content and rated lamp life, showing compliance with specified requirements.

E. Samples:

1. Provide one sample(s) of each specified luminaire where indicated.

2. Provide one sample(s) of each luminaire proposed for substitution upon request.

3. Provide one sample of each product finish illustrating color and texture upon request.

F. Certificates for Poles and Accessories: Manufacturer's documentation that products are suitable for the luminaires to be installed and comply with designated structural design criteria.

G. Field Quality Control Reports.

1. Include test report indicating measured illumination levels.

H. 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.

I. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

J. 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 LED drivers: Ten percent of total quantity installed for each type, but not less than two of each type.
3. Extra Fuses: Five percent of total quantity installed for each type, but not less than two of each type.
4. Touch-Up Paint: 2 gallons, to match color of pole finish.

K. Project Record Documents: Record actual connections and locations of pole foundations, luminaires, and any pull or junction boxes.

1.6. 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. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.7. DELIVERY, STORAGE, AND HANDLING

A. Receive, handle, and store products according to NECA/IESNA 501 and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

C. Receive, handle, and store wood poles in accordance with ANSI O5.1.

1.8. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide three year manufacturer warranty for all LED luminaires, including drivers.

PART 2 PRODUCTS

2.1. MANUFACTURERS-LUMINAIRES

A. Furnish products as inidcated in the Luminaire Schedule found in the drawings.

2.2. LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

B. Substitutions: Proposed substitutions shall be made in electronic format using the proper form found in the front end documents and must be submitted to the Architect 10 business days prior to Bid.

PART 3 EXECUTION

4.1. 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.

4.2. 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.

4.3. INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Install products in accordance with manufacturer's instructions.

C. Install luminaires in accordance with NECA/IESNA 501.

D. Provide required support and attachment in accordance with Section 26 0529.

E. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

F. 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.

G. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

3. Provide minimum of two supports for each luminaire equal to or exceeding 4 feet in length, with no more than 4 feet between supports.

4. Install canopies tight to mounting surface.

5. Unless otherwise indicated, support pendants from swivel hangers.

H. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to center of luminaire.

I. Pole-Mounted Luminaires:

1. Maintain the following minimum clearances:

a. Comply with IEEE C2.

2. Foundation-Mounted Poles:

a. Provide cast-in-place concrete foundations for poles as indicated, in accordance with Section 03 3000.

1) Install anchor bolts plumb per template furnished by pole manufacturer.

2) Position conduits to enter pole shaft.

b. Install foundations plumb.

c. Install poles plumb, using leveling nuts or shims as required to adjust to plumb.

d. Tighten anchor bolt nuts to manufacturer's recommended torque.

e. Install non-shrink grout between pole anchor base and concrete foundation, leaving small channel for condensation drainage.

f. Install anchor base covers or anchor bolt covers as indicated.

3. Grounding:

a. Bond luminaires, metal accessories, metal poles, and foundation reinforcement to branch circuit equipment grounding conductor.

4. Install separate service conductors, 12 AWG copper, from each luminaire down to handhole for connection to branch circuit conductors.

5. Install non-breakaway in-line fuse holders and fuses complying with Section 26 2813 in pole handhole or transformer base for each ungrounded conductor.

6. Install weather resistant GFI duplex receptacle with weatherproof cover as specified in Section 26 2726 in designated poles.

J. Install accessories furnished with each luminaire.

K. Bond products and metal accessories to branch circuit equipment grounding conductor.

L. Install lamps in each luminaire.

4.4. 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. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by Architect.

4.5. ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by Architect. Secure locking fittings in place.

B. Luminaires with Field-Rotatable Optics: Position optics according to manufacturer's instructions to achieve lighting distribution as indicated or as directed by Architect.

4.6. CLEANING

A. Clean surfaces according to NECA/IESNA 501 and manufacturer's instructions to remove dirt, fingerprints, paint, or other foreign material and restore finishes to match original factory finish.

4.7. CLOSEOUT ACTIVITIES

A. See Section 01 7800 - Closeout Submittals, for closeout submittals.

B. Just prior to Substantial Completion, replace all lamps that have failed.

4.8. PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 28 4600 - FIRE DETECTION AND ALARM

PART 1 GENERAL

1.1. SECTION INCLUDES

A. Fire alarm system design and installation, including all components, wiring, and conduit.

B. Transmitters for communication with supervising station.

C. Circuits from protected premises to supervising station, including conduit.

D. Maintenance of fire alarm system under contract for specified warranty period.

1.2. RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping: Materials and methods for work to be performed by this installer.

B. Section 08 7100 - Door Hardware: Electrically operated locks and door holder devices to be monitored and released by fire alarm system.

C. Section 21 1300 - Fire-Suppression Sprinkler Systems: Supervisory, alarm, and actuating devices installed in sprinkler system.

D. Section 23 3300 - AIR DUCT ACCESSORIES: Smoke dampers monitored and controlled by fire alarm system.

1.3. REFERENCE STANDARDS

A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.

B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.

C. IEEE C62.41.2 - Recommended Practice on Characterization of Surges in Low-Voltage (1000 V and less) AC Power Circuits; 2002 (Cor 1, 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; 2016.

F. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

G. IFC - Internation Fire Code; Most Recent Edition Adopted by the Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.4. SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Drawings must be prepared as DXF-format CAD drawings.

1. Architect will provide CAD floor plan drawings for Contractor's use upon Contractor's completion of Waiver of Liability Agreement form.

C. Evidence of designer qualifications. Design must be completed by a NICET level IV designer, minimum.

D. 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.

E. Evidence of installer qualifications. Installer must be hold a NICET level III certificate, minimum.

F. Evidence of instructor qualifications; training lesson plan outline.

G. Evidence of maintenance contractor qualifications, if different from installer.

H. Inspection and Test Reports:
1. Submit inspection and test plan prior to closeout demonstration.
2. Submit documentation of satisfactory inspections and tests.
3. Submit NFPA 72 "Inspection and Test Form," filled out.

I. Operating and Maintenance Data: See Section 01 7800 for additional requirements; revise and resubmit until acceptable; have one set available during closeout demonstration:
1. Original copy of NFPA 72 with portions that are not relevant to this project neatly crossed out by hand; label with project name and date.
2. Complete set of specified design documents, as approved by authority having jurisdiction.
3. Additional printed set of project record documents and closeout documents, bound or filed in same manuals.
4. Contact information for firm that will be providing contract maintenance and trouble call-back service.
5. List of recommended spare parts, tools, and instruments for testing.
6. Replacement parts list with current prices, and source of supply.
7. Detailed troubleshooting guide and large scale input/output matrix.
8. Preventive maintenance, inspection, and testing schedule complying with NFPA 72; provide printed copy and computer format acceptable to Owner.
9. Detailed but easy to read explanation of procedures to be taken by non-technical administrative personnel in the event of system trouble, when routine testing is being conducted, for fire drills, and when entering into contracts for remodeling.

J. Project Record Documents: See Section 01 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.

K. Closeout Documents:

1. Certification by manufacturer that the system has been installed in compliance with manufacturer's installation requirements, is complete, and is in satisfactory operating condition.
2. NFPA 72 "Record of Completion", filled out completely and signed by installer and authorized representative of authority having jurisdiction.
3. Certificate of Occupancy.
4. Maintenance contract.

L. Maintenance Materials, Tools, and Software: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.
2. 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.
3. 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.

1.5. QUALITY ASSURANCE

A. Copies of Design Criteria Documents: Maintain at the project site for the duration of the project, bound together, an original copy of NFPA 72, the relevant portions of applicable codes, and instructions and guidelines of authorities having jurisdiction; deliver to Owner upon completion.

B. Designer Qualifications: NICET Level IV (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.

C. Installer Qualifications: Installer with a minimum NICET Level III (3) and three years 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 3 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.

D. Maintenance Contractor Qualifications: Same entity as installer or different entity with specified qualifications.

E. Instructor Qualifications: Experienced in technical instruction, understanding fire alarm theory, and able to provide the required training; trained by fire alarm control unit manufacturer.

F. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.6. WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. 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.

C. Provide installer's warranty that the installation is free from defects and will remain so for 1 year after date of Substantial Completion.

PART 2 PRODUCTS

2.1. MANUFACTURERS

A. Fire Alarm Control Units and Accessories - Basis of Design: Honeywell Security & Fire Solutions/Notifier: www.notifier.com.

B. Initiating Devices and Notification Appliances:

1. Same manufacturer as control units.

2. Provide initiating devices and notification appliances made by the same manufacturer, where possible.

C. Substitutions: See Section 01 6000 - Product Requirements.

1. For other acceptable manufacturers of control units specified, submit product data showing equivalent features and compliance with Contract Documents.

2. For substitution of products by manufacturers not listed, submit product data showing features and certification by Contractor that the design will comply with Contract Documents.

2.2. FIRE ALARM SYSTEM

A. Fire Alarm System: Provide a new automatic fire detection and alarm system:

1. Provide all components necessary, regardless of whether shown in Contract Documents or not.

2. Protected Premises: Entire building shown on drawings.

3. Comply with the following; where requirements conflict, order of precedence of requirements is as listed:

a. ADA Standards.

b. The requirements of the State Fire Marshal.

c. The requirements of the local authority having jurisdiction, which is the Zoning Administrator (618-544-7616).

d. Applicable local codes.

e. Contract Documents (drawings and specifications).

f. NFPA 101.

g. 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.

h. International Fire Code.

4. Fire-alarm signal initiation shall be by one or more of the following devices[and systems]:

a. Manual stations.

b. Smoke detectors.

c. Duct smoke detectors.

d. Automatic sprinkler system water flow.

e. Fire-extinguishing system operation.

f. Fire standpipe system.

g. Fire pump running.

5. Fire-alarm signal shall initiate the following actions:

a. Continuously operate alarm notification appliances[, including voice evacuation notices].

b. Identify alarm and specific initiating device at fire-alarm control unit[, connected network control panels, off-premises network control panels,][and remote annunciators].

c. Transmit an alarm signal to the remote alarm receiving station.

d. Unlock electric door locks in designated egress paths.

e. Release fire and smoke doors held open by magnetic door holders.

f. Activate voice/alarm communication system.

g. Switch heating, ventilating, and air-conditioning equipment controls to fire-alarm mode.

h. Close smoke dampers in air ducts of designated air-conditioning duct systems.

i. Activate emergency lighting control.

j. Activate emergency shutoffs for gas and fuel supplies.

k. Record events in the system memory.

l. Record events by the system printer.

m. Indicate device in alarm on the graphic annunciator.

6. Supervisory signal initiation shall be by one or more of the following devices and actions:

a. Retain only those devices and actions in subparagraphs below applicable to Project. Coordinate with requirements in other Sections that specify devices and systems.

b. Valve supervisory switch.

c. Fire pump running.

d. Fire-pump loss of power.

e. Fire-pump power phase reversal.

f. User disabling of zones or individual devices.

g. Loss of communication with any panel on the network.

7. System trouble signal initiation shall be by one or more of the following devices and actions:

a. Open circuits, shorts, and grounds in designated circuits.

b. Opening, tampering with, or removing alarm-initiating and supervisory signal-initiating devices.

c. Loss of communication with any addressable sensor, input module, relay, control module, remote annunciator, printer interface, or Ethernet module.

d. Loss of primary power at fire-alarm control unit.

e. Ground or a single break in internal circuits of fire-alarm control unit.

f. Abnormal ac voltage at fire-alarm control unit.

g. Break in standby battery circuitry.

h. Failure of battery charging.

i. Abnormal position of any switch at fire-alarm control unit or annunciator.

8. System Supervisory Signal Actions:
    a. Initiate notification appliances.
    b. Identify specific device initiating the event at fire-alarm control unit[, connected network control panels, off-premises network control panels,][and remote annunciators].
    c. Record the event on system printer.
    d. After a time delay of 30 seconds, transmit a trouble or supervisory signal to the remote alarm receiving station.
    e. Transmit system status to building management system.
    f. Display system status on graphic annunciator.

B. FIRE-ALARM CONTROL UNIT

1. General Requirements for Fire-Alarm Control Unit:
    a. Field-programmable, microprocessor-based, modular, power-limited design with electronic modules, complying with UL 864.
        1) System software and programs shall be held in nonvolatile flash, electrically erasable, programmable, read-only memory, retaining the information through failure of primary and secondary power supplies.
        2) Include a real-time clock for time annotation of events on the event recorder and printer.
        3) Provide communication between the FCP and remote circuit interface panels, annunciators, and displays.
        4) The FCP shall be listed for connection to a central-station signaling system service.
        5) Provide nonvolatile memory for system database, logic, and operating system and event history. The system shall require no manual input to initialize in the event of a complete power down condition. The FCP shall provide a minimum 500-event history log.
    b. Addressable Initiation Device Circuits: The FCP shall indicate which communication zones have been silenced and shall provide selective silencing of alarm notification appliance by building communication zone.
    c. Addressable Control Circuits for Operation of Notification Appliances and Mechanical Equipment: The FCP shall be listed for releasing service.
    d. Alphanumeric Display and System Controls: Arranged for interface between human operator at fire-alarm control unit and addressable system components including annunciation and supervision. Display alarm, supervisory, and component status messages and the programming and control menu.
    e. Annunciator and Display: Liquid-crystal type, three line(s) of 80 characters, minimum.
    f. Keypad: Arranged to permit entry and execution of programming, display, and control commands[and to indicate control commands to be entered into the system for control of smoke-detector sensitivity and other parameters].
2. Initiating-Device, Notification-Appliance, and Signaling-Line Circuits:
    a. Pathway Class Designations: NFPA 72, Class B.
    b. Pathway Survivability: Level 0 or 1.
    c. Install no more than 50 addressable devices on each signaling-line circuit.
    d. Serial Interfaces:
        1) One dedicated RS 485 port for central-station operation using point ID DACT.

2) One RS 485 port for remote annunciators, Ethernet module, or multi-interface module (printer port).
3) One [USB] [RS 232] port for PC configuration.
4) One RS 232 port for VESDA HLI connection.
5) One RS 232 port for voice evacuation interface.

3. Smoke-Alarm Verification:
   a. Initiate audible and visible indication of an "alarm-verification" signal at fire-alarm control unit.
   b. Activate an approved "alarm-verification" sequence at fire-alarm control unit and detector.
   c. Record events by the system printer.
   d. Sound general alarm if the alarm is verified.
   e. Cancel fire-alarm control unit indication and system reset if the alarm is not verified.
4. Notification-Appliance Circuit:
   a. Audible appliances shall sound in a three-pulse temporal pattern, as defined in NFPA 72.
   b. Where notification appliances provide signals to sleeping areas, the alarm signal shall be a 520-Hz square wave with an intensity 15 dB above the average ambient sound level or 5 dB above the maximum sound level, or at least 75 dBA, whichever is greater, measured at the pillow.
   c. Visual alarm appliances shall flash in synchronization where multiple appliances are in the same field of view, as defined in NFPA 72.
5. Door Controls: Door hold-open devices that are controlled by smoke detectors at doors in smoke-barrier walls shall be connected to fire-alarm system.
6. Remote Smoke-Detector Sensitivity Adjustment: Controls shall select specific addressable smoke detectors for adjustment, display their current status and sensitivity settings, and change those settings. Allow controls to be used to program repetitive, time-scheduled, and automated changes in sensitivity of specific detector groups. Record sensitivity adjustments and sensitivity-adjustment schedule changes in system memory, and print out the final adjusted values on system printer.
7. Transmission to Remote Alarm Receiving Station: Automatically transmit alarm, supervisory, and trouble signals to a remote alarm station.
8. Printout of Events: On receipt of signal, print alarm, supervisory, and trouble events. Identify zone, device, and function. Include type of signal (alarm, supervisory, or trouble) and date and time of occurrence. Differentiate alarm signals from all other printed indications. Also print system reset event, including same information for device, location, date, and time. Commands initiate the printing of a list of existing alarm, supervisory, and trouble conditions in the system and a historical log of events.
9. Primary Power: 24-V dc obtained from 120-V ac service and a power-supply module. Initiating devices, notification appliances, signaling lines, trouble signals, [supervisory signals] [supervisory and digital alarm communicator transmitters] [and] [digital alarm radio transmitters]shall be powered by 24-V dc source.
   a. Alarm current draw of entire fire-alarm system shall not exceed 80 percent of the power-supply module rating.
10. Secondary Power: 24-V dc supply system with batteries, automatic battery charger, and automatic transfer switch.

a. Batteries:[Sealed lead calcium] [Sealed, valve-regulated, recombinant lead acid] [Vented, wet-cell pocket, plate nickel cadmium].

11. Instructions: Computer printout or typewritten instruction card mounted behind a plastic or glass cover in a stainless-steel or aluminum frame. Include interpretation and describe appropriate response for displays and signals. Briefly describe the functional operation of the system under normal, alarm, and trouble conditions.
12. 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.
13. 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.
14. Program notification zones and voice messages as directed by Owner.
15. Hearing Impaired Occupants: Provide visible notification devices in all public areas and in dwelling units.
16. Master Control Unit (Panel): New, located as shown on plans.
17. Combined Systems: Do not combine fire alarm system with other non-fire systems.

C. Supervising Stations and Fire Department Connections:

1. Public Fire Department Notification: By remote supervising station.
2. On-Premises Supervising Station: None.
3. Remote Supervising Station: UL-listed central station under contract to facility.
4. Means of Transmission to Remote Supervising Station: Digital alarm communicator transmitter (DACT), 2 telephone lines.
5. Auxiliary Connection Type: Local energy.

D. Circuits:

1. Initiating Device Circuits (IDC): Class B, Style A.
2. Signaling Line Circuits (SLC) Within Single Building: Class B, Style 0.5.
3. Notification Appliance Circuits (NAC): Class B, Style W.

E. Spare Capacity:

1. Initiating Device Circuits: Minimum 25 percent spare capacity.
2. Notification Appliance Circuits: Minimum 25 percent spare capacity.
3. Speaker Amplifiers: Minimum 25 percent spare capacity.
4. Fire Alarm Control Units: Capable of handling all circuits utilized to capacity without requiring additional components other than plug-in control modules.

F. 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).

2.3. FIRE SAFETY SYSTEMS INTERFACES

A. Supervision: Provide supervisory signals in accordance with NFPA 72 for the following:

1. Sprinkler water control valves.

B. Alarm: Provide alarm initiation in accordance with NFPA 72 for the following:

1. Sprinkler water flow.
2. Duct smoke detectors.

C. HVAC:

1. Duct Smoke Detectors: Close dampers indicated; shut down air handlers indicated.

D. Doors:

1. Smoke Barrier Door Magnetic Holders: Release upon activation of smoke detectors in smoke zone on either side of door, upon alarm from manual pull station on same floor, and upon sprinkler activation on same floor. Refer to Section 08 7100.
2. Electromagnetic Door Locks on Egress Doors: Unlock upon activation of any alarm initiating device or suppression system in smoke zone that doors serve as egress from. Refer to Section 08 7100.

2.4. DIGITAL ALARM COMMUNICATOR TRANSMITTER

A. Digital alarm communicator transmitter shall be acceptable to the remote central station and shall comply with UL 632.

B. Functional Performance: Unit shall receive an alarm, supervisory, or trouble signal from fire-alarm control unit and automatically capture one telephone line(s) and dial a preset number for a remote central station. When contact is made with central station(s), signals shall be transmitted. If service on either line is interrupted for longer than 45 seconds, transmitter shall initiate a local trouble signal and transmit the signal indicating loss of telephone line to the remote alarm receiving station over the remaining line. Transmitter shall automatically report telephone service restoration to the central station. If service is lost on both telephone lines, transmitter shall initiate the local trouble signal.

C. Local functions and display at the digital alarm communicator transmitter shall include the following:

1. Verification that both telephone lines are available.
2. Programming device.
3. LED display.
4. Manual test report function and manual transmission clear indication.
5. Communications failure with the central station or fire-alarm control unit.

D. Digital data transmission shall include the following:

1. Retain applicable subparagraphs below; revise to match characteristics of fire-alarm control unit and requirements of the central station.
2. Address of the alarm-initiating device.
3. Address of the supervisory signal.
4. Address of the trouble-initiating device.
5. Loss of ac supply.
6. Loss of power.
7. Low battery.
8. Abnormal test signal.
9. Communication bus failure.

E. Secondary Power: Integral rechargeable battery and automatic charger.

F. Self-Test: Conducted automatically every 24 hours with report transmitted to central station.

2.5. COMPONENTS

A. General:

1. Provide flush mounted units where installed in finish areas; in unfinished areas, surface mounted unit are acceptable.
2. Provide legible, permanent labels for each control device, using identification used in operation and maintenance data.

B. Fire Alarm Control Units: Analog, addressable type; listed, classified, and labeled as suitable for the purpose intended.

C. Master Control Unit: As specified for Basis of Design above, or equivalent.

D. Initiating Devices:
1. Addressable Systems:
a. Addressable Devices: Individually identifiable by addressable fire alarm control unit.
b. Provide suitable addressable interface modules as indicated or as required for connection to conventional (non-addressable) devices and other components that provide a dry closure output.
2. Manual Pull Stations:Provide 1 extra.
3. Smoke Detectors: Provide 1 extra.
4. Duct Smoke Detectors: Provide 1 extra.
5. Addressable Interface Devices: Provide 1 extra..

E. Notification Appliances:
1. Horns: Provide 1 extra.
2. Speakers: Provide 1 extra.
3. Strobes: Provide 1 extra.

F. Circuit Conductors: Copper or optical fiber; provide 200 feet extra; color code and label.

G. Surge Protection: In accordance with IEEE C62.41.2 category B combination waveform and NFPA 70; except for optical fiber conductors.
1. Equipment Connected to Alternating Current Circuits: Maximum let through voltage of 350 V(ac), line-to-neutral, and 350 V(ac), line-to-line; do not use fuses.
2. Initiating Device Circuits, Notification Appliance Circuits, and Communications Circuits: Provide surge protection at each point where circuit exits or enters a building; rated to protect applicable equipment; for 24 V(dc) maximum dc clamping voltage of 36 V(dc), line-to-ground, and 72 V(dc), line-to-line.
3. Signaling Line Circuits: Provide surge protection at each point where circuit exits or enters a building, rated to protect applicable equipment.

H. Locks and Keys: Deliver keys to Owner.
1. Provide the same standard lock and key for each key operated switch and lockable panel and cabinet; provide 5 keys of each type

I. 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

3.1. INSTALLATION

A. Install in accordance with applicable codes, NFPA 72, NFPA 70, the International Fire Code, and Contract Documents.

B. Install all cabling in conduit.

C. Conceal all wiring, conduit, boxes, and supports where installed in finished areas.

D. Obtain Owner's approval of locations of devices, before installation.

E. Install instruction cards and labels.

3.2. INSPECTION AND TESTING FOR COMPLETION

A. Notify Owner 7 days prior to beginning completion inspections and tests.

B. Notify authorities having jurisdiction and comply with their requirements for scheduling inspections and tests and for observation by their personnel.

C. Provide the services of the installer's supervisor or person with equivalent qualifications to supervise inspection and testing, correction, and adjustments.

D. Prepare for testing by ensuring that all work is complete and correct; perform preliminary tests as required.

E. Provide all tools, software, and supplies required to accomplish inspection and testing.

F. Perform inspection and testing in accordance with NFPA 72 and requirements of local authorities; document each inspection and test.

G. Correct defective work, adjust for proper operation, and retest until entire system complies with Contract Documents.

3.3. Owner PERSONNEL INSTRUCTION

A. Provide the following instruction to designated Owner personnel:

1. Hands-On Instruction: On-site, using operational system.

2. Classroom Instruction: Owner furnished classroom, on-site or at other local facility.

B. Administrative: One-hour session(s) covering issues necessary for non-technical administrative staff; classroom:

1. Initial Training: 1 session pre-closeout.

2. Refresher Training: 1 session post-occupancy.

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.

2. Refresher Training: 1 session post-occupancy.

D. Furnish the services of instructors and teaching aids; have copies of operation and maintenance data available during instruction.

3.4. CLOSEOUT

A. Closeout Demonstration: Demonstrate proper operation of all functions to Owner.

1. Be prepared to conduct any of the required tests.

2. Have at least one copy of operation and maintenance data, preliminary copy of project record drawings, input/output matrix, and operator instruction chart(s) available during demonstration.

3. Have authorized technical representative of control unit manufacturer present during demonstration.

4. Demonstration may be combined with inspection and testing required by authority having jurisdiction; notify authority having jurisdiction in time to schedule demonstration.
5. Repeat demonstration until successful.

B. Occupancy of the project will not occur prior to Substantial Completion.

C. Substantial Completion of the project cannot be achieved until inspection and testing is successful and:

1. Specified diagnostic period without malfunction has been completed.
2. Approved operating and maintenance data has been delivered.
3. Spare parts, extra materials, and tools have been delivered.
4. All aspects of operation have been demonstrated to Owner.
5. Final acceptance of the fire alarm system has been given by authorities having jurisdiction.
6. Occupancy permit has been granted.
7. Specified pre-closeout instruction is complete.

D. Perform post-occupancy instruction within 3 months after Substantial Completion.

3.5. 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